Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,
Shriman Chandulal Sheth College of Commerce,
Shrimati Shobhanatai Chandulal Sheth College of Science,
Khed-Ratnagiri, Maharashtra, India.

TEACHING LEARNING BEYOND CURRICULUM

Academic Year
2018-19 to 2022-23

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B++ Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
Ph No. 02356-260100
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Ref. No.: ICS/ **Date :**

Report of Outcome

Best Practice 1 – Teaching learning beyond curriculum.

Undertaken best practice have following outcome

Sr.No	Outcome	Appendix
1	Increased student attendance.	I
2	Increased student participation in University level competition.	II
3	Rate of progression to higher education is increased.	III
4	Assessing students' readiness for industry demands and real-world challenges can indicate the success of the practice in preparing them for their future careers.	IV
5	Teacher's research activities are increased like conducting research, publishing research papers & research projects.	V

I/C PRINCIPAL,
Shrimati Indira Mahadev Beharay College of Arts
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Shrimati Shobhanatai Chandulal Sheth College of Science,
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Appendix I

Attendance Report of Institute

Year	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Attendence in Percentage	70.26	73.65	79.94	82.73	86.31	90.48

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Appendix II

Students Succeed in Various Competitions at Zonal/University/State/National Level.

YEAR	Name Of Award /Medal	Team / Individual	University /State/National/ International	Sport/Cultural	Name Of The Students
2018-2019	Taekwondo (Women)	Individual	University	Sport	More Vanshree Manoj
	Indian Folk Dance	Team	University(Zonal)	Cultural	Kothare Priyanka, Kadam Mayuri, Natekar Rohit, Bhairavkar Tejas
	Elocution(B)	Individual	University(Zonal)	Cultural	Gazali Namira,
	Story Telling(B)	Individual	University(Zonal)	Cultural	Gazali Namira
	Mimicry	Individual	University(Zonal)	Cultural	Jadhav Tushar
	Poster Making	Individual	University(Zonal)	Cultural	Natekar Rohit
2019-2020	Taekwondo (Men)	Individual	University	Sport	Bhairavkar Tejas Rajesh
	Elocution(B)	Individual	University(Zonal)	Cultural	Surve Iram
	Story Telling(B)	Individual	University(Zonal)	Cultural	Patel Anam
	On The Spot Painting	Individual	University(Zonal)	Cultural	Sadaf Mukadam
	Poster Making	Individual	University(Zonal)	Cultural	Natekar Rohit
	Story Telling(B)	Individual	University(Zonal)	Cultural	Gazali Namira,
2022-2023	Athletic	Individual	University(Zonal)	Sport	Bandre Saurabh Sachin
	Taekwondo	Individual	University(Zonal)	Sport	Parte Harshada Shankar
	Taekwondo	Individual	Kokan(Zonal)	Sport	Parte Harshada Shankar
	Taekondo	Individual	University(Zonal)	Sport	Baikar Tejas Rajesh
	Yogasana	Individual	University(Zonal)	Sport	Jadhav Priyanka Baban
					Pofalkar Vinaya
					Jadhav Nisha
					Pailhar Tejasvi
					Tambe Ravina
					More Nikita
	On The spot Painting	individual	University (Zonal)	Cultural	Sutar Rahul
	On The spot Painting	individual	University level	Cultural	Sutar Rahul
	Mehendi	Individual	University(Zonal)	Cultural	Parkar Sobiya

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Appendix III

Progression of the drop out students in exam (Year 2019-20)

SR.No	Name of the Student	FYBCom		SYBCom	
		Sem I	Sem II	Sem III	Sem IV
1	BHEKARE VAIBHAV SHANTARAM	182 F	189 P		
2	DHOTRE NILIMA ANIL	287 P	292 P		
3	MOTLEKAR SARA MUSHTAQUE	461 P	164 P		
4	KADAM AISHWARYA SANTOSH			373 P	375 P
5	KAWCHALI AQSA MUKHTAR			421 P	423 P
6	MAPKAR FARHEEN ASLAM RUKHSANA			387 P	389 P
		FYBA		**SYBA**	
		Sem I	**Sem II**	**Sem III**	**Sem IV**
7	KHAN SHADAB ALI KHAN PARWEZ	405 F	427 P		
8	BHANDARE YASH SURESH	347 F	364 P		
9	MALI ROSHANI RAJARAM			375 F	394 P
10	TATAKARE ANKITA SHANTARAM			335 F	336 P
		FYBSc		**SYBSc**	
		Sem I	**Sem II**	**Sem III**	**Sem IV**
11	MAHADIK AQSA AFZAL MEHJABIN	652 P	654 P		
12	MANE AKSHAY BARKU	672 P	675 P		
13	AKHADE SURESH KASHIRAM			466 F	552 P
14	AMBRE MANDAR DILIP			533 F	594 P
15	AMBRE SIDDHARAJ SUBHASH			584 F	698 P
16	AMBRE VEDA SACHIN			489 F	575 P
		FYBMS		**SYBMS**	
17	Ambre Dnyandeep Avinash	293 P	303 P		
18	Butala Dhruv Rajesh	293 P	354 P		
19	Bhosale Sakshi Rajendra			388 P	428 P
20	Khot Faizan Khalid			334 P	364 P
		F.Y.Bsc.I.T		**S.Y.Bsc.I.T**	
		Sem I	Sem II	Sem III	Sem IV
21	Akshade Sneha Ramchandra	489 P	572 P		
22	Antule Usama Riyaz	501 P	554 P		
23	Ambedkar Abdul Basid Shaukat			412 P	441 P
24	Mandavkar Omkar Chandrakant			477 P	505 P
		F.Y.Bsc.C.S		**S.Y.Bsc.C.S**	
		Sem I	Sem II	Sem III	Sem IV
25	Ambre Gaurav Ganesh	596 P	675 P		
26	Bukhari Abdalla Nizam	505 P	553 P		
27	Burte Rupali Suresh			763 P	784 P
28	Chiplunkar Ziyad Iqbal			607 P	675 P

Progression of the drop out students in exam (Year 2020-21)

SR.No	Name of the Student	FYBCom		SYBCom	
		Sem I	Sem II	Sem III	Sem IV
1	JADHAV ASMITA SURYAKANT	395 P	476 P		

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2	KADAM PRAJAKTA VIJAY	380 P	419 P		
3	DALVI AKSHAY BABAN			287 P	462 P
4	CHAVAN JAGDISH DEVU			341 P	511 P
		FYBA		**SYBA**	
		Sem I	**Sem II**	**Sem III**	**Sem IV**
5	JADHAV ALPESH SHARAD	378 P	465 P		
6	BHOSALE AMRUTA CHANDAN	463 P	490 P		
7	JADHAV AVANTIKA DILIP			568 P	629 P
8	JADHAV SANJIWANI RAJESH RAJESHRI			490 P	714 P
		FYBSc		**SYBSc**	
		Sem I	**Sem II**	**Sem III**	**Sem IV**
9	MHADE PRASAD SANDIP	682 P	686 P		
10	NADKAR NANDINI BALARAM	686 P	735 P		
11	BHOSALE JAYESH LAVESH			611 P	707 P
		F.Y.BMS		**S.Y.BMS**	
		Sem I	Sem II	Sem III	Sem IV
12	Kadam Suchit Shashikant	562 P	599 P		
13	Kadiri Abrar Yasin	552 P	600 P		
14	Ghanekar Sahil Arjun			545 P	565 P
15	Murudkar Ishtiyaq Sameer			507 P	584 P
		F.Y.Bsc.I.T		**S.Y.Bsc.I.T**	
		Sem I	Sem II	Sem III	Sem IV
18	Dabholakar Vivek Vinod	558 P	594 P		
19	Fakir Parhaj Mehbub	579 P	647 P		
20	Mohite Shubham Vilas			541 P	633 P
21	More Nachiket Anant			557 P	612 P
22	Parkar Wakif Liyakat				
23	Ambedkar Abdul Basid Shaukat				
		F.Y.Bsc.C.S		**S.Y.Bsc.C.S**	
		Sem I	Sem II	Sem III	Sem IV
24	Bamne Atiya Parweshalli	824 P	881 P		
25	Parkar Ilham Tajamul	809 P	878 P		
26	Ambre Gaurav Ganesh			798 P	840 P
27	Bate Faisal Ganesh			787 P	847 P

Progression of the drop out students in exam (Year 2021-22)

SR.No	Name of the Student	FYBCom		SYBCom	
		Sem I	Sem II	Sem III	Sem IV
1	JANGAM ABHISHEK YOGESH	320 F	356 P		
2	GAMARE KARINA VILAS			319 P	424 P
3	JADHAV JAY JOGESH			317 P	340 P
4	KADAM URMILA SHIVAJI			297 F	395 P
5	NIKAM ABHIJIT DATTARAM			350 P	434 P
6	PATIL DISHA ARJUN			345 F	416 P
7	SAKPAL SAMIKSHA SUBHASH			317 F	545 P
		FYBA		**SYBA**	
		Sem I	**Sem II**	**Sem III**	**Sem IV**

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8	MOHITE PALLAVI DIPAK SUMAN	418 F	451 P		
9	PAWAR RUPESH DILIP SUMITRA	268 P	297 P		
10	PASTE VISHAL VINAYAK			543 P	678 P
11	SAWANT KAJOL SURESH			432 F	636 P
		FYBSc		**SYBSc**	
		Sem I	**Sem II**	**Sem III**	**Sem IV**
12	PAWASKAR AQSA AHMED	805 P	832 P		
13	REWALE SAMPADA ANIL			613 P	632 P
14	POMENDKAR BHAGYASHRI VISHNU			683 P	726 P
15	KAMBLE YASH SANTOSH			478 F	731 P
		FYBMS		SYBMS	
		Sem I	Sem II	Sem III	Sem IV
16	BHANDARE SAHIL SANJAY	561 P	631 P		
17	BIJLE ATIQUE ABDUL	573 P	605 P		
18	BARVE VISHAL HARISHCHANDRA			605 P	632 P
19	BHOSALE SUSHMITA VISHVANATH			558 P	594 P

Progression of the drop out students in exam (Year 2022-23)

SR.No	**Name of the Student**	**FYBCom**		**SYBCom**	
		Sem I	Sem II	Sem III	Sem IV
1	KADAM AARATI ASHOK	F 148	P 311		
2	KADU RAVINA RAJARAM	F 273	P 366		
3	MOHITE PRACHI SANTOSH	F 174	P 255		
4	KAMBAR GAYATRI SURESH	P 368	P 413		
5	TETAWALEKAR AFRIN ASHFAQUE			P 314	P 350
6	JADHAV RUCHITA RAJU			F 235	P 288
7	PATEL BATISH MOHD			F 150	P 278
8	DIGHE VRUSHALI RAJENDRA			P 476	P 506
		FYBA		**SYBA**	
		Sem I	**Sem II**	**Sem III**	**Sem IV**
9	BHILARE NETRA NILESH	F 256	P 340		
10	BHOSALE SIDDHI SUNIL	F 209	P 249		
11	AKHADE JAYASHREE VINOD			F 414	P 476
12	GUPTA KAJAL SHYAMBIHARI			P 612	P 629
		FYBSc		**SYBSc**	
		Sem I	**Sem II**	**Sem III**	**Sem IV**
13	KADAM KIRTI DILIP	F 524	P 750		
14	KADAM SARIKA DIPAK	P 821	P 871		
15	AMBRE RAJ RAJESH	F 292	P 533		
16	ALWARE SUBHANA SAEED			F 645	P 769
17	BAIT SUYOG SANTOSH			F 475	P 517
18	BELOSE AYUSH RAJESH			F 462	P 506
		F.Y.BMS		**S.Y.BMS**	
		Sem I	Sem II	Sem III	Sem IV
19	Antulay Anam Asif	321 P	383 P		
20	Awati Shruti Suresh	297 P	389 P		
21	Barve Amisha Hasan			352 P	441 P

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22	Dhadve Prathamesh Bharat			312 P	332 P
23	Bijle Atique Abdul Rauf				
24	Bukhari Hasan Ismail				
		F.Y.Bsc.I.T		S.Y.Bsc.I.T	
		Sem I	Sem II	Sem III	Sem IV
25	Chiplunkar Ayyan Ilyas	300 P	399 P		
26	Mukadam Huda Farooque	407 P	430 P		
27	Bhandare Swanand Ramchandra			412 P	479 P
28	Bhuvad Rohit Ramchandra			449 P	525 P
29	Chougle Nitika Ashok				
30	Dhanse Fatima Husainmiya				
		F.Y.Bsc.C.S		S.Y.Bsc.C.S	
		Sem I	Sem II	Sem III	Sem IV
31	Kherade Tejas Vijay	527 P	595 P		
32	Pawar Ninad Vinayak	519 P	555 P		
33	Mahadik Uzma Ismail Khan			522 P	643 P
34	Chougle Assad Imtiyaz			533 P	584 P

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Appendix IV

List of Plecement Students

Year	Name Of the Student who has been placed	Program Graduate From	Name Of The Institute/Company	Pay Packaged At appointment
2018-19	PRATIK SAWANT	B.Sc CS	SHREE PUSHKAR	25,000 P.M
	MANNAN NADKAR	B.Sc CS	DIYAR UNITED COMPANY	45,000 P.M
	TUFAIL KURESHAI	B.Sc CS	A.I INTERNATIONAL	1,00,000 P.M
	VIJAY GUPTA	B.M.S	N.B.N.L INDIA PRIVATE LTD	1,50,000 P.M
	DANISH KARBARI	B.SC.IT	A.I RAJHI BANK	1,00,000 P.M
	ARISH TAJ	B.M.S	OWN BUSINESS	90000 P.M
	KABIR DHANSHE	B.M.S	DHANSHE ASSOCIATION	2,00,00 P.M
2019-2020	ABDUL NADAKAR	COMPUTER SCIENCE	DIYAR UNITED COMPANY	45,000 P.M
	PRANALI PATIL	B.SCI	B.K.L WALAWKAR HOSPITAL	12,000 P.M
	POOJA KADAM	B.SCI	B.K.L WALAWKAR HOSPITAL	10,000 P.M
	JEETESH AKHADHE	B.SCI	SUPRIYA LIFE SCIENCE LTD	12,000 P.M
	GUHAGARKAR CHIRAG	B.SCI I.T	STCK HOLDING PVT LTD	20,000 P.M
	AKHADE RAMCHANDRA	B.SCI I.T	SILACUS SOLUTION PVT LTD	25,000 P.M
	JASNAIK MOHD SAUD	B.SCI I.T	OWN BUSINESS MUMBAI	2,00,000 P.M
	KAPADI AISHWARAYA	M.SCI I.T	DYANDEEP BORAJ KHED	10,000 P.M
	KUPE HASHAM	M.SCI I.T	VISION TECHNOLOGIES	12,000 P.M
	KHAN SARGUROH ALFIYA	B.M.S	ECLERX SERVICE LTD	12,000 P.M
2020-2021	GAZALI SUNGE	M.A	IDEAL ENGLISH SCHOOL	12,000 P.M
	ILHAAM PARKAR	B.COM	IDEAL ENGLISH SCHOOL	8,000 P.M
	SANOBAR SIDDHIQI	B.SCI	IDEAL ENGLISH SCHOOL	10,000 P.M

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	MISBAH TISEKAR	B.COM	IDEAL ENGLISH SCHOOL	8,000 P.M
	HANISA NADKAR	B.A	IDEAL ENGLISH SCHOOL	7,000 P.M
	VINAY KADAM	B.M.S	GARGI ENTERPRISES	12,000 P.M
	MEMON AHMED	B.SCI I.T	MEDICAL OWNER DAPOLI	1,00,000 P.M
	MULTANI ZAMEER	B.SCI. I.T	ACL DIGITAL PUNE	25,000 P.M
	BAGWAN SIDDIQUE	B.SCI I.T	DUBAI COMPANY	30,000 P.M
	TISEKAR TEHREEN	M.SCI I.T	KUNABI SHIKSHAN PRASAR	8590 P.M
	BAHUTULE VAIBHAVI	B.SCI	HUDL INDIA PVT LTD	10,000 P.M
	ALVI KAIF	B.M.S	IFFCO INVESTING IN FUTURE	12,000 P.M
2021-2022	MUNIB NADKAR	B.COM	GARGI ENTERPRIZES	11,000 P.M
	ADITYA JADHAV	B.SCI B.Sc CS	DEEP COMPUTERS	13,000 P.M
	KAJAL GUPTA	B.COM	CHIRAG MARBLES	13,000 P.M
	CHIPLUNKAR SANIYA	B.COM	AMRUTA ENTERPRIZE	11,000 P.M
	CHOUGLE NAZNEEN	B.SCI	AMRUTA ENTERPRIZE	11,000 P.M
	DEVALKAR ANKITA	B.COM	AMRUTA ENTERPRIZE	11,000 P.M
	DEVALEKAR NIKITA	B.COM	CHIRAG MARBLES	13,000 P.M
	DINWARE TAHREEM	B.COM	CHIRAG MARBLES	13,000 P.M
	GAYKAR NIKITA	B.M.S	CHIRAG MARBLES	13,000 P.M
	GHARTE AYESHA	B.COM	CHIRAG MARBLES	13,000 P.M
	BURTE RUPALI SURESH	B.SCI I.T	DEEP COMPUTERS	14,000 P.M
	GAVIT SUREKHA NARPAT	M.A	ICS COLLEGE	12,000 P.M
	POOJA SANKET BUTALA	M.SCI I.T	ICS COLLEGE	12,000 P.M
	TAMBE ALIYA ASLAM	M.COM	ICS COLLEGE	12,000 P.M
2022-2023	SAHIL BHANDARE	B.M.S	IFFCO	20,000 P.M
	ABDUL BIJLE	B.M.S	HODI PVT LTD	25,000 P.M

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	RAJ GHOLAP	B.M.S	IFFCO	13,000 P.M
	PRANAY JANGAM	B.M.S	HUDI	21,000 P.M
	NISHIKANT MODAK	B.SCI	DEEPAK NOVOCHEM	24,000 P.M
	SURAJ SHIRKAN	B.SCI	SUPRIYA LIFE SCIENCE LTD	12,000 P.M
	MUKUL MORE	BMS	T.V.S SUPPLY CHAIN SOLUTION	10,000 P.M
	SHUBHAM GURAV	BSC CS	IFFCO	12,000 P.M.
	AMMAR MANDLEKAR	BSC CS	IFFCO	10,000 P.M.
	SADAF MASURKAR	BSC IT	IFFCO	12,500 P.M.
	RAJ GHOLAP	B.SCI I.T	GROMINI MART	8,000 P.M
	SAFA MAHADIK	B.SCI I.T	GROMINI MART	8,000 P.M

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Appendix V

Teacher's research activities

Grants received from Government and non-governmental agencies for research projects, endowments in the institution during the last

Name of the research project/ endowment	**Name of the Principal Investigator/Co-investigator**	**Department of Principal Investigator**	**Year of Award**	**Amount Sanctioned**	**Duration of the project**	**Name of the Funding Agency**	**Type (Government/non-Government)**
Potential of Beach Tourisum in Ratnagiri District	Dr. A.J. Awati	Geography	2018-2019	30,000/-	01Year (12 months)	University of Mumbai	Government
Socio-economic betterment and devlopment by scientific approch to the ocean state forecast (OSF) through wave rider buoy (WRB) parameters and PFZ	Dr. R.S. Bhalerao	Zoology	2018-2019	15,00,000 /-	02 Years (24 months)	Indian National Center for Ocean Information Services (INCOIS)	Government
दिव्या माथुर की कहानियो में चित्रित समस्याए	Dr. V.S. Shinde	Hindi	2019-2020	25,000/-	01 Year (12 months)	University of Mumbai	Government
Structural Properties in Binary Mixture of Polar Liquids yhrough Quantum Chemical Calculations	Dr. A.V. Patil	Physics	2019-2020	30,000/-	01Year (12 months)	University of Mumbai	Government
Utilizing the Ocean State Forecaste (OSF) data through Wave Rider Bouy (WRB) Parameters and Potential Fishing Zone (PFZ)	Dr. R.S. Bhalerao	Zoology	2022-2023	36,00,000 /-	04 Years (48 months)	Indian National Center for Ocean Information Services (INCOIS)	Government

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Number of books and chapters in edited volumes/books published and papers published in national/ international conference									
Sl. No.	**Name of the teacher**	**Title of the book/chapters published**	**Title of the paper**	**Title of the proceedings of the conference**	**Name of the conference**	**National / International**	**Year of publication**	**ISBN/ISSN number of the proceeding**	**Name of the publisher**
1	Dr.Anita Awati	Sane Guruji –	Importance of Communication in Tourism Industry		Contribution of Eminent Personalities	International	20 Nov. 2018	ISBN-978-93-87628-29-8	Snehwardhan Prakashan, Pune &Mahatma Gandhi Institute Mauritius
2	Dr.Anita Awati	Manavi bhugol v paryavaran bhugol					2018-19	ISBN-978-93-5576-312-9	Sheth Publishers
3	Dr.Anita Awati	Contribution of eminent personalities at national and international levels					2018-19	ISBN-978-93-87628-29-8	Snehavardhan prakashan

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4	Mr. Sachin S. Bhosale Mr. Vinayak I. Pujari Dr. Amol V. Patil	Object oriented programming					2018	ISBN: 978-1-387-73177-0	Lulu Publication 3101 Hillsborough St, Raleigh, NC 27607, United States.
5	Mr. Sachin S. Bhosale Mr. Vinayak I. Pujari Dr. Amol V. Patil	software engineering					2018	ISBN : 978-1-387-73178-7	Laxmi book publications
6	A.V. Patil and V.P. Pawar	NAAC Sponsored Two Days National Seminar On Revised Accreditation Framework (RAF) August 2019		Role of Accreditation Process for Higher Education in India			2019	978-81-930332-2-8	Anandi Publication Chiplun Dist. Ratnagiri
7	Dr.Anita Awati	paryavaran shikshan					2019-20	ISBN-978-93-5576-627-1	Sheth Publishers

8	Dr.Anita Awati	Econamic Geography					2020		
9	Mr. Sachin Bhosale Mr. Vinayak Pujari	POLICIES OF BUSINESS INTELLIGENCE USING BIG DATA ANALYTICS					2020	ISBN– 978-1-716-35715-2	Lulu Publication 3101 Hillsborough St, Raleigh, NC 27607, United States.
10	Dr.Anita Awati	Contemporary india issues and challenges					2021	978-93-81247-38-9	Shriyanshi prakashan
11	Dr. Vidya Shinde	Kala Pathar rachana prakriya aur samkalin bodh	ek prasangik natak kala pathar				2022	978-93-94575-02-08	paridrishya prakashan
12	Dr. Vidya Shinde	vanchana bhagvandas morwal	vanchana				2022	978-81-957036-3-0	vijay prakashan
13	Dr. Anita Awati	Krishi Bhugol	Agriculture Geography				2023	978-98-95710-44-2	Atharv publications

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BEST PRACTICE - 1

TEACHING LEARNING BEYOND CURRICULUM

Academic Year
2018-19 to 2022-23

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,
Shriman Chandulal Sheth College of Commerce,
Shrimati Shobhanatai Chandulal Sheth College of Science,
Khed-Ratnagiri, Maharashtra, India.

TEACHING LEARNING BEYOND CURRICULUM FILE

- **NAME OF THE TEACHER –**

  DR. SUSHIL KESHAVRAO GHUMBRE

- **QUALIFICATION –**

  M.SC. PH.D. (CHEMISTRY)

- **SUBJECT –**

  CHEMISTRY

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,

Shriman Chandulal Sheth College of Commerce, ShrimatiShobhanatai Chandulal Sheth College of Science,

Khed-Ratnagiri, Maharashtra, India.

Evidences of teacher taught beyond curriculum

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Molecular Orbital Symmetry Conservation in Transition Metal Catalysis

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I. Introduction

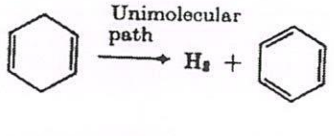
Woodward and Hoffmann published a short communication in 1965 discussing the stereochemical paths of electrocyclic reactions (*1*). This paper introduced a simple, basic concept which was subsequently to have a significant impact in organic chemistry. Stated briefly, the authors proposed that "the steric course of electrocyclic transformations is determined by the symmetry of the highest occupied molecular orbital of the open-chain partner in these changes." This idea had been suggested prior to this time by L. J. Oosterhoff as a possible explanation of a stereospecific triene cyclization (*2*), but it had not been generalized nor recognized for its broader significance. Longuet-Higgins and Abrahamson, expanding on the Woodward–Hoffmann proposal, described the stereoselective paths of electrocyclic reactions using a complete set of molecular orbitals correlated relative to common elements of symmetry preserved throughout the transformations (*3*). Woodward and Hoffmann then generalized these concepts embracing virtually all concerted organic reactions (*4*). This broader treatment crystallized the postulate of molecular orbital symmetry conservation which finds application in all molecular transformations.

Orbital symmetry conservation extends simple molecular orbital theory into reaction chemistry. Its principal power is its simplicity in application. Orbital symmetry descriptions of transforming systems focus on the molecular orbitals and their symmetries relative to common elements of symmetry (i.e., the symmetry elements of the transition state) maintained throughout a concerted reaction.

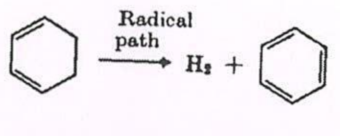
Molecular orbitals tend to preserve their symmetry throughout a molecular transformation. This concept is intuitively obvious when a given molecular transformation is reduced to the transformations of its composite molecular orbitals. An olefin π orbital, for example, if designated "symmetric" (relative to some element of symmetry) at one point along the reaction coordinate, is unlikely to transform into an orbital that is antisymmetric (e.g., a π^* orbital) at another point along the reaction coordinate. Molecular transformations can be described using correlation diagrams in which the molecular orbitals of the reactant(s) on one side of the reaction coordinate are correlated, relative to symmetry, with the molecular orbitals of the product(s) on the other side of the reaction coordinate. If all bonding orbitals of the reactant(s) correlate with bonding orbitals of the product(s), then a ground-state molecular transformation is possible and the reaction is categorized "symmetry-allowed." If, however, bonding orbitals correlate with antibonding orbitals, then a high-energy transition state is indicated and the reaction is "symmetry-forbidden." All concerted reactions, then, fall into "allowed" or "forbidden" categories depending on the extent of bonding—as reflected in the correlation diagram—that is maintained across the reaction coordinate. The assignment of symmetry-allowed in no way reflects the likelihood that a reaction will proceed; it means only that a ground-state, concerted reaction path exists. A symmetry-forbidden assignment, however, may preclude reaction along the indicated path. Although there can be exceptions to this in special cases in which there is a significant degree of asymmetry in the reactants, for the vast majority of organic reactions described forbidden, molecular transformations along the concerted pathways are rare. Selected forbidden reactions will be discussed in greater detail later in this chapter; the application of symmetry concepts and the nature of forbidden paths should be clarified in the treatments of specific systems discussed in subsequent sections.

A significant portion of complex organic chemistry is resolved through simple symmetry conservation descriptions. A thorough treatment of this chemistry would be inappropriate here, but a brief examination of selected cases would be instructive to underscore the dimensions of application. The concerted fusion of two olefins to a cyclobutane derivative, for example, constitutes a 1,2-cycloaddition, a forbidden transformation (*5*). The corresponding addition of an olefin across the carbon termini of a 1,3-diene is a 1,4-cycloaddition, an allowed process. This latter reaction is, of course, the well-known Diels–Alder reaction which proceeds smoothly in a broad variety of cases. Concerted 1,2-cycloadditions, in contrast, are essentially unknown. Exchanging one olefin with a hydrogen molecule will not alter the reaction restraints. The concerted addition of hydrogen across a carbon–carbon double bond (and the reverse transformation) is forbidden while the 1,4-addition across a 1,3-diene is allowed. These limitations on reacting systems are convincingly illustrated in the thermal decomposition of cyclohexadienes (*6*). Under comparable conditions, a 1,4-cyclohexadiene decomposes unimolecularly to hydrogen and benzene, while 1,3-cyclohexadiene yields products via a chain (radical) mechanism.

1,4-Elimination (allowed)

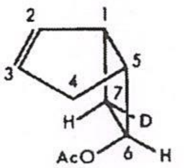


1,2-Elimination (forbidden)

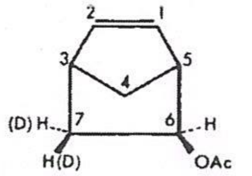


It should be noted that the hydrogens to be eliminated in 1,3-cyclohexadiene are on adjacent carbon atoms, significantly closer to each other than those in the 1,4-isomer. Comparatively minor ring distortion is required of the 1,3-diene in a concerted transformation to hydrogen and benzene. This isomer, however, does not undergo the concerted elimination of hydrogen but instead reacts along the higher energy, free-radical paths. These results are virtually unexplainable in terms of more classic descriptions of bond transformations. This behavior, however, is predictable from simple symmetry conservation rules. Since the only concerted elimination path open to 1,3-cyclohexadiene (i.e., 1,2-elimination) is forbidden, decomposition via a stepwise, free-radical mechanism is ensured. The 1,4-isomer, in contrast, has open to it a concerted elimination which is allowed (1,4-elimination) and, apparently, is a lower energy process than the alternative stepwise (radical) course.

Berson and Nelson provide an interesting example of a highly selective sigmatropic transformation which neatly demonstrates the predictive power of symmetry rules (*7*). Symmetry conservation requires that the bicycloheptene I (bicyclo[3.2.0]-2-hepten-*endo*-6-yl acetate-*exo*-7-*d*) undergoes a concerted transformation to II with inversion at carbon-7 (*8*).



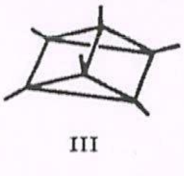
I



II

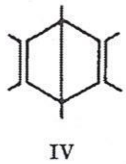
Bicycloheptene I was found to rearrange to II at 307° with greater than 95% stereoselectivity to the predicted *exo*-7-*d* II. This rearrangement, of course, requires rotation about the C-6—C-7 bond as carbon-7 moves across the face of the cyclopentene ring to carbon-3. The stereochemically more comfortable path (no rotation about the C-6—C-7 bond) is symmetry-forbidden. That the rearrangement proceeds with a methylene rotation in preference to the smooth, unhindered 1,3-migration illustrates the depth of control that molecular orbital symmetry conservation holds on transforming molecules.

Thus far we have considered only the observed molecular transformations. Just as important are the transformations that are not observed, but should reasonably be expected to occur on the basis of classic bonding descriptions. There are molecules, for example, whose existence at ordinary temperatures rests on symmetry restrictions to molecular transformations. Consider hexamethylprismane (III) (*9*).

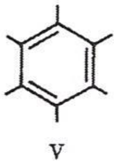


III

This highly strained hydrocarbon is a higher energy species than its unsaturated valence isomers hexamethyl-Dewar-benzene (IV) and hexamethylbenzene (V).

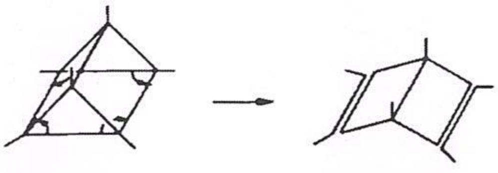


IV



V

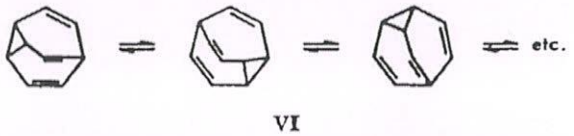
Direct isomerizations to the more stable molecular forms are easily envisioned. If the two σ bonds of the cyclobutane base in III are considered separate, localized electron pairs, a simple repositioning of electrons from one pair of σ bonds in III yields the pair of π bonds in IV.



III IV

This rearrangement should require little additional strain on the molecular structure; the energy path of the rearranging atoms would be predictably favorable. Hexamethylprismane is, in fact, perfectly stable at room temperature and decomposes at significant rates only around 100°, e.g., between 90 and 120°, III undergoes valence isomerization in a first-order mechanism ($\Delta H^{**} = 34$ kcal mole^{-1} and $\Delta S^{**} = 15$ e.u.) to a mixture of V and IV in a ratio of 30 : 1 (*10*). The surprising thermal stability of molecular structure III is a consequence of the fact that the direct, concerted reaction paths to the less-strained valence isomers IV and V are symmetry-forbidden. Molecules constructed of this bond framework are locked in that bonding configuration by molecular orbital symmetry restraints precluding smooth, ground-state transformation to the lower energy valence isomers.

The extent of the restraints imposed on structure III by orbital symmetry conservation is brought into sharper perspective when its rigidity is contrasted to the fluxional behavior of von Doering's interesting invention (*11*), bullvalene (VI) (*12*).



VI

Bullvalene, which undergoes rapid thermally allowed Cope rearrangement, exhibits a single sharp line in the NMR spectrum at 100° (*12*). At temperatures at which III is static, bullvalene continues to undergo rapid structural interconversion, e.g., at 10°, $k(\text{sec}^{-1}) = 1.2 \times 10^3$ (*13*). This dramatic difference in behavior cannot be accommodated using classic descriptions of bonding. Because the rearrangement paths connecting the identical structures of bullvalene are allowed, the electrons (bonds) are free to flow within the molecular framework.

An important dimension to the Woodward–Hoffmann approach in describing reacting systems involves an improved representation of bonds in transformation. Aside from the impressive predictive power of the selection rules, there is the deeper insight into transforming systems provided by treating a given molecular transformation as a transformation of the composite molecular orbitals rather than a repositioning of nuclei and localized bonds. Molecular transformation involves the ordered reorganization of bonds and the molecular orbital description of this process is a better approximation than the repositioning of localized electron pairs. Simple molecular orbital theory has been known for some time and has been applied with moderate success to problems associated with molecular structure, spectra, and reactivity. Its extension into reaction chemistry, however, is a fresh direction and one that promises significant rewards.

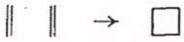
This writer and J. H. Schachtschneider have extended the concepts of molecular orbital symmetry conservation into transition-metal catalysis (*14*). It was found that molecular transformations that are symmetry-forbidden can be switched to symmetry-allowed through interaction with certain transition-metal systems. The mechanism of this unique operation is purely electronic. Substrates may undergo the otherwise forbidden transformation in the ground state through a novel interflow of electron pairs between the metal and the reacting system. This interaction between the metal and reactants constitutes a novel kind of catalysis in which the function of the catalyst is to provide a ground-state reaction path for the reactants by rerouting electron pairs through a matrix of metal *d* orbitals.

A considerable amount of new chemistry is currently emerging which appears to be associated with this kind of catalysis. The remainder of this chapter will treat in detail the specific catalytic functions of the transition metal in the various types of transformations and discuss the associated chemistry.

II. Cycloaddition Reactions

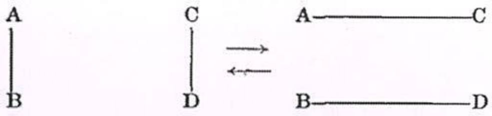
A. Theoretical Aspects

Cycloaddition reactions are transformations involving the fusion of open-chain substrates to cyclic products. Woodward and Hoffmann have divided all concerted cycloaddition reactions into allowed and forbidden categories defined by a complete set of selection rules (*5*). We address ourselves here to the catalytic operations required of a transition metal to switch the forbidden transformations to allowed. Our attention, therefore, will be directed exclusively to the forbidden reactions. Forbidden-to-allowed catalysis will be discussed as it applies to the simplest, and perhaps most important cycloaddition, the concerted, suprafacial, 1,2-addition of two olefins.



(1)

Orbital symmetry restraints exist in both directions of a transformation, so this treatment will apply to cyclobutane ring opening, as well as to olefin fusion. Further, these arguments will not be restricted to the fusion of π bonds, but may apply generally to the concerted fusion of any two bonds in the following manner:



The forbidden character of transformation (1), therefore, is qualitatively the same as that restricting the concerted addition of hydrogen to a double bond.

In describing the fusion of two olefin π bonds to cyclobutane σ bonds [Eq. (1)], the molecular orbitals representing the bonds undergoing character change are combined using the fundamental rules of simple molecular orbital theory. The two π bonds, for example, combine giving a bonding and antibonding combination (Fig. 1). The antibonding bonds of the olefin (i.e., the olefin π^* orbitals) must be treated similarly (Fig. 2). Figures 1 and 2 give a complete molecular orbital description of the interaction of two olefin π bonds.

The σ bonds in cyclobutane corresponding to the transforming olefin π bonds are then described in this way. There are two bonding molecular orbitals representing the two σ bonds and two antibonding

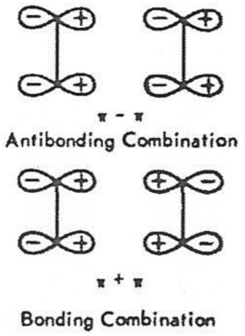


FIG. 1. Olefin π orbital combinations.

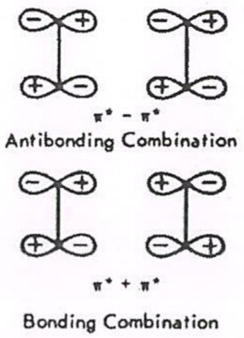
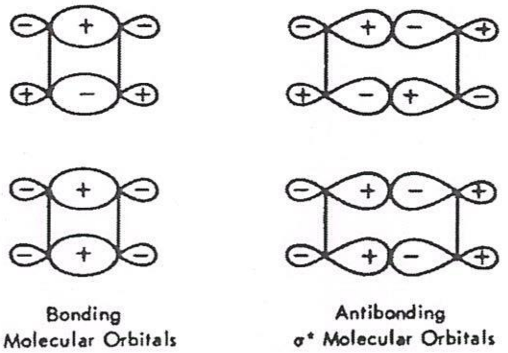


FIG. 2. Olefin π* orbital combinations.

combinations representing the corresponding σ* bonds (Fig. 3). The two sets of molecular orbitals are then assigned symmetries relative to the common elements of symmetry maintained across the reaction coordinate. For cyclobutanation, the elements of symmetry are two planes, P_1 and P_2 (Fig. 4).

A correlation diagram can now be constructed (Fig. 5) with the molecular orbitals ordered by relative energies—a knowledge of absolute energies is not required—and assigned symmetries relative to P_1 and P_2 (S, symmetric and A, antisymmetric). In Fig. 5, the assignment SA, for example, means symmetric about P_1, and antisymmetric about P_2.

Molecular orbital symmetry conservation requires that molecular orbitals maintain their symmetry about the common elements across the reaction coordinate. This gives the orbital correlations outlined in Fig. 5. The olefin AS π combination, for example, transforms into the



Bonding
σ Molecular Orbitals

Antibonding
σ^* Molecular Orbitals

FIG. 3. Cyclobutane σ and σ^* molecular orbitals.

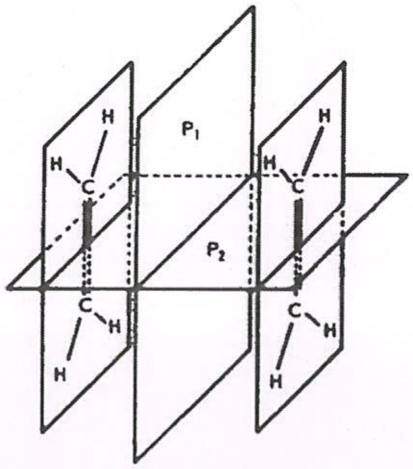


FIG. 4. Symmetry elements for olefin π bond fusion.

cyclobutane AS σ^* orbital and the olefin SA π^* combination becomes the cyclobutane SA σ bond. This orbital crossing, in effect, is characteristic of a forbidden reaction. This is clearly evident as the bonding electron pairs are placed in the appropriate molecular orbitals. In two fusing olefins, the two olefin electron pairs rest in π orbitals and, therefore, reside in the two π combinations, SS and AS in Fig. 5. As cyclobutanation proceeds, the electron pair in the SS π combination flows into the cyclobutane SS σ bond while the electron pair in the AS π combination moves into the cyclobutane AS σ^* bond. The net bonding between the approaching olefins is, therefore, essentially zero across the reaction coordinate.

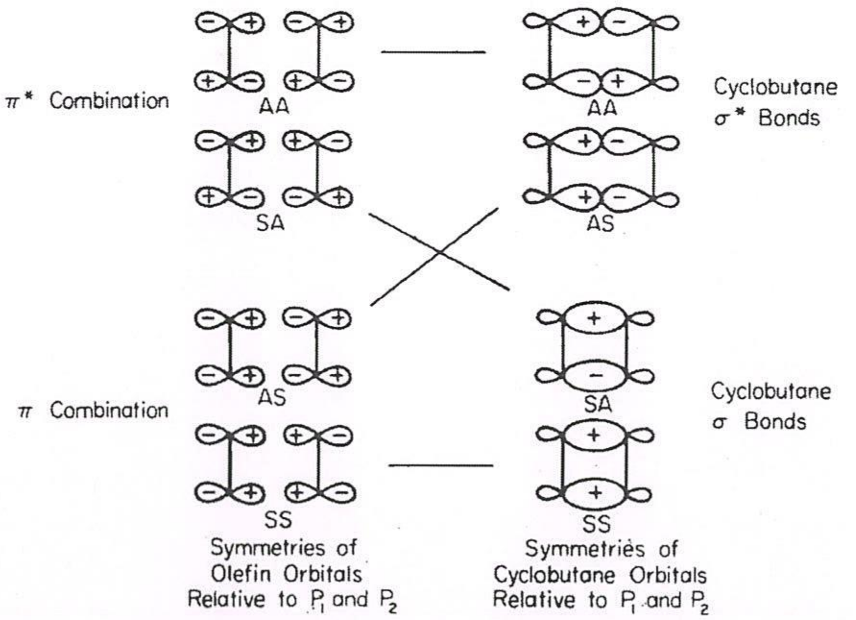


FIG. 5. Correlation diagram for the interconversion of a cyclobutane ring with two olefins.

We turn now to the operations required of any catalytic systems to effect the smooth, ground-state interconversion of two olefins and a cyclobutane ring. The construction of a cyclobutane ring requires the electronic population of the SA and SS orbitals and the electronic vacancy of the AS and AA orbitals. Two of the prerequisites—population of the SS orbital and vacancy of the AA orbital—are assured since these orbitals are correlated with the appropriate orbitals in the olefin combinations. The primary function of the catalyst, clearly, is the removal of an electron pair from the olefin AS π combination and the insertion of an electron pair into the olefin SA π^* combination. A hypothetical catalyst can conceivably carry out these operations with a pair of orbitals of SA and AS symmetry and an electron pair. This operation is represented in Fig. 6; for simplicity the electron pairs have been localized (indicated by shading) in the originating and terminating bonds.

Electronic localization is not implied in this transformation. A more realistic approximation would distribute the electrons throughout the

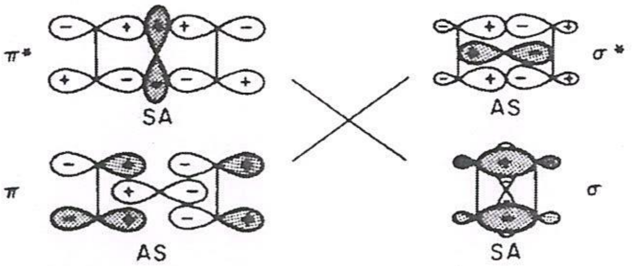
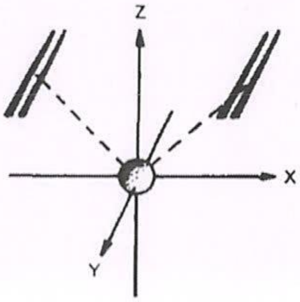


FIG. 6. Correlation diagram of the SA and AS orbitals and the orbitals of a hypothetical catalyst.

combinations in a pattern dictated by the energy differential of the composite orbitals and the orbital overlaps. The important point here, however, is that an electron pair from the catalyst must flow into the incipient cyclobutane SA σ bond through a catalyst orbital of that symmetry, while a pair of electrons from the AS π combination of the transforming olefins flows into a catalyst orbital of that symmetry. This means that the hypothetical catalyst must have electrons in an SA orbital which are essentially liquid, free to flow upon demand, and an empty AS orbital capable of receiving an electron pair. Ideally, the catalyst SA and AS orbitals would be nonbonding in the catalyst system so the flow and counterflow of electron density would not disrupt the bonding character of the catalyst. The catalyst, in effect, behaves as an electron relay switch and need not suffer significant charge generation or electronic excitation.

A transition-metal complex can conceivably carry out the operation required to switch olefin cyclobutanation from a symmetry-forbidden



VII

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Article

Exact Analytical Form of Diatomic Molecular Orbitals

Yunzhi Li and Chen Li*

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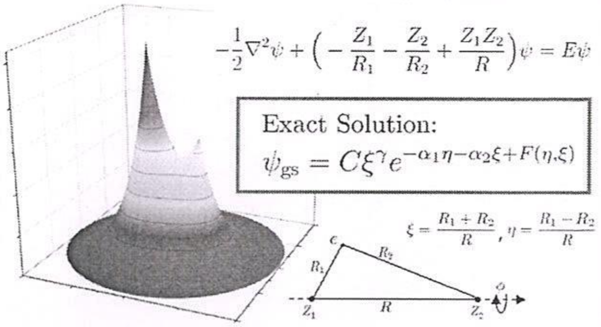
ABSTRACT: We provide the exact analytical form of diatomic molecular orbitals, as given by the solutions of a single-electron diatomic molecule with arbitrary nuclear charges, using our recently developed method for solving Schrödinger equations. We claim that the best representation of the wave function is a factorized form including a power prefactor, an exponentially decaying term, a modulator function on the exponential, and additional factors accounting for nodal surfaces and the magnetic quantum number. Applying our method, we have identified unexpected extreme points along the potential energy curves, hence revealing the limitations of the well-known concepts of bonding and antibonding.



I. INTRODUCTION

Since the concept of orbital was proposed in the early days of quantum chemistry, this concept has been widely accepted by chemists as the most powerful theoretical tool to gain deep insight into chemical problems. Although orbitals are based on the independent single-electron picture, which is only an approximation to the correlated many-electron picture described by many-electron wave functions in atoms and molecules, their concise, intuitive, and visualizable features make them the most commonly used terminology in chemists' routine discussions.

Among various orbitals introduced for different purposes, the most successful ones are undoubtedly the atomic orbitals (AOs) of hydrogenic systems. Rigorously defined as the solutions of a single-electron Schrödinger equation (SE) with spherical symmetry, each of these AOs can be analytically written as a product of a radial function and a spherical harmonic. For many-electron atoms with electron−electron interactions, although one cannot separate variables to deduce single-electron SEs, the clever idea of introducing electronic screening and effective nuclear charge has allowed a reduction to the hydrogenic picture where electrons fill into different energy levels.[1,2] The resulting AOs for many-electron atoms capture the essential physics and have achieved enormous success in explaining the electronic structure of elements in the periodic table.

Yet, chemistry deals with molecules. Apart from understanding AOs, perhaps even more important for chemists is to decipher the molecular orbitals (MOs). In contrast to atoms, molecules display much greater complexity in the presence of multiple electrons and nuclei. The idea of treating electron−electron interactions as an effective screening as used in atoms is not feasible for molecules due to the ambiguity of assigning effective nuclear charges. It turns out that a plausible way is to invoke a fictitious noninteracting system with an effective potential. The resulting MOs can be generated by solving the SE of that particular potential, either local or nonlocal, for example, as has been practiced by the Kohn−Sham density functional theory (KS-DFT)[3] or the Hartree−Fock (HF) theory, giving rise to different MOs associated with different methods or different functional approximations in DFT. This ambiguity of MOs can be once again attributed to the attempt at using approximate orbitals to describe a correlated many-electron wave function.

Nevertheless, for single-electron molecules, MOs can be unambiguously defined. For diatomic molecules, in particular, these MOs are named σ, π, δ, etc., in analogy with the s, p, and d types for AOs, and have given tremendous inspiration to chemists. In fact, they have become the most essential part of modern chemistry textbooks.[1,2,4] In contrast to the s, p, and d orbitals whose analytical forms have been clarified, however, the exact analytical forms of MOs remain a challenge. For example, the MOs for the simplest molecular ion, H_2^+, have been studied intensively, but their compact analytical forms are still elusive.[5−19] Instead, these MOs are usually numerically represented as linear combinations of atomic orbitals (LCAOs).[20,21]

In this paper, we show that we can do better than basis expansion by finding the exact analytical forms of all the MOs.

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In particular, we apply our recently developed method for solving SEs to single-electron diatomic molecules and derive the exact expressions for σ, π, δ orbitals and so on. For each MO, our formula is in an exactly factorized form, i.e., casting the wave function into a product of multiple factors resembling the exact formula of an AO. This is in contrast to the conventional LCAOs and other basis expansion methods that decompose the wave function into a sum of infinite terms. Our representation of MOs reveals their intrinsic analytical structure and furthermore has proven to have computational advantages, as shown in our recent work.[22] Importantly, the newly obtained analytical form of MOs could give us new insight into the nature of chemical bonds.

II. METHODS

We start by reviewing our newly proposed method for solving one-dimensional (1D) SEs, as has been implemented for finding the exact analytical solutions of 1D hydrogen atom and H_2^+ with soft Coulomb potentials.[23,24] In particular, for a nicely behaved potential in 1D, by formulating the corresponding ground state wave function as $\psi = Ce^{\beta}$, we can transform the SE for $\psi(x)$ into a Riccati equation[25] for $u \equiv \frac{d\beta}{dx}$, where energy enters as a parameter. In doing this, we reduce the second-order ordinary differential equation (ODE) into first-order at the sacrifice of linearity. The equation is then solved by expanding u into a Taylor series, which combined with the boundary conditions ultimately leads to an algebraic equation that determines the energy.[23,24] In this work, we extend our approach to real-world molecules in 3D. As will be shown, the increased dimensionality leads to an increase in the number of algebraic equations and unknown variables, yet the basic structure remains similar.

Without loss of generality, let us consider the generic single-electron diatomic molecular problem in atomic units:

$$-\frac{1}{2}\nabla^2\psi + \left(-\frac{Z_1}{R_1} - \frac{Z_2}{R_2} + \frac{Z_1Z_2}{R}\right)\psi = E\psi \tag{1}$$

Here R_i's are the electron−nuclear distances, R is the nuclear separation, and Z_i's are the nuclear charges (we assume $Z_1 \geq Z_2$). Although eq 1 appears to be a coupled equation in terms of the three Cartesian coordinates, it has been shown to be separable in spheroidal coordinates (also called confocal elliptic coordinates).[4−7] In particular, $\xi = \frac{R_1+R_2}{R}$, $\eta = \frac{R_1-R_2}{R}$, and ϕ is the angle of rotation of the electron about the z axis; see Figure 1 for an illustration. ξ and η are analogous to the radial distance r and the cosine of the polar angle θ in the spherical coordinate system; in the limit $R \rightarrow 0$, $\xi \rightarrow 2r/R$ and $\eta \rightarrow \cos\theta$. The wave function can be then factorized into $\psi = \tilde{M}(\eta)\tilde{N}(\xi)e^{im\phi}$. Here, analogous to the hydrogen atom, the equation for ϕ is an eigenvalue equation, for which one can define a magnetic quantum number $m = 0, \pm1, \pm2, ...$ characterizing the z component of the electronic orbital angular momentum. Differing from the hydrogen atom, here ξ and η do not obey eigenvalue equations; instead, they satisfy two decoupled ODEs with two undetermined separation constants:

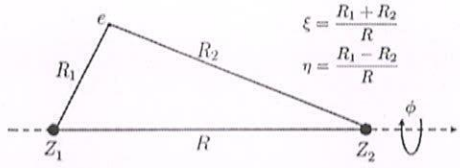

Figure 1. Illustration of the spheroidal coordinates for a diatomic molecule with arbitrary nuclear charges. Here, by definition, $\xi \geq 1$, $-1 \leq \eta \leq 1$, and $0 \leq \phi \leq 2\pi$.

$$\left[(1-\eta^2)\frac{d^2}{d\eta^2} - 2\eta\frac{d}{d\eta} - \frac{m^2}{1-\eta^2} - \frac{1}{2}\tilde{E}R^2\eta^2 - R(Z_1-Z_2)\eta - \tilde{A}\right]\tilde{M}(\eta) = 0 \tag{2}$$

$$\left[(\xi^2-1)\frac{d^2}{d\xi^2} + 2\xi\frac{d}{d\xi} - \frac{m^2}{\xi^2-1} + \frac{1}{2}\tilde{E}R^2\xi^2 + R(Z_1+Z_2)\xi + \tilde{A}\right]\tilde{N}(\xi) = 0 \tag{3}$$

Here $\tilde{E} \equiv E - Z_1 Z_2/R$ is the electronic energy, and $\tilde{A}$ is related to the total angular momentum and the Runge−Lenz vector.[26−29] Similar to eigenvalue equations, though, only when $\tilde{E}$ and $\tilde{A}$ take special values can eqs 2−3 have solutions. It is worth noticing that these ODEs have singularities at $\eta = \pm1$ and $\xi = 1$, respectively, indicating that $\tilde{M}(\eta)$ and $\tilde{N}(\xi)$ cannot be finitely differentiable at these boundary points. In light of this and inspired by previous works,[5,8,9] we make the following change of variables, $\tilde{M}(\eta) = (1-\eta^2)^{|m|/2}M(\eta)$ and $\tilde{N}(\xi) = (\xi^2-1)^{|m|/2}N(\xi)$, which after straightforward derivation gives explicit equations for $M(\eta)$ and $N(\xi)$:

$$\left[(1-\eta^2)\frac{d^2}{d\eta^2} - 2(|m|+1)\eta\frac{d}{d\eta} - \frac{1}{2}\tilde{E}R^2\eta^2 - R(Z_1-Z_2)\eta - A\right]M(\eta) = 0 \tag{4}$$

$$\left[(\xi^2-1)\frac{d^2}{d\xi^2} + 2(|m|+1)\xi\frac{d}{d\xi} + \frac{1}{2}\tilde{E}R^2\xi^2 + R(Z_1+Z_2)\xi + A\right]N(\xi) = 0 \tag{5}$$

Here $A = \tilde{A} + m(m+1)$.

To solve for the ground state, we apply our previous technique to eqs 4−5. As with the ground state of the hydrogen atom, here we assume that the wave function has an absence of nodal points and $m = 0$.[30] Then writing the wave function in exponential forms, $M(\eta) = C_1e^{\beta_1(\eta)}$ and $N(\xi) = C_2e^{\beta_2(\xi)}$, and denoting $u = \frac{d\beta_1}{d\eta}$ and $v = \frac{d\beta_2}{d\xi}$, we deduce the following Riccati equations:

$$(1-\eta^2)\frac{du}{d\eta} + (1-\eta^2)u^2 - 2\eta u - \frac{1}{2}\tilde{E}R^2\eta^2 - R(Z_1-Z_2)\eta - A = 0 \tag{6}$$

$$(\xi^2-1)\frac{dv}{d\xi} + (\xi^2-1)v^2 + 2\xi v + \frac{1}{2}\tilde{E}R^2\xi^2 + R(Z_1+Z_2)\xi + A = 0 \tag{7}$$

Equations 6−7 will be solved by performing Taylor expansions. To have a finite radius of convergence, it is preferable to transform ξ onto a finite interval $[0,1)$ by introducing $q = 1 - \frac{1}{\xi}$. The resulting ODE for q reads

$$q(2-q)(1-q)^2\frac{\mathrm{d}v}{\mathrm{d}q} + q(2-q)v^2 + 2(1-q)v + \frac{1}{2}\tilde{E}R^2 + R(Z_1+Z_2)(1-q) + A(1-q)^2 = 0 \tag{8}$$

We then expand $u(\eta)$ and $v(q)$ into Taylor series:

$$u(\eta) = \sum_{k=0}^{\infty} u_k\eta^k \tag{9}$$

$$v(q) = \sum_{k=0}^{\infty} v_k q^k \tag{10}$$

Here we assume that the validity of these expansions extends to the entire domain of η and q, i.e., the radius of convergence is greater than 1. This assumption is valid for most cases of interest but has exceptions, which will be discussed later. Comparing terms η and q order by order in eqs 6 and 8, we arrive at recursive relations for u_k's and v_k's, so that each u_k and v_k can be represented as a function of u_0, v_0, $\tilde{E}$, and A.

To determine these unknown variables, one has to invoke the boundary conditions. Assuming that the derivative terms in the ODEs are finite, one can readily find that they are eliminated at the boundary points $\eta = \pm 1$ and $q = 0, 1$; hence, eqs 6 and 8 reduce to four algebraic equations regarding $u(\pm 1)$, $v(0)$, and $v(1)$, which by eqs 9–10 can be further rewritten in terms of u_k's and v_k's. Therefore, we end up with four coupled algebraic equations for four unknowns, which can be solved by a multidimensional Newton's iteration approach.[31,32] Here we note that physics guarantees the existence and uniqueness of the solution.

Once u_0, v_0, $\tilde{E}$, and A are obtained, all the u_k's and v_k's are readily accessible by the recursive relations. It follows that β_1 and β_2 can be obtained by explicit integration:

$$\beta_1(\eta) = \sum_{k=1}^{\infty}\frac{u_{k-1}}{k}\eta^k \equiv -\alpha_1\eta + F_1(\eta) \tag{11}$$

$$\begin{aligned}\beta_2(\xi) &= \sum_{k=0}^{\infty} v_k\int^{\xi}\left(1-\frac{1}{\xi'}\right)^k \mathrm{d}\xi' \\ &= \sum_{k=0}^{\infty} v_k\left[\xi - k\ln\xi + \sum_{j=1}^{k-1}\frac{(-1)^j k!}{j(j+1)!(k-j-1)!}\xi^{-j}\right] \\ &= -\alpha_2\xi + \gamma\ln\xi + F_2(\xi)\end{aligned} \tag{12}$$

Here in eq 11, $\alpha_1 = -u_0 > 0$, and $F_1(\eta) = \sum_{k=2}^{\infty}\frac{u_{k-1}}{k}\eta^k$. For heteronuclear cases, β_1 is dominated by $-\alpha_1\eta$ for large R; for homonuclear cases, α_1 is strictly zero, and β_1 reduces to F_1 for all R. In eq 12, $\alpha_2 = -\sum_{k=0}^{\infty}v_k$, $\gamma = -\sum_{k=0}^{\infty}kv_k$, and $F_2(\xi) = \sum_{k=2}^{\infty}v_k h_k(\xi^{-1})$ with $h_k(s) = \sum_{j=1}^{k-1}\frac{(-1)^j k!}{j(j+1)!(k-j-1)!}s^j$. Using the boundary condition at $\xi = 1$, we can prove $\alpha_2 = \sqrt{-\frac{R^2}{2}\tilde{E}}$ and $\gamma = \frac{R(Z_1+Z_2)}{2\alpha_2} - 1$, whose limiting behaviors for $R \to 0$ (united atom) and $R \to \infty$ have been analyzed accordingly.[32]

The ground state wave function is then given by

$$\begin{aligned}\psi &= C_1C_2\exp[\beta_1(\eta) + \beta_2(\xi)] \\ &= C\xi^{\gamma}\exp[-\alpha_1\eta - \alpha_2\xi + F(\eta,\xi)]\end{aligned} \tag{13}$$

where $C = C_1C_2$ is the normalization constant and $F(\eta, \xi) = F_1(\eta) + F_2(\xi)$. Cast in an exactly factorized form, the wave function manifests its analytical structure in the most concise and informative manner, which is much more physically meaningful than an LCAO type of basis representation. Compared with the hydrogen atom, we recognize both familiar features and new structures. The primary similarity is in the exponential decay, where the analogous decay pattern in eq 13 is through $\mathrm{e}^{-\alpha_2\xi}$ and the rate of decay is closely related to the energy. The major difference appears in the additional factors, among which we call special attention to $F(\eta, \xi)$, which we define as the *modulator function* in the sense that it modulates the exponential decay. In contrast to the other terms in eq 13, $F(\eta, \xi)$ can only be written as a series expression. Yet, it can have qualitatively different behavior for small and large nuclear separation and deserves some further discussion.

In particular, in deriving eq 13, our assumption about the Taylor expandability of $u(\eta)$ and $v(q)$ implies that they are free from singularities within the unit circle on the complex plane. It turns out, however, that the assumption for $u(\eta)$ is violated for large R when $Z_1 \approx Z_2$. Nevertheless, eq 13 can still hold in such cases if one modifies the definition of F_1. This can be achieved by moving the singularities outside the unit circle through a Mobius transformation; the resulting formula of F_1 can be found in the Supporting Information.[32]

Importantly, the new analytical structures identified in eq 13 appear to be generally applicable to the ground solution of SEs for Coulomb systems, as they have been observed in our previous works on 1D model problems.[23,24] Moreover, the exact formula also sheds light on simple approximate formulas. In fact, one can achieve a high accuracy by approximating $F(\eta, \xi)$ as simple elementary functions and parametrizing the variational wave function with as few as three parameters.[32]

Our method for finding the exact ground state wave function can be extended to target all the excited states, for which one shall additionally factorize the nodal points, i.e., $M(\eta) = C_1\prod_{l=1}^{L}(\eta - a_l)\mathrm{e}^{\beta_1(\eta)}$, $N(\xi) = C_2\prod_{k=1}^{K}(\xi - b_k)\mathrm{e}^{\beta_2(\xi)}$. Here L and K are the number of nodes in $M(\eta)$ and $N(\xi)$, respectively; a_l and b_k denote the nodal positions. This is in the same spirit as our previous work on 1D model problems.[22] Substituting the factorized formulas into eqs 4–5, we can derive analogous equations to 6 and 8, which again can be solved by Taylor expansion. It is worth mentioning that the $K + L$ nodal points now become unknowns. Substituting each of these variables into the ODEs leads to a new algebraic equation, which along with the boundary conditions is sufficient to determine all the unknowns.[32]

After repeating essentially the same steps for finding the ground state, we can deduce the exact formula for a generic eigenstate characterized by quantum numbers KLm as the following:

$$\begin{aligned}\psi_{KLm}(\eta, \xi, \phi) = {} & C\left[\sqrt{(1-\eta^2)(\xi^2-1)}\right]^{|m|}\mathrm{e}^{im\phi} \\ & \times\left[\prod_{l=1}^{L}(\eta - a_l)\right]\left[\prod_{k=1}^{K}(\xi - b_k)\right] \\ & \times \xi^{\gamma}\mathrm{e}^{-\alpha_1\eta - \alpha_2\xi + F(\eta,\xi)}\end{aligned} \tag{14}$$

Here $\alpha_2 = \sqrt{-\frac{R^2}{2}\tilde{E}}$ and $\gamma = \frac{R(Z_1+Z_2)}{2\alpha_2} - (K + |m| + 1)$. The formulas of F and α_1 are formally the same as those of the ground state, although u_k's and v_k's take different values. One can readily see that eq 14 reduces to eq 13 for the ground state ($m = 0$ without nodal points).

Equations 13−14 are the key results of this paper. In contrast to the wave function formulas proposed in the literature that involve an infinite summation as part of the factorization,[8,9] eq 14 is an exact and complete factorization, elucidating the analytical structure as much as possible. For example, it clearly shows that the nodal surfaces of MOs are hyperboloids and ellipsoids with the nuclei as foci, validating the argument in the literature[6,7] by specifying the exact positions. As an additional remark, there have also been attempts at solving the H_2^+ problem by transforming the SE into Riccati equations, such as the Riccati−Padé method (RPM).[33−36] Yet, RPM uses the Padé approximation to represent u and v rather than targeting their exact formulas or the exact wave function. In addition, RPM gives no knowledge of the nodal points.

III. RESULTS AND DISCUSSION

Next, we demonstrate the usefulness of our exact formulas by showing some intuitive examples. Starting with the H_2^+ problem, we compute potential energy curves of representative low-lying states; see Figure 2. Here, instead of labeling states with (KLm), we use the united-atom designation,[9,10] with (nlm) based on the types of reduced AOs in the limit $R \rightarrow 0$. One can easily work out the relations $n = K + L + m + 1$ and $l = L + m$. As with AOs, s, p, d, ... are used to reflect the information on l; by contrast, σ, π, δ, ... are used to specify the value of m (corresponding to $m = 0, 1, 2, ...$), which also shows the types of MOs.

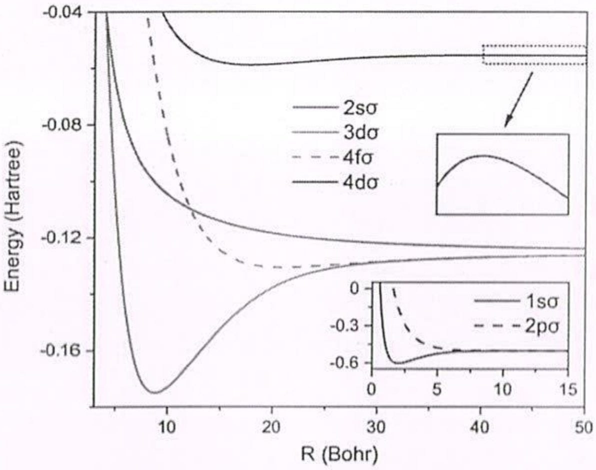

Figure 2. Energy curves of representative states of H_2^+, labeled by united atom designation. Curves in the energy range from −0.18 to −0.04 Hartree are shown in the main plot, while the lowest bonding and antibonding states are shown in the lower inset. Bonding/antibonding states are drawn in solid/dashed lines. Interestingly, the 4fσ state has a local minimum around 21 Bohr; and the 4dσ state has a local maximum around 44 Bohr (see the enlarged plot in the upper inset).

Chemists are used to characterizing MOs as bonding or antibonding by judging (i) whether a buildup of charge occurs at the bond midpoint[1,2,4] and (ii) whether the attractive forces between atoms are strengthened or weakened by occupying the MO.[37−39] For H_2^+, by (i) an MO with a mirror/nodal plane between the nuclei is a bonding/antibonding orbital; by (ii), a bonding state is supposed to produce an energy well, while an antibonding state shall monotonically decrease its energy upon dissociation.[4] (i) and (ii) are consistently true for some lowest-lying states, such as the 1sσ and 3dσ states. However, by computing the exact energy curves to an extended range and to a high precision, we find that this is not generally true for other states. For example, Figure 3 shows that the 4fσ state, which is an antibonding state by (i), develops a local minimum at $R \approx 21$ Bohr, while the 2sσ state, which is a bonding state by (i), is monotonically decreasing. Even more surprisingly, bonding states such as 4dσ can have a local maximum in the large-R region, corresponding to a transition state. In fact, such examples are widespread as shown in Table 1, where we have tabulated the positions and energies of extreme points along the energy curves of some low-lying states.

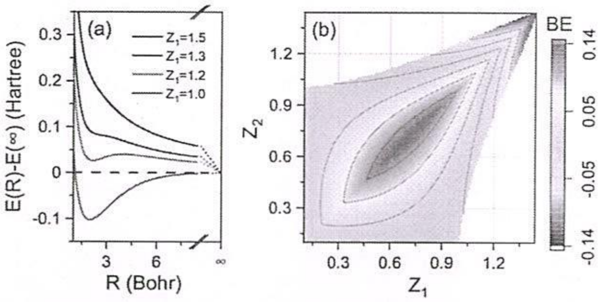

Figure 3. (a) Energy curves of the 1sσ state for different Z_1, fixing $Z_2 = 1$. Energy at the dissociation limit of each curve has been set to zero. (b) Binding energy (energy difference between the dissociation limit and the minimum, if it exists) as a function of Z_1 and Z_2, could be negative. For the blank area, there exists no minimum in the energy curve.

From the LCAO perspective, a bonding/antibonding orbital has also been associated with a decrease/increase of energy relative to the separated atoms.[1,2] Yet, we find that this is not

Table 1. Extreme Points along Energy Curves of Representative Low-Lying States of H_2^+, Including Minima and Maxima (If They Exist) Denoted as R_{min} and R_{max}, Respectively[a]

state	R_{min}	$E_{min} - E_D$	R_{max}	$E_{max} - E_D$
1sσ	2.0	-1.03×10^{-1}		
2pσ	12.5	-6.08×10^{-5}		
3dσ	8.8	-5.00×10^{-2}		
4fσ	20.9	-5.66×10^{-3}		
4dσ	17.8	-3.26×10^{-3}	43.5	1.65×10^{-4}
5gσ	23.9	-2.27×10^{-3}		
2pπ	7.9	-9.51×10^{-3}	25.8	1.44×10^{-4}

[a] Their energies, E_{min} and E_{max}, are shown relative to their respective dissociation limit E_D. Some states, such as 2sσ, 3pσ, and 3sσ, have neither maximum nor minimum and are not listed in the table. All values are in atomic units. Here we note that the shallow minimum of 2pσ has also been reported in ref 4.

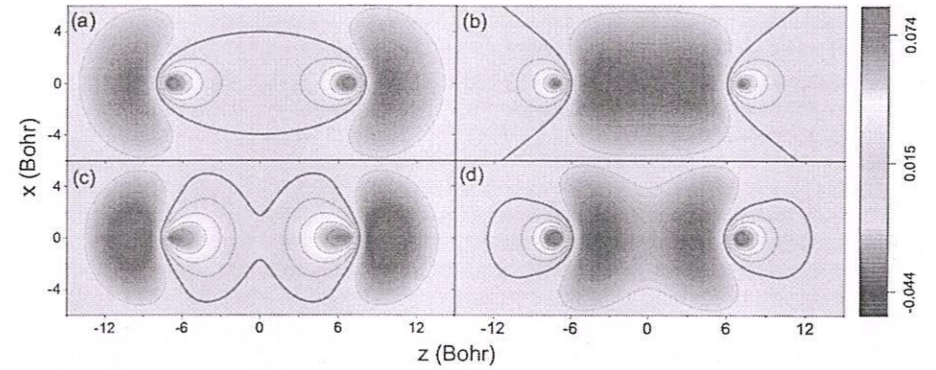

Figure 4. Contour plots of wave functions with a nuclear separation of 14 Bohr: (a) 2sσ state by our method; (b) 3dσ state by our method; (c) 2sσ state by basis expansion; (d) 3dσ state by basis expansion. For (a) and (b), 80 nonzero u_k's and 64 v_k's are used. For (c) and (d), the basis set of aug-cc-pV5Z (160 basis functions) is used. Apparently, the basis expansion here gives qualitatively incorrect nodal surfaces.

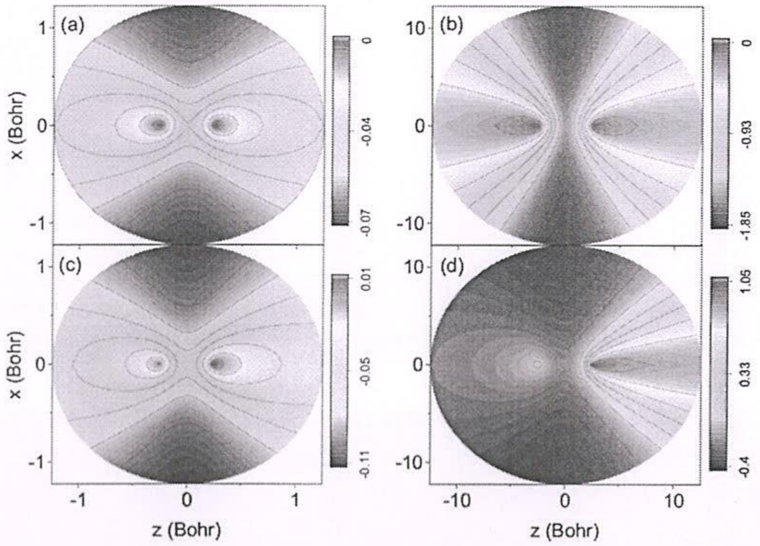

Figure 5. Modulator F shown as a function of x and z for the ground state of H_2^+ (upper panels) and HeH^{2+} (lower panels). In (a) and (c), $R = 0.5$ Bohr; in (b) and (d), $R = 5$ Bohr. Here we present results in the circled rather than the squared region.

consistent with (i) either. For example, the 4fσ state at finite R, which is antibonding by (i), has an energy lower than its dissociation limit; see Figure 2.

For heteronuclear molecules, binding curves become more sophisticated. In Figure 3a, we compare ground state energy curves with different Z_1, fixing $Z_2 = 1$. As Z_1 increases, we see a weakened binding behavior. When Z_1 reaches 1.2, an obvious transition state emerges in the energy curve, separating the local minimum from the energetically more favorable dissociation limit. This minimum fades away when further increasing Z_1. If we allow Z_2 to change, all possible combinations of Z_1 and Z_2 that lead to a minimum (binding) encircle the colored region in Figure 3b.

These observations thus call into question the validity of traditional bonding vs antibonding concepts. Furthermore, as the interplay between the electronic energy $\tilde{E}$ and the nuclear Coulomb repulsion yields energy curves with so many complicated features for systems as simple as single-electron diatomic molecules, one could likely find unexpected intermediates or transition states on the energy surfaces (particularly for excited states) of other molecules.

Besides accurate energies, perhaps more importantly, our formulas can accurately describe important features of MOs at a much lower computational cost. For example, eq 14 gives accurate hyperboloids (3dσ) and ellipsoids (2sσ) as nodal surfaces as shown in Figure 4a and b. By contrast, conventional basis expansion methods cannot capture the nodal shapes even qualitatively with commonly used basis sets; see Figure 4c and d. More demonstrations of the computational advantage of our method over conventional basis expansion can be found in the Supporting Information. Importantly, if we decompose MOs using LCAOs in the infinite separation limit, the resulting AOs are sp hybrids rather than pure 2s or 2p$_z$ orbitals.[32]

The modulator function F is an essential term in our factorization. In Figure 5, we show that F for the ground state behaves qualitatively differently for small and large R, for homonuclear as well as heteronuclear cases. In the limit $R \to 0$, in particular, F approaches a constant because the wave function reduces to the ground state of a hydrogenic atom, given by $Ce^{-\alpha_2 \xi}$. This is manifested in Figure 5a and c, where the overall scale is small. When R is large, however, F changes rapidly in the internuclear region; see Figure 5b and d. This shows that F can be used as an indicator for distinguishing compact from dissociated molecules, which is consistent with our observations for H_2^+ in 1D,[24] and could be useful for tackling the delocalization error in density functional theories, particularly for improving the recently developed localized orbital scaling correction (LOSC) functional.[40−45] Of particular interest is the behavior of F for heteronuclear cases such as HeH^{2+}. For small R as in Figure 5c, F is smooth and delocalized over the two nuclei, resembling the united atom limit. For large R as in Figure 5d, interestingly, we find that F is localized around the lighter atom (hydrogen), although the wave function is localized near the heavier atom (helium).

IV. CONCLUSIONS

In this paper, we have obtained the exact analytical forms of diatomic MOs, as given by the solutions of a single-electron SE for a diatomic molecule. We show that the best way of representing the ground MO is in our factorized form in eq 13 involving a power prefactor, an exponentially decaying term, and a modulator on the exponential, while the best way of representing excited state MOs involves additional factors accounting for the nodal surfaces and the magnetic quantum number as in eq 14. Our factorized formulas are formally intuitive and physically informative and unify the exact formulas of AOs and MOs. The usefulness of our exact formulas has been demonstrated in several aspects. Importantly, our new findings about bonding/antibonding MOs have revealed the limitation of these concepts particularly in stretched molecules.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge at https://pubs.acs.org/doi/10.1021/acsomega.2c01905.

Some details of derivations and supplemental results (PDF)

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Notes

The authors declare no competing financial interest.

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(44) Mahler, A.; Williams, J. Z.; Su, N. Q.; Yang, W. Wannier Functions Dually Localized in Space and Energy. **2022**; arXiv:2201.07751.

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I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T. Y. B.Sc. (2021-22)
Topic: Molecular Symmetry

Duration:30 min. **Marks:10**

Name of the student:

Q. Solve the following multiple choice questions

1. A linear molecule having different ends belongs to ------ point group.
a) C
b) D
c) D_{3h}
d) C_{2h}
2. A linear molecule having identical ends belongs to ------ point group.
a) C
b) D
c) D_{3h}
d) C_{2h}
3. Ammonia molecule belongs to -------- point group
a) C_{2v}
b) C_{3v}
c) D_{3h}
d) C_{2h}
4. D_{3h} point group can be explained by giving an example of -------- molecule.
a) BCl_3
b) NH_3
c) H_2O
d) H_2
5. Symmetry operation move an object into a position ------- with its original one.
a) indistinguishable
b) distinguishable
c) identical
d) more or less similar
6. For centre of symmetry to exist, except atom at i, all the atoms in a molecule must occur -------
a) in pairs
b) singly
c) passing in pairs and partly in single
d) more than pairs
7. Improper rotational axis is called --------
    a) Rotation followed by reflection axis
    b) Reflection followed by rotation axis
    c) Axis through which molecule can not be rotated properly
    d) Parallel axis

8. Cabcd molecule contain ------- point group.

   a) C_1
   b) C_{3v}
   c) D_{3h}
   d) C_{2h}

9. Benzene contain -------- symmetry element

   a) C_1
   b) C_6
   c) D_8
   d) C_7

10. CCl_4 contain --------- point group.

   a) Oc
   b) C_6
   c) D_8
   d) Td

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T. Y. BSc (Semester-I)
Topic: Molecular Symmetry

Duration :30 min. Marks:10

Name of the student: --

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Solve the following multiple choice questions

1. A linear molecule having different ends belongs to ------ point group.
   a) C
   b) D
   c) D_{3h}
   d) C_{2h}
2. A linear molecule having identical ends belongs to ------ point group.
   a) C
   b) D
   c) D_{3h}
   d) C_{2h}
3. Ammonia molecule belongs to -------- point group
   a) C_{2v}
   b) C_{3v}
   c) D_{3h}
   d) C_{2h}
4. D_{3h} point group can be explained by giving an example of -------- molecule.
   a) BCl_3
   b) NH_3
   c) H_2O
   d) H_2
5. Symmetry operation move an object into a position ------- with its original one.
   a) indistinguishable
   b) distinguishable
   c) identical
   d) more or less similar
6. For centre of symmetry to exist, except atom at i, all the atoms in a molecule must occur -------
   a) in pairs
   b) singly
   c) passing in pairs and partly in single
   d) more than pairs
7. Improper rotational axis is called --------

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990

SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)

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Ref. No.: ICS/ **Date :**

Notice

Date- 25/06/2022

All T.Y.B.Sc. students are here by informed that class test will be conducted as on **25/06/2022** on **Topic Name-** 'Molecular Symmetry' as part of teaching learning beyond curriculum**.**

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T. Y. BSc (Semester-I)
Topic: Molecular Symmetry

Duration :30 min. Marks:10
Name of the student: Akhade Mangesh Ramesh.
Roll no.
Instruction:

✓ Tick correct option

Q.1 Solve the following multiple choice questions

1. A linear molecule having different ends belongs to ------ point group.
a) C
b) D
[✓ c)] D_{3h}
d) C_{2h}
01
2. A linear molecule having identical ends belongs to ------ point group.
a) C
b) D
[✓ c)] D_{3h}
01
d) C_{2h}
3. Ammonia molecule belongs to -------- point group
a) C_{2v}
[✓ b)] C_{3v}
c) D_{3h}
01
d) C_{2h}
4. D_{3h} point group can be explained by giving an example of -------- molecule.
a) BCl_3
[✓ b)] NH_3
01
c) H_2O
d) H_2
5. Symmetry operation move an object into a position ------- with its original one.
a) indistinguishable
b) distinguishable
[✓ c)] identical
01
d) more or less similar
6. For centre of symmetry to exist, except atom at i, all the atoms in a molecule must occur -------
a) in pairs
[✓ b)] singly
c) passing in pairs and partly in single
d) more than pairs
01
7. Improper rotational axis is called --------

a) Rotation followed by reflection axis
b) Reflection followed by rotation axis
00 [✓ c) Axis through which molecule can not be rotated properly]
d) Parallel axis

8. Cabcd molecule contain ------- point group.

a) C_1
b) C_{3v}
00 [✓ c) D_{3h}]
d) C_{2h}

9. Benzene contain -------- symmetry element

a) C_1
b) C_6
01 c) D_8
[✓ d) C_7]

10. CCl_4 contain --------- point group.

a) Oc
b) C_6
00 c) D_8
[✓ d) Td]

$$\frac{08}{10}$$

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T. Y. BSc (Semester-I)
Topic: Molecular Symmetry

Duration :30 min. Marks:10

Name of the student: Bade Danisha Iqbal.

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Solve the following multiple choice questions

1. A linear molecule having different ends belongs to ------ point group.
a) C
b) D
01 [✓ c)] D_{3h}
d) C_{2h}

2. A linear molecule having identical ends belongs to ------ point group.
a) C
b) D
01 [✓ c)] D_{3h}
d) C_{2h}

3. Ammonia molecule belongs to -------- point group
[✓ a)] C_{2v}
00 b) C_{3v}
c) D_{3h}
d) C_{2h}

4. D_{3h} point group can be explained by giving an example of -------- molecule.
a) BCl_3
[✓ b)] NH_3
c) H_2O
01 d) H_2

5. Symmetry operation move an object into a position ------- with its original one.
a) indistinguishable
[✓ b)] distinguishable
01 c) identical
d) more or less similar

6. For centre of symmetry to exist, except atom at i, all the atoms in a molecule must occur - ------
a) in pairs
[✓ b)] singly
01 c) passing in pairs and partly in single
d) more than pairs

7. Improper rotational axis is called --------

a) Rotation followed by reflection axis
b) Reflection followed by rotation axis
00 [✓ c) Axis through which molecule can not be rotated properly]
d) Parallel axis

8. Cabcd molecule contain ------- point group.

[✓ a) C_1]
01 b) C_{3v}
c) D_{3h}
d) C_{2h}

9. Benzene contain -------- symmetry element

a) C_1
b) C_6
01 c) D_8
[✓ d) C_7]

10. CCl_4 contain --------- point group.

a) Oc
01 b) C_6
c) D_8
[✓ d) Td]

08.

$$\frac{08}{10}.$$

I.C.S. College Khed
Department of Chemistry
Class: TY BSc (2021-22)
Name of Topic: Molecular Symmetry

Sr. No.	Name of Student	Mark Obtained (10)
1	AKHADE MANGESH RAMESH	8
2	AKHADE AKSHAY GANGARAM	7
3	AKHADE SANGITA JANU	6
4	AKHADE SURYAKANT ANANT	6
5	AMBRE ASHISH AJAY	7
6	BADE DANISA IQBAL	8
7	BHANDARE SAURABH SANJAY	7
8	BHOSALE RUTUJA NANAJI	7
9	BHOSALE SAKSHEE ANIL	6
10	BHOSALE AMOL CHANDRAKANT	6
11	BHOSALE JAYESH LAVESH	5
12	BHUVAD SANI SUBHASH	6
13	BHUWAD VIRAJ VIKAS	5
14	BOTHARE SUNAYANA SHRIRAM	5
15	CHALKE VAISHNAVI SAMBHAJI	6
16	CHAVAN RAKHI SANJAY	6
17	CHAVAN SUHAS SURESH	6
18	CHAVAN OMKAR RAJENDRA	5
19	CHOUGLE MUSKAN MOHD SHAH	7
20	SHANUF ABDUL WAHAB CHOUGULE	7
21	DALVI POOJA JANARDAN	6
22	DAWRE MISBAH A RAZZAK	6
23	DHADVE ANIKET GAJANAN	7
24	DHEBE GANESH VITTHAL	5
25	DHEBE PANKAJ DIPAK	5
26	GAIKWAD AVANTIKA GANGARAM	5
27	GAMARE SHUBHAM MILIND	7
28	GAMARE MANASI MAHENDRA	7
29	GAMARE POOJA PRATAP	7
30	GAMARE PRANAY MOHAN	7
31	GAVADE MADHAVI MAHESH	6
32	GAVADE TRUPTI RAJENDRA	7
33	GHADGE TUSHAR DHANAJI	5
34	GHAG ABHISHEK AMARDIP	5
35	GHEVDEKAR RUTUJA SUDHAKAR	7
36	GHOSALKAR SNEHAL SANJAY	6
37	GHOSALKAR MITAL MADHUKAR	6
38	GHOSALKAR SAHIL SANTOSH	5
39	GHOSALKAR SAHIL PRAMOD	7
40	GHOSALKAR DURGESH DIPAK	6
41	GUHAGARKAR RUTIK DIPAK	6
42	GUJAR SNEHAL SUBHASH	6
43	GURAV SNEHAL SANDIP	6

I.C.S. College Khed
Department of Chemistry
Class: TY BSc (2021-22)
Name of Topic: Molecular Symmetry

Sr. No.	Name of Student	Mark Obtained (10)
44	JADHAV MANASI MADHUKAR	6
45	JADHAV REVATI RAMESH	5
46	JADHAV SHUBHAM SATISH	6
47	JADHAV SIDHANT SANTOSH	6
48	JADHAV POOJA MUKESH	5
49	JAGADALE PRATIKSHA GANESH	6
50	JANGAM SHUBHANGI PRAMOD	6
51	JUVALE RUTIK LAVU	5
52	KADAM PRIYANKA SANJAY	6
53	ALFIYA LIYAQAT KADIRI	5
54	KAJARE AMRUTA ANANT	6
55	KHAN OBAIDURRAHMAN ABDUR RAHMAN	6
56	KHAPARE RUSHIKESH SURESH	5
57	KHARAT SURAJ JAYRAM	5
58	KHARAVATE VINAY VILAS	6
59	KHEDEKAR AISHWARYA ASHOK	7
60	KHEDEKAR AYESHA ABDUL GAFFAR	5
61	KHERADE SHUBHAM SANJAY	6
62	MUKADAM YUSRA HIDAYAT	7
63	MULLAJI IQRA JAVEED	6
64	NACHARE SONAL KRUSHNA	6
65	PADWAL SHUBHAM SUBHASH	7
66	PANDAM AKSHAY CHANDRAKANT	6
67	PANDERE PRANALI PRAKASH	6
68	PARKAR AHLAM ANIS	7
69	PARKAR SAIMA FAYYAZ	6
70	PARKAR SHAKILA FAIYYAZ	5
71	PARKAR MEHRIN NAZIR	5
72	PARTE AKSHATA SHANKAR	5
73	PATOLE ANURADHA DAGADU	6
74	PAWAR ROHIT RAJENDRA	6
75	PAWAR KASHMIRI SUBHASH	5
76	RAJPUT SAKSHI GANESH	6
77	RANE SHALINI ANIL	6
78	SONDE SAFA JALIL	5
79	SANOBAR MOHAMMED RAFIQUE SURVE	6
80	SUTAR PRATIKSHA BHARAT	5
81	TAMBE SADAF ZAKIR	7
82	TAMBITKAR SHUBHAM SUBHASH	7
83	THOMBARE ABHISHEK ANANT	6
84	UDEK SHUBHAM SURESH	7
85	UPALE AJAY BAJI	5

I.C.S. College Khed
Department of Chemistry
Class: TY BSc (2021-22)
Name of Topic: Molecular Symmetry

Sr. No.	Name of Student	Mark Obtained (10)
86	VICHARE MAYUR MANOJ	7
87	ZORE VIJAY PANDURANG	5
88	ZORE VIJAY RAVINDRA	5
89	ZORE SHUBHAM HARIRAM	6

Dr. Ghumbre S.K.

Class :- T.Y. B.Sc.
Subject :- Chemistry-III
Topic :- Carbohydrate Chemistry

Nations Relief and Rehabilitation Administration and the Emergency Conference on European Cereals Supplies are addressing themselves equally with the Economic and Social Council, will strengthen the common interest in prosperity, the recognition that economic prosperity, like peace, is indivisible, and render more tractable the animosities and political problems which have already caused such concern to the new Organisation. But while it must be remembered that conceptions of democracies and of other political systems may vary widely in different countries, and no one political system is likely to serve the needs of all nations, there are certain principles which must be observed if any international association is to be possible. The United Nations Organisation is not, and cannot be made, a world government : it is at best an instrument of international co-operation. Even so, it cannot function except on a basis of mutual trust and the abandonment of the claim to be a judge in one's own cause. Full confidence can only come as the new instrument proves its worth, but the way forward lies in the full and public understanding of the way it functions and what it can and cannot do. There is no more urgent or more important step towards that end than full and free discussion in all countries by those who realize the importance of this new venture and the catastrophe which will overwhelm mankind if it fails.

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[1] Third Montague Burton Lecture on International Relations : Victory and After. By Prof. Gilbert Murray. Pp. 16. (University of Leeds, 1945.) 6*d*.

[2] League of Nations. Report on the Work of the League during the War. (Official No. A.6. 1946.) Pp. 167. (Geneva : League of Nations. London : George Allen and Unwin, Ltd., 1945.) 2*s*.

[3] The United Nations Charter. (Peace Aims Pamphlet 31.) Pp. 56. (National Peace Council, 144 Southampton Row, London, W.C.1, 1946.) 1*s*.

[4] *Proceedings of the American Academy of Arts and Sciences*, 75, No. 1. Papers on Post-War Problems. Pp. 54. (Boston, Mass. : Amer. Acad. Arts and Sci., 1942.) 1.25 dollars.

ADVANCES IN CARBOHYDRATE CHEMISTRY

Advances in Carbohydrate Chemistry
Edited by W. W. Pigman and M. L. Wolfrom. Vol. 1. Pp. xii+374. (New York : Academic Press, Inc., 1945.) 6 dollars.

THE rapid increase in the volume of scientific publications makes it ever more difficult for those interested, specialists and non-specialists alike, to keep abreast of recent developments in any particular field. Many attempts have been made to solve this problem, one of the most recent taking the form of a series of volumes devoted to articles on specialist topics in one field of inquiry. In the circumstances, these serve a useful purpose, but it must be admitted that their acquisition is rapidly becoming a formidable financial problem both for libraries and for private individuals. The latest comer in this group is "Advances in Carbohydrate Chemistry", the first volume of which has just appeared under the supervision of an editorial board which includes both American and British representatives. The present volume, however, is entirely American in authorship, this being clearly a reflexion of war-time difficulties of writing and communication, and not an indication of the relative interest in carbohydrate chemistry in the two countries.

The eleven articles are in the main detailed reviews of the type made familiar to all chemists by *Chemical Reviews*. They are admirable of their kind, lucidly written and well illustrated by formulæ and equations. They are a veritable storehouse of historical and factual information, much of which is not readily accessible otherwise, and is in any event difficult to assemble. We can be grateful, therefore, to the experts who have given us these authoritative accounts of the historical development and the present position of knowledge in these special branches of carbohydrate chemistry.

It is very appropriate that the first article in this new venture should come from the pen of C. S. Hudson, whose contribution on "The Fischer Cyanohydrin Synthesis and Configurations of Higher Carbon Sugars and Alcohols" is one of the most interesting in the volume. To most readers it will be a surprise to realize how much detailed effort and skill have been devoted in the past half-century to the elucidation of the structures of the higher sugars and their derivatives, and how many problems still remain to be solved.

N. K. Richtmyer writes on "The Altrose Group of Substances". Until recently little was known about this group, which is of special interest because of its configurational relationship to ribose. Rapid progress is, however, being made in methods of preparation and in the detailed investigation of individual members of the group, which includes the naturally occurring ketose sedo-heptulose.

The interesting, and in many ways puzzling, group of "The Carbohydrate Orthoesters" is described in detail by E. Pacsu, who makes a gallant, but to the reviewer not altogether convincing, attempt to 'explain' the peculiar properties of these esters in terms of modern electronic theories of valency.

A. L. Raymond discusses the thio- and seleno-sugars, an interesting but comparatively little investigated group of substances concerning which much more is likely to be heard in the future. This article is followed by one on the "Carbohydrate Components of the Cardiac Glycosides" by R. C. Elderfield, who describes the occurrence, preparation and constitution of all the known simple sugars and of one of the disaccharides in this rare and complex but fascinating group of substances. A detailed account of the "Metabolism of the Sugar Alcohols and their Derivatives" is contributed by C. J. Carr and J. C. Krautz, and a masterly and readable article on the "Chemistry of the Nucleic Acids" is given by R. S. Tipson. In it he discusses the difficulties met with in the investigation of the desoxyribosylpurines and the isolation of 2-desoxyribose, and shows how the structures of the various nucleosides and nucleotides have been elucidated.

An article by T. J. Schoch on the "Fractionation of Starch" is particularly welcome in view of the prominent part this author has taken in recent work on the separation of the amylose and amylopectin components of starch, through which an entirely new chapter has been opened up in starch chemistry. There are articles on starch esters by R. L. Whistler and on "Cellulose Organic Esters" by C. R. Fordyce —mainly dealing with a summary account of methods of preparation and physical properties. The concluding section is by E. Anderson and Lila Sands on "A Discussion of Methods of Value in Research on Plant Polyuronides". These substances are among the most complex natural products known, and in this useful article a critical account is given of the practical methods available for the isolation, purification and examination of various pectic materials, gums and mucilages.

It will be obvious from the brief description of the contents that the articles cover a wide field, and their publication will serve a most useful purpose. In some places observations hitherto unpublished are recorded, but it is to be hoped that the publication of original papers in this form will be resisted by the editorial board. There is a place for the regular publication of review articles in volumes of this type, but questions relating to indexing, to mention one aspect only, would become still more complex if these "Advances" became partly reviews and partly original material.

E. L. Hirst

THE FIRST NATIONAL PHARMACOPŒIA

Pharmacopoeia Londinensis of 1618

Reproduced in facsimile, with a Historical Introduction by George Urdang. (Hollister Pharmaceutical Library, No. 2.) Pp. ix + 299. (Madison, Wis.: State Historical Society of Wisconsin; New York: Schuman's, 1944.) 12 dollars.

It is difficult to say when the first pharmacopœia was published. The first edition of the Chinese Materia Medica is said to have been prepared about 3000 B.C. by the emperor Shen Nung. The Ebers Papyrus was written about 1500 B.C. Books on materia medica were written by Theophrastus (380–286 B.C.), Scribonius Largus (A.D. 45), Dioscorides (c. A.D. 60), Galen (A.D. 130–200) and many others. It is sometimes said that the first real pharmacopœia was the "Nuovo Receptario Composito", which was made official in Florence in 1498, or the book prepared by Valerius Cordus which was adopted officially by Nuremburg (1546), or that prepared by Adolph Occo (1564) which was actually called a pharmacopœia and was made official in Augsburg in 1613.

These books were only 'official' in small territories. The Royal College of Physicians in London was the first body to prepare a pharmacopœia which became official throughout a whole country. The project was first discussed in 1585, and the College decided to think it over. Four years later the College discussed it again and decided to take action. A committee was appointed, and started work energetically; but though it was reinforced five years later, it did not complete its task. There was then a period of nearly twenty years during which little or nothing was done. In 1614 activity revived; a new committee was appointed which finished its work in four years and produced the first issue of the pharmacopœia in May 1618. Apparently only two copies of this issue are known to exist, and one of these has now been reproduced in facsimile. The actual text is preceded by 80 pages of most interesting historical discussion by Dr. George Urdang, who fled from Germany in 1939 and is now director of the American Institute of the History of Pharmacy, Madison.

This first issue evidently met with much criticism from the younger fellows of the Royal College of Physicians and was replaced in December 1618 by a larger book, which became accepted as the first edition. All the blame for the deficiencies of the first issue was laid on the printer: "As a blaze flares up from a fire and in a greedy famine deprives the stomach of its still unprepared food, so the printer snatched away from our hands this little work not yet finished off, without consulting the president, yea even during a time when the latter who most thoroughly took care of corrections and polishing was out of town because of a call". Dr. Urdang believes that the printer was merely a convenient scapegoat who took the blame for a fundamental change in the book. A detailed comparison of the two issues provides weighty evidence for this view. The first issue was a comparatively brief list of drugs and compounds in common use. The second issue was a combination of formulary and text-book with the purpose of giving general information and a survey of the entire materia medica. Its list of simples (crude drugs) was nearly twice as long. The names of three senior members of the College which had been attached to formulæ in the first issue were eliminated. The new list of fellows of the College contains more information about the professional distinctions of junior fellows. The production of the second issue was thus probably due to the desire of these junior fellows for a more learned and comprehensive book which would bring more credit to the College in general and to themselves in particular, and would include all the drugs which they themselves prescribed. The most striking increase was in the section devoted to organotherapy. Under the heading "Animalia" there are 47 items in the first issue and 162 in the second. The additions include the flesh of vipers, swallows' nests, feathers, saliva, sweat and five kinds of urine, none of which is official to-day; but they also include liver, stomach, and honey, which are. The new issue was clearly quite a new book, and the official reasons for the suppression of the first issue do not stand up to critical examination. The first issue was more like a modern pharmacopœia and, if it had survived, later committees would have been saved from much expurgation.

Apart from this discussion of the two issues, Dr. Urdang gives an interesting account of the historical background. Both issues were based on numerous previous formularies, of which the most directly important was the Augsburg pharmacopœia, which was reproduced as No. 1 of the Hollister Pharmaceutical Library. The preface addressed *candido lectori* is identical in both issues and makes entertaining reading. It is much more appropriate to the first issue than the second. It makes grateful reference to the learned and active King James who had just bestowed a royal charter on the Society of Apothecaries, and who authorized the inclusion of a royal proclamation in both issues forbidding apothecaries to use any other pharmacopœia. It emphasizes the desire of the Royal College of Physicians to include both old drugs and new: "Although we revere the wisdom of the old masters and have arrayed their preparations, so to speak, in the first line of battle, nevertheless we have not rejected or disdained the auxiliary troops of the new chemistry". The revolutionary views associated with the name of Paracelsus and his followers were thus officially recognized. The main purpose of the original committee was, however, to conduct a campaign against complicated prescriptions. This purpose was largely defeated by the publication of the second issue.

Dr. Urdang has done a great service in bringing these facts to light, and is to be congratulated on having produced a magnificent book.

J. H. Gaddum

I. C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T. Y. B.Sc. (2019-20)
Topic: Carbohydrate Chemistry

Duration: 30 min. **Marks: 10**

Name of the student:

Q. Solve the following multiple choice questions

1] -------- is a polysaccharide.

[✓ a) cellulose] b) glucose c) maltose d) lactose

2] ------- is a aldose.

a) ribose b) ribulose c) sorbose d) xylulose

3] ------- are stereoisomer are possible for a ketohexose.

a) 8 b) 6 c)10 d) 16

4] ------moles of periodic acid consume with D-glucose

a) 2 b) 3 c) 4 d) 5

6] ------ is most stable form of glucose.

a) D(+) mannose b) D(+) ribulose c) D(+) xylulose d) D(+) fructose

7] ------- method used to ascent the series of aldehyde in carbohydrates.

a) Wohl's b) Weerman's c) Ruff's d) Kiliani's

8] The reduction of D(+) glucose with $NaBH_4$ gives --------

a) sorbitol + mannitol b) mannitol c) sorbitol d) none of these

9] --------- reagent react with sucrose.

a) sucrose b) maltose c) lactose d) None of these

10] --------- sugar component of DNA has the empirical formula $C_5H_{10}O_4$.

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T. Y. BSc (Semester-VI)
Paper-IV
Topic: Carbohydrate Chemistry

Duration :30 min. Marks:10

Name of the student: ---

Roll no.

Instruction:

- ✓ Tick correct option

Q. Solve the following multiple choice questions

1] -------- is a polysaccharide.

a) cellulose b) glucose c) maltose d) lactose

2] ------- is a aldose.

a) ribose b) ribulose c) sorbose d) xylulose

3] ------- are stereoisomer are possible for a ketohexose.

a) 8 b) 6 c)10 d) 16

4] ------moles of periodic acid consume with D-glucose

a) 2 b) 3 c) 4 d) 5

6] ------ is most stable form of glucose.

a) D(+) mannose b) D(+) ribulose c) D(+) xylulose d) D(+) fructose

7] ------- method used to ascent the series of aldehyde in carbohydrates.

a) Wohl's b) Weerman's c) Ruff's d) Kiliani's

8] The reduction of D(+) glucose with $NaBH_4$ gives --------

a) sorbitol + mannitol b) mannitol c) sorbitol d) none of these

9] --------- reagent react with sucrose.

a) tollen b) fehling c) barfoed d) None of these

10] --------- sugar component of DNA has the empirical formula $C_5H_{10}O_4$.

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Sahajeevan Shikshan Sanstha's

Estd.-1990

SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
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Ref. No.: ICS/ **Date :**

Notice

Date- 13/03/2022

All T.Y.B.Sc. students are here by informed that class test will be conducted as on **16/03/2022** on **Topic Name-** 'Carbohydrate Chemistry' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T. Y. BSc (Semester-VI)
Paper-IV
Topic: Carbohydrate Chemistry

Duration :30 min. Marks:10

Name of the student: Agre Santosh Sanjay

Roll no.

Instruction:

- ✓ Tick correct option

Q. Solve the following multiple choice questions

1] -------- is a polysaccharide.

01 [✓ a) cellulose] b) glucose c) maltose d) lactose

2] ------- is a aldose.

01 [✓ a) ribose] b) ribulose c) sorbose d) xylulose

3] ------- are stereoisomer are possible for a ketohexose.

01 [✓ a) 8] b) 6 c)10 d) 16

4] ------moles of periodic acid consume with D-glucose

01 a) 2 b) 3 [✓ c) 4] d) 5

6] ------ is most stable form of glucose.

00 a) D(+) mannose b) D(+) ribulose c) D(+) xylulose [✓ d) D(+) fructose]

7] ------- method used to ascent the series of aldehyde in carbohydrates.

01 a) Wohl's b) Weerman's c) Ruff's [✓ d) Kiliani's]

8] The reduction of D(+) glucose with $NaBH_4$ gives --------

01 a) sorbitol + mannitol b) mannitol [✓ c) sorbitol] d) none of these

9] --------- reagent react with sucrose.

00 a) tollen [✓ b) fehling] c) barfoed d) None of these

10] --------- sugar component of DNA has the empirical formula $C_5H_{10}O_4$.

01 a) ribose b) glucose [✓ c) deoxy ribose] d) deoxy glucose

$\overline{07}$ $\frac{07}{10}$

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T. Y. BSc (Semester-VI)
Paper-IV
Topic: Carbohydrate Chemistry

Duration :30 min. Marks:10
Name of the student: Jangam Prathamesh Pratik.
Roll no.
Instruction:
- ✓ Tick correct option

Q. Solve the following multiple choice questions

1] -------- is a polysaccharide.

01 [✓ a) cellulose] b) glucose c) maltose d) lactose

2] ------- is a aldose.

01 [✓ a) ribose] b) ribulose c) sorbose d) xylulose

3] ------- are stereoisomer are possible for a ketohexose.

01 [✓ a) 8] b) 6 c)10 d) 16

4] ------moles of periodic acid consume with D-glucose

01 a) 2 b) 3 [✓ c) 4] d) 5

6] ------ is most stable form of glucose.

00 a) D(+) mannose b) D(+) ribulose c) D(+) xylulose [✓ d) D(+) fructose]

7] ------- method used to ascent the series of aldehyde in carbohydrates.

01 a) Wohl's b) Weerman's [✓ c) Ruff's] d) Kiliani's

8] The reduction of D(+) glucose with $NaBH_4$ gives --------

01 a) sorbitol + mannitol b) mannitol [✓ c) sorbitol] d) none of these

9] --------- reagent react with sucrose.

00 a) tollen b) fehling c) barfoed [✓ d) None of these]

10] --------- sugar component of DNA has the empirical formula $C_5H_{10}O_4$.

a) ribose b) glucose c) deoxy ribose [✓ d) deoxy glucose]

00

$\frac{06}{10}$

I.C.S. College Khed
Department of Chemistry
Class: TY BSc (2019-20)
Name of Topic: Carbohydrate Chemistry

Sr. No.	Name of Student	Mark Obtained (10)
1	AGRE SANTOSH SANJAY	7
2	JITESH YASHWANT AKHADE	6
3	AKHADE SONIYA SANTOSH	5
4	AMBARE SWAPNIL SHARAD	5
5	AMBRE ANKET RAVINDRA	6
6	AMBRE SUSHANT SHASHIKANT	5
7	BHAKTI VINOD AMBRE	5
8	ROHIT RAJENDRA AMBRE	6
9	MRUNALI SANJAY BHALEKAR	5
10	BHOSALE DAMINEE VASANT	7
11	BHOSALE SHITAL BHASKAR	7
12	MANISH MAHENDRA CHALKE	7
13	SHRADDHA MANOJ CHAVAN	6
14	CHAVAN SURAJ BALU	6
15	KARISHMA LAXMAN CHAVAN	5
16	CHINCHAVILKAR RAJANI JAYANT	5
17	SAIRA USMAN CHOUGULE	6
18	ADNAN ABDULKADIR CHOUGULE	6
19	CHAITALI CHANDRASHEKHAR DANDEKAR	7
20	MANGESH ANIL DEVLEKAR	7
21	DEVRUKHKAR SNEHA RAMESH	7
22	DHADAVE ANIKET SANTOSH	8
23	DHADAVE SHEKHAR GANESH	6
24	DHADAVE AKASH SHRIKANT	5
25	DIPALI RAMAJI DHEBE	5
26	DHOTRE PRAJAKTA PRAMOD	8
27	ALPESH ASHOK DIWALE	8
28	GAIKWAD CHETAN CHANDRAKANT	8
29	GAJMAL KIRAN SUDHIR	7
30	GAJMAL DIPESH VIJAY	5
31	GAMARE ATUL SUNIL	5
32	GAMARE BHAVESH SUNIL	6
33	GAWADE PRITI PRAKASH	6
34	NAMEERA IRFAN GAZALI	6
35	PRATIK TUKARAM GOTAL	7
36	ROSHAN DIPAK GUHAGARKAR	5
37	PRATIKSHA PRADIP GUHAGARKAR	6
38	IPTE SAURABH SANTOSH	6
39	AJAY SANDESH JADHAV	7
40	JADHAV GAURAV GANPAT	7
41	JADHAV ROHIT SUNIL	5
42	JADHAV OMKAR NETAJI	6
43	SHAMAL SHARAD JADHAV	7

I.C.S. College Khed
Department of Chemistry
Class: TY BSc (2019-20)
Name of Topic: Carbohydrate Chemistry

Sr. No.	Name of Student	Mark Obtained (10)
44	SHAMBHAVI ANIL JADYAL	7
45	JAGADE VAISHALI DATTARAM	5
46	OMKAR NARESH JANGAM	5
47	JANGAM PRATHAMESH PRADIP	6
48	JASNAIK SUHAIL MUSTAFA	6
49	NIKITA SUDHIR JAWALE	7
50	JOGALE SANKET RAVINDRA	6
51	SAYALI SANTOSH KADAM	5
52	POONAM DILIP KADAM	6
53	KADAM ROHIT PRADIP	6
54	PUJA SHIVAJI KADAM	5
55	SAHIL PRAKASH KADAM	7
56	KADAM PREM PRADEEP	5
57	SANA SAYED DAWOOD KADIRI	6
58	KADU SAYALI SHASHIKANT	7
59	KADVEKAR SAHIL SALEEM	7
60	SOHAM SUBHASH KARJULKAR	6
61	KAVATIYA VISHAL VINOD	6
62	KAZI ARUSA ABUL HASAN	5
63	KHAIRE ROSHAN BHAGURAM	6
64	RUCHI MILIND KHALE	6
65	KHERADE MAYUR RATNAKAR	7
66	KORADE PURWANSHI PURUSHOTTAM	5
67	KOTERE AMRUTA ASHOK	6
68	KULE VISHAL SANTOSH	5
69	CHAITANYA CHANDRAKANT KULE	5
70	DIKSHITA ASHOK LAD	5
71	SAMRUDDHI MAHESH LAKHAMDE	6
72	SHUBHAM MANGESH MAHADIK	7
73	MAHADIK ANIKET DILIP	5
74	MANIYAR AISHA IBRAHIM	5
75	RAKHI RAMESH MHADLEKAR	6
76	MHADLEKAR SHRADDHA SANTOSH	7
77	MHAISKAR PRAVIN PRAKASH	5
78	MOHITE SMITA ANAND	6
79	PRIYANKA VIJAY MOHITE	6
80	PRAJAL PRADIP MORE	5
81	SONALI VISHNU MORE	6
82	MORE TEJRAJ BHAGOJI	7
83	SADAF MUSHTAK MUKADAM	7
84	AYESHA A RAUF MURUDKAR	7

Dr. Bhagat S. M.

Class :- F. Y. B.Sc
Subject :- chemistry - I (Semester - II)
Name of Topic :- Acid-base Theories.

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Article

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Investigating Students' Reasoning about Acid–Base Reactions

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Supporting Information

ABSTRACT: Acid–base chemistry is central to a wide range of reactions. If students are able to understand how and why acid–base reactions occur, it should provide a basis for reasoning about a host of other reactions. Here, we report the development of a method to characterize student reasoning about acid–base reactions based on their description of *what* happens during the reaction, *how* it happens, and *why* it happens. We show that we can reliably place student responses into categories that reflect the model of acid–base reactivity used and whether the students invoke an electrostatic causal argument. However, the quality of student responses is highly dependent on the structure of the task prompt, which must be structured to provide students with enough information for them to understand what is needed. In general, students who construct responses that invoke a causal mechanistic Lewis model are more likely to draw appropriate curved arrow reaction mechanisms.

KEYWORDS: *Undergraduate/College Chemistry, Acid–Base Reactions, Mechanistic Explanations, Chemistry Education Research, Testing/Assessment*

FEATURE: Chemical Education Research

INTRODUCTION

Acid–base reactions are a major component of chemistry. If students understand acid–base chemistry in all its guises, it becomes possible to predict and explain the outcomes of a wide range of apparently unrelated reactions. For example, students would be able to connect and integrate seemingly diverse phenomena such as proton transfer, transition metal coordination complexes, and organic reactions involving nucleophilic and electrophilic attack. However, as discussed below, there are a wide range of well-recognized problems that students face as they learn acid–base concepts: from misconceptions, to the use of surface level features to identify acids and bases, to difficulties with understanding how to use and move flexibly between models of acid–base chemistry. While there is a great deal of research on student misconceptions about the nature of acids and bases, and the difficulties that students have in recognizing and using the idea of acid–base chemistry, there are fewer reports on student understanding of acid–base reactions themselves. To help us understand how students think about acid–base reactions, we have developed assessment tasks that prompt students to construct explanations about how and why these reactions occur. In this paper, we describe how we use these student responses to develop an approach that allows us to characterize how students reason about acid–base reactions. We also investigate how the model that students use to reason about these reactions might be associated with their mechanistic reasoning. Since mechanistic reasoning is normally operationalized (at least in organic chemistry courses) by drawing mechanistic arrows, we also investigate how students verbal mechanistic reasoning compares to the ways they drew mechanistic arrows.

The goals of this study are guided by three research questions (RQs):

RQ 1: In what ways do students reason about acid–base reactions?

RQ 2: In what ways does the structure of the item prompt affect student responses?

RQ 3: In what ways does student reasoning about acid–base reactions relate to how they draw mechanistic arrows?

STUDENT UNDERSTANDING OF ACIDS AND BASES

There have been a number of approaches to characterize how students understand acids and bases and their chemistry. Much of this research has focused on documenting the misconceptions or non-normative ideas that hinder understanding of acid–base chemistry in high school level,[1−10] undergraduate general chemistry,[11−14] undergraduate organic chemistry,[15−19] and graduate chemistry.[20] Some reports focus on difficulties with mathematical ideas involving acid–base chemistry including difficulty with and the meaning of pH calculations, equilibrium calculations, and buffers.[5,7,13,21,22] Others indicate that difficulty with prior knowledge often hinders understanding. For example, Nakhleh and Krajcik[13] studied student understanding of acids and bases and reported underlying problems such as the inability to distinguish between a molecule, atom, and ion, and how acids and bases are represented. Other researchers[23] have reported on how students recognize acids and bases, for example, by looking

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for the presence of a H or an OH (that is, a surface level feature) to identify acids and bases or by identifying the types of heuristics that more advanced students use as shortcuts when ranking acid strength.[16] It has been shown that students tend to rely on isolated features and heuristics rather than scientifically acceptable arguments. Concept inventories[24] that address a range of misconceptions about acid–base strength in the context of organic molecules have also been developed.

However, there are relatively few studies that investigate how students reason about acid–base reactions—that is, the way acids and bases interact, instead of focusing on acids or bases separately. In this study, we are concerned with the ways that students explain *what* happens during an acid–base reaction and *how* and *why* acid–base reactions occur. After all, acids and bases are inextricably interwoven; acids (or bases) do not exist in isolation—they are part of an acid–base system.

STUDENT UNDERSTANDING OF ACID–BASE MODELS

By the time students complete a general chemistry course, it is generally assumed that they have been introduced to the three common models that describe acid–base chemistry: Arrhenius, Brønsted–Lowry, and Lewis. These models can be seen as building on each other; the Arrhenius model is subsumed by the Brønsted–Lowry model, which in turn is subsumed by the Lewis model. While students are typically introduced to the Arrhenius model in high school, the Brønsted–Lowry model is usually the first approach that can be applied to a range of systems. Indeed, many experts use the Brønsted–Lowry model for situations that involve only proton transfer. However, if students can also use the Lewis acid–base model, that is, understand proton transfer as an interaction between an electron pair and a proton, it becomes easier to expand an understanding of acid–base reactions to a wider class of reactions that involve interactions between an electron pair and an electron-deficient center. As has been noted,[18,25] if students learn to use the Lewis model appropriately, it opens up a wide range of reaction types, particularly in organic chemistry, that can be assimilated into a coherent framework to explain *how* and *why* these reactions occur.

The ability to move flexibly between appropriate models is one of the hallmarks of a sophisticated understanding of the scientific enterprise,[26] and it has been shown that students often have trouble understanding the nature of models, particularly in chemistry.[27,28] Typically, younger students tend to understand models as concrete representations of reality rather than tools with which to predict and explain.[29,30]

Ideally, as students enter college and move to more advanced chemistry ideas, they would move toward a more sophisticated use of models as predictive tools. Moving flexibly among models, understanding the limitations of models, and choosing appropriate models that can predict and explain outcomes requires that students understand the nature of scientific models as ways of thinking that are not direct representations of reality but rather that they are ways to abstract the important components of a system.[26] However, it has been shown that even organic chemistry students have difficulty in moving between the accepted models of acid–base chemistry.[18] As Paik[31] has noted, as students move from Arrhenius to Brønsted, they are moving from a view of acids and bases as a type of matter to a process by which a proton is transferred. That is, they must move from isolated ideas about what an acid or a base is to an acid–base reaction system. This change in distinct ontological categories, that is, from "matter" to "process" is what Chi considers to be difficult.[32]

While both Brønsted and Lewis models describe acid–base reactions as a process, in fact, the Brønsted model only requires a description of *what* is happening; that is, a proton is transferred from the acid to the base. The switch from Brønsted to Lewis requires that students become comfortable thinking about the system in a flexible and more expert-like way. The transfer of a proton is indeed a process, but *how* that proton is transferred falls under the Lewis model. Cartrette and Mayo[18] investigated whether students think about acids and bases using Brønsted or Lewis ideas, both, or neither and found that while all students could define Brønsted acids and bases, less than half could do the same for Lewis acids and bases, and that most participants relied heavily on the Brønsted definition—even when it was not warranted. Indeed, a number of authors have speculated that if students use the Lewis model to think about acid–base reactions, they should develop a more robust framework on which to build their understanding of a broader range of chemical reactions;[18,25] however, there is currently little empirical evidence to support this hypothesis.

One further reason to support earlier emphasis on the Lewis acid–base model is that it provides an entrée into reasoning about chemical reactions from a mechanistic view by helping students think about how reactions occur. If students think about acid–base reactions as proton transfers, without considering how the transfer happens, they will be less likely to make the connection between acid–base reactions and (for example) nucleophilic substitutions. The move to Lewis acid–base theory means that students will be introduced to mechanistic reasoning. In fact, some organic texts[33,34] discuss Lewis acid–base models as an introduction to the formal drawing of mechanistic arrows.

MECHANISTIC AND CAUSAL REASONING

As has been discussed by Krist et al.,[35] mechanistic reasoning occurs at a scale or grain size below that of the phenomenon being explained. While the Brønsted model describes a proton transfer, using the Lewis model requires that students understand the process as an interaction between the lone pair of the Lewis base and an empty orbital (or incipient empty orbital) on the Lewis acid. That is, students must reason mechanistically about *how* the reaction occurs. In organic chemistry, mechanistic reasoning is usually operationalized by "arrow pushing". Most instructors of organic chemistry emphasize the need for students to learn how to construct mechanisms for the reactions they are learning. That is, students learn to draw arrows from electron source to sink and by doing this are able to predict the outcome of many organic reactions. This is a powerful tool that can take organic chemistry from the realm of memorization to a coherent framework which can tie together many seemingly unrelated systems of reactions. Studies on how students actually go about drawing mechanisms have shown that many (most) students do not use mechanistic arrows in the ways they are intended. For example, in our prior studies,[36] we found that, even when explicitly asked to write mechanisms for reactions, about half of the students did not draw arrows but instead wrote the (memorized) product directly. In fact, about 20% of the students who drew arrows actually did so after they had produced the product, thus doubling the amount of material they had to memorize. Further, the number of students drawing any type of mechanisms did not increase over the course of the

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two-semester sequence; this despite the fact that mechanism users were significantly more likely to produce the correct product for an unfamiliar reaction. Other qualitative studies support these findings,[37,38] for example, studies on how and why graduate students construct mechanisms indicate that even at this level many students are not aware of the power of mechanistic arrows or what they actually mean.[39] That is, many students do not seem to be aware that (except for some electrocyclic reactions) the arrows are indicative of an interaction between sites of differing polarities. Arrow pushing is a formalized shorthand to show how interactions begin and how electron density shifts over the course of a reaction, but if students fail to recognize this, it is unlikely that they will be able to use arrows with any degree of success. For example, many students use arrows to indicate the movement of the hydrogen atom itself (in acid–base reactions) rather than the attraction of electron-rich sites to electron-poor sites via movement of electrons.[36]

As we have noted earlier,[40] there is a great deal of evidence to support the idea that asking students to explain why a phenomenon occurs leads to deeper learning. That is, having students approach mechanistic reasoning in organic chemistry systems by helping students articulate *why* reactions occur may help them construct a framework with which to reason. However, there is considerable evidence that most students do not consider the underlying reasoning for *why* mechanistic arrows are drawn this way. That is, students do not seem to associate arrow drawing with the *causal mechanism* by which the reaction occurs. Constructing a causal mechanistic explanation about an acid–base reaction would require that students do more than describe the course of the reaction (whether it be by proton transfer or movement of electrons), rather it would require that students discuss the cause of the reaction as beginning with an interaction between the lone pair on an electronegative atom (e.g., oxygen) and the electropositive proton. That is, students should understand that acid–base reactions start with an electrostatic interaction between moieties of opposite (partial) charge. Understanding the mechanism (how the reaction occurs) is not the same as understanding the causal mechanism (why the reaction occurs). Similarly, it is possible to provide causal reasoning without providing a mechanism (as discussed below).

■ ASSESSMENT OF STUDENT REASONING

Our goals are to characterize the ways in which students reason about acid–base reactions and to develop an assessment protocol for acid–base mechanistic reasoning. To capture such reasoning requires the design of tasks that can elicit evidence of student understanding.[41] In our work on such tasks, we are using a modified evidence centered design (ECD) framework.[42] ECD is an approach to assessment development that relies on the idea of assessment as an evidentiary argument. That is, assessments must elicit evidence which can be used to make an argument about student understanding. Using this approach typically involves several steps:

(1) *Define the construct that is to be assessed or characterized.* In this study, the construct is how students reason about acid–base reactions. Note that the construct is more than knowledge; we are interested not only in student knowledge about acid–base reactions but also the ways in which students reason about why such reactions occur.

(2) *Decide what evidence is acceptable to support the argument that students understand the construct.* Evidence of student reasoning about acid–base reactions can be elicited by asking students to provide causal mechanistic explanations for why these reactions occur: by which we mean that students should be able to identify an acid–base reaction, describe the scientific principles or evidence that supports their identification, and provide reasoning about why this reaction is occurring. There is a great deal of evidence to support the use of tasks that involve having students provide causal mechanistic explanations for phenomena.[40]

(3) *Design assessment tasks that would elicit the types of evidence specified in step 2.* We have designed open-ended tasks because we believe they will provide stronger evidence about student reasoning than forced choice items. As discussed in the Methods section, the structure of the prompt to which students respond is crucial.[43] It must provide enough information to signal to students what is expected but should not "over-prompt" the students so that they are guided to an answer that they would not otherwise have given. In a similar vein, it has been reported that multiple choice tests tend to overestimate the level of student understanding when compared to open-ended responses.[44]

(4) *Decide how to analyze the evidence elicited in the assessment tasks.* Evidence from student-constructed responses can be analyzed in a number of ways. For example, much of the prior work on student understanding has focused on the identification of types of misconceptions or the model of acid–base behavior used. However, we are eventually interested in comparing student responses across courses and over time, and for this, we have developed an approach based on the type of reasoning of the student response (see discussion below). That is, rather than "right" or "wrong" responses, we would like to identify how the student reasons about acid–base chemistry, and ideally, we would like to gain some measure of the level of sophistication of the response.

■ METHODS

Student Participants

The development of assessment tasks to elicit student acid–base reasoning included several groups of students enrolled in college level general chemistry and organic chemistry at two different universities (Table S1 in the Supporting Information). All administrations of the assessment tasks were conducted at the end of the semester indicated except where noted. In addition, all students involved in this research agreed to participate in this study and signed informed consent forms. In this paper, however, we highlight two groups of second-semester general chemistry (GC2) students to discuss the development of the assessment task: (1) students enrolled at a medium-sized public southeastern research university (University 1) in the spring 2012 (referred to as SP12) semester ($N = 121$) and (2) students enrolled at a large public midwestern university (University 2) during the spring 2015 (referred to as SP15) semester ($N = 107$).

These two groups of students were selected to illustrate how, by changing the task prompt, we were able to elicit stronger evidence about the ways in which students reason about acid–base reactions. Both of these groups of students were enrolled in transformed second-semester general chemistry courses at these two institutions. At University 1 ($N = 121$), the assessment was administered in the accompanying laboratory course for credit to the whole class, and at University 2, it was administered as an extra credit assignment out of class to a representative sample (N = 107) of the whole class population (N = 812). We found no significant difference in the students' course grades between the students who completed the assessment and those who did not complete the assessment using a Mann–Whitney test (U = 35503, p = 0.33, median = 3.0).

Even though these students attended different universities, both of the groups of students used the same two-semester general chemistry curriculum *Chemistry, Life, the Universe and Everything* (CLUE).[45] In the CLUE curriculum, three models (Arrhenius, Brønsted–Lowry, and Lewis) of acid–base reactions are introduced and developed in such a way that each subsequent model is shown to build on and supersedes the last. That is, students are reminded that they may have encountered the Arrhenius model in their earlier education and then introduced to the Brønsted model. Care is taken to show how all Arrhenius acid–base reactions can be described using the Brønsted model, while the reverse is not true. Finally, the Lewis acid–base model is introduced in the same way, and students see that it can be used to describe all Arrhenius and Brønsted reactions, but again, the reverse is not true. At the same time as the Lewis model, students are also taught to draw simple reaction mechanisms (i.e., mechanistic arrows) for acid–base reactions and for simple nucleophilic substitutions. In addition, acid–base chemistry is threaded throughout the second semester as the focus of sections on equilibrium reactions and networked biological reactions.

The SP12 and SP15 students were compared to determine if the two groups were similar according to the available demographic information and assessment measurements. The students' final course grades in the CLUE curriculum and their incoming ACT composite scores were compared using a Mann–Whitney analysis (Table S2 in Supporting Information). Although there were no significant differences between the students' final course grades, their ACT scores were different (SP12 average ACT 28, SP15 average ACT 26) with a medium effect size. The ratio of males and females within each group were compared using a χ^2 analysis (Table S3 in Supporting Information), and we found no significant differences. Although the SP12 students had slightly higher average ACT scores, we believe that the two groups are similar enough for our comparison purposes here (particularly since the SP15 students constructed more sophisticated explanations for the assessment item as discussed below). It should also be noted that, in our earlier work, students from University 2 (SP15) performed at the same level as those from University 1 (SP12) on a different assessment task involving understanding intermolecular forces.[46] The results from the statistical analyses are shown in Tables S2 and S3 in the Supporting Information.

Development of the Assessment Tasks

The assessment tasks were designed to elicit molecular level mechanistic reasoning about acid–base reactions. The initial iteration of the assessment (Figure 1) was developed as part of a series of studies on student understanding of structure–property relationships.[46–51] Based on this previous work, we designed the tasks around simple reaction systems in which the full Lewis structures and the products were provided. In the preliminary iterations of the assessment tasks, we explored how presenting students with representations of condensed structures (without any structural cues) compared to providing Lewis structures (Table S1 in Supporting Information, early spring 2012). We found that students were less likely to mention lone pairs during their discussion of the molecular level explanations when presented with the condensed structural representations. Since our goal in this study was to elicit reasoning about the acid–base reaction, and because in our previous work we found that it was helpful to focus students' attention on the goal, we decided to provide students with the structural cues (i.e., Lewis structures) rather than have students get side-tracked by worrying about how to draw the structure or grappling with an unfamiliar structurally complex system. Therefore, in the study, a common acid–base reaction was presented to students (reaction of hydrochloric acid (HCl) with water (H_2O)).

For this reaction:

a. How would you classify the above reaction? Please explain your reasoning.
b. Please explain your reasoning for what you think is happening at the molecular level for this reaction.

Figure 1. Initial iteration of the assessment tasks (SP12).

The first iteration of the assessment tasks was administered at the end of the second semester of general chemistry during the spring semester of 2012 at University 1, referred to as SP12 (N = 121). Since this iteration required only written responses from students, it was administered using *SurveyMonkey*, an online survey program, and was composed of questions about the reaction of hydrochloric acid (HCl) with water (H_2O) (Figure 1).

As we analyzed the student responses, it became clear that the prompt "explain your reasoning for what you think is happening at the molecular level" did not elicit responses that would provide us with evidence about student understanding. Rather, the majority of students provided a descriptive response, telling us *what* was happening in the reaction, rather than reasoning about *how* or *why* it was happening, as shown in Laura's response "The equation is turning from an acid–base to its conjugate acid/base pair. The HCl acid donates its H^+ to create a base, while the H_2O gains an H^+ to become an acid". That is, many students merely stated what atoms were rearranging instead of explaining *why* these atoms rearrange.

As Jin and Anderson[43] noted, the structure of the prompt is crucial in designing assessments that are intended to provide evidence of student reasoning. It must be accessible so that all levels of students can understand what is intended, and it should also provide enough structure so that students understand what is required to answer the question. We want students to provide as much relevant information as they can, but they must understand what is needed. Many students are "bilingual" in that they are capable of answering a question on many levels, and it is important to provide enough structure to indicate the type of response required. On the other hand, overstructuring the prompt may provide students with enough information to answer the question in ways that they may not have thought of otherwise. By providing too much information in the prompt, we may encounter the problem found with multiple choice questions that have been shown to overestimate student understanding,[44] or it may even send students off in an unproductive direction.

Over the next administrations, the structure of the task prompt was modified in an attempt to elicit rich student responses, without "over-prompting" students. For example, one iteration asked students to consider "electronegativity" in their responses, and while students did include this word in their responses, some of their answers were no more meaningful.

The iteration of the assessment discussed here (Figure 2) was administered at the end of the spring semester 2015 to second-semester general chemistry students at University 2, referred to as SP15 ($N = 107$). This iteration of the survey was administered using *beSocratic*, an online system where students can construct written and drawn free-response answers.[52,53] In this iteration (SP15), we separated the explanation into separate prompts: describe *what* is happening at the molecular level and finally *why* it is happening. In addition, another question that asked students to draw mechanistic arrows for the reaction was added. Since this iteration of the assessment was administered in the *beSocratic* system, we could replay each student's response to determine whether the student has drawn mechanistic arrows and the sequence in which they were drawn.

For this reaction:

a. How would you classify this reaction? Please explain why you chose that classification.
b. Describe in full detail **what** you think is happening on the molecular level for this reaction. Specifically, discuss the role of each reactant.
c. Using a molecular level explanation, please explain **why** this reaction occurs. Specifically, why the reactants form the products shown.
d. Please draw arrows to indicate how this reaction occurs.

Figure 2. Final iteration of the assessment tasks (SP15).

To make sure that students understood what was meant by the task, we interviewed five students toward the end of the spring 2015 general chemistry course before the final iteration (SP15) was administered. The interviews were geared toward gauging students' interpretation of the questions and the alignment of their responses. We found that students were consistently able to provide explanations that were aligned with the provided prompts, and therefore no further interviews were necessary.

■ DATA ANALYSIS

The student responses for both *what* was happening on the molecular level (Figure 2b) and *why* the reaction occurs (Figure 2c) were combined for analysis purposes since some students responded to the *why* prompt in the *what* response space (and vice versa). Since we were interested in identifying the type of reasoning in the student response (rather than right or wrong, misconception, or model used), we placed these responses into categories that were aligned with student reasoning, as shown in Table 1.

That is, students who provided simple descriptions were simply categorized as General Descriptive, if the student provided a more extensive descriptive response that used the Brønsted–Lowry model, it was designated Brønsted Descriptive. For students who use the Brønsted model but also added some causal reasoning (indicated by discussion of polarity or ideas about attractive forces), the response was designated Brønsted Causal. Students who used the Lewis model to discuss how the reaction occurred were Lewis Mechanistic, and if they added causal reasoning, they were designated as Lewis Causal. These characterizations are further discussed in the Results and Discussion section.

The three authors coded a random sample of 20% of student-generated explanations from each SP12 and SP15 assessment to establish inter-rater reliability, resulting in pairwise Cohen's Kappa ranging from 0.73 to 0.79. The three authors further discussed the coding scheme, which resulted in a Kappa value of 0.90.

The arrow pushing mechanisms that students constructed for this reaction were also inspected and coded for (1) whether the first arrow was shown in the correct direction, from the lone pair on the oxygen in water to the hydrogen in HCl and (2) whether the complete mechanism was correct, as shown in Figure 3.

■ RESULTS AND DISCUSSION

A majority of students from both implementations of the assessment task were able to identify that the reaction provided was an acid–base reaction (SP12, 81% and SP15, 94%). Other responses included redox, displacement, hydrolysis, and substitution reactions. That is, most students recognized without prompting that the given reaction was an acid–base reaction.

RQ 1: In what ways do students reason about acid–base reactions?

Examples of each type of student reasoning are shown in Table 1. In both SP12 and SP15 administrations, relatively few students provided Non-normative answers. For example, Donald wrote, "The electrons are being excited and therefore causing the hydrogen bonding to occur", and Bob indicated that "The chlorine is losing electrons and the oxygen is gaining electrons."

Responses assigned to the General Descriptive category invoked an acid–base reaction and typically included a generic description of *what* is happening to the reactants and products without any indication of *how* or *why* the reaction happens, such as Aiden's response, "Because there is a conjugate base formed and the acid is gone." General Arrhenius explanations were also included in this category. For example, Kate provided the following explanation: "HCl is being dissociated completely by the water."

In the Brønsted Descriptive category, students now identify which reagent is the acid and base in the reaction and generally provide some description of *what* happens during the reaction and using a Brønsted model of acid–base for the explanation. For example, Hannah's response, "HCl is acid and H_2O is base. HCl is proton donor, H_2O is proton acceptor, this means the H in HCl transfer to H_2O and form the H_3O^+ which is an conjugate acid. And Cl^- becomes conjugate base." While this is a quite complete description of *what* is happening during the reaction, it does not include any description of *how* or *why* the reaction happens. On the other hand, responses that invoked a causal mechanism, for example, by including terms such as *attraction*, *pulling off*, and *interacting partial charges* were all considered as a demonstration of causal accounts. Freddy's response, "This occurs because the hydrogen is attracted to the most electronegative atom, which is the oxygen, thus creating the hydronium molecule. The chlorine is then left alone with a full octet", was assigned to the Brønsted Causal category.

Table 1. Characterization Scheme for Student Reasoning about Acid–Base Reactions

Characterizations	Examples
No Response	Viktor: *"I do not really have a reasoning"*
No answer or their explanations were unreadable or incomprehensible	
Non-normative	Raymond: *"The hydrogen on the HCl is donating its electron to the oxygen on the water"*
Students provide non-normative or unrelated explanations. In addition, students do not recognize it is an acid–base reaction and instead attribute the mechanism to other types of reactions or other macroscopic observations	
General Descriptive (what)	Catherine: *"The acid is reacting with the base and the acid is a proton donor while the base is a proton acceptor"*
Students provide scientifically simplistic description and may discuss bond breaking or forming	
Brønsted Descriptive (what)	Heather: *"The HCl is the acid meaning it is a proton donor and the water is the base meaning it is a proton acceptor. At the molecular level the hydrogen from the HCl is breaking off and the water is gaining it forming* H_3O^+*"*
Students provide Brønsted acid–base explanation including identification of acid and/or base and discussion of proton transfer	
Brønsted Causal (what and why)	Remy: *"The oxygen is extremely electronegative and attracts the proton of the hydrogen. The hydrogen donates its electron to the chlorine so that its proton can go to the oxygen"*
Students provide Brønsted acid–base causal reasoning that includes discussion of polarity of one or both of the reactants	Claire: *"The oxygen atom in water bonds to the hydrogen atom in hydrochloric acid as the hydrogen and chlorine atom break apart. The partial negative oxygen in water is attracted to the partial positive hydrogen in hydrochloric acid. When the oxygen and hydrogen form a bond the hydrogen and chlorine break their bond creating the products* H_3O^+ *and* Cl^-*"*
Lewis Mechanistic (what and how)	Jackie: *"The O in the* H_2O *gives its electrons to the H in the HCl bond, and simultaneously the HCl bond breaks, placing those electrons onto the Cl. This reaction happens because it is more favorable"*
Students provide Lewis acid–base explanation, including role of lone pair (may also encompass the Brønsted explanation)	
Lewis Causal (what, how and why)	Doug: *"HCl acts as a proton donor and donates a proton to water which is the proton acceptor.* H_2O *and HCl are attracted to each other because of their partial charges. When the H on HCl interacts with the lone pair on O, the HCl bond breaks and the Cl is left with the bonding electrons"*
Students provide Lewis acid–base causal reasoning that includes discussion of polarity of one or both of the reactants (may also encompass the Brønsted explanation).	Francis: *"The lone pair on the water molecule attracts the Hydrogen from the HCl. The H–Cl bond is broken and forms a new bond with oxygen. The reaction occurs because the partial negative charge on the oxygen attracts the partial positive charge on the hydrogen. The bond between the Hydrogen and Cl is less strong than the bond that forms between hydrogen and oxygen"*

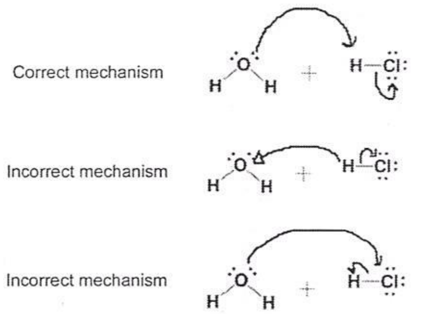

Figure 3. Examples of correct and incorrect mechanistic arrow drawings by students from SP15.

Responses that described the involvement of the lone pair on the base were assigned to the Lewis category. For example, LeAnn's explanation of "Oxygen's electrons reach out and grab the Hydrogen (proton). So the bond breaks and the electrons go back to the Cl from the HCl bond" invoked the Lewis model and was assigned to the Lewis Mechanistic category. In contrast Guadalupe invokes both cause and mechanism for the reaction, and her response is categorized as Lewis Causal: "The H_2O is the base. It is a proton acceptor. It will accept the proton from the HCl. The HCl will donate its proton to the H_2O. The polarity of the H_2O is what first attracts the partially negative oxygen to the partially positive H in the HCl. Since O is highly electronegative, it will pull off the H from the HCl and make a bond with one of its lone pair of electrons. The electrons from the bond of the HCl will stay on the Cl since it is more electronegative than H." It should be noted that, like Guadalupe, some students used both models, for example, by talking about proton transfer but invoking an electron pair description of the mechanism. In these cases, responses were designated as Lewis because while they discussed *what* is happening using the Brønsted model, they discussed *how* and *why* it is happening using the Lewis model.

RQ 2: In what ways does the structure of the item prompt affect student responses?

To determine how the change in prompt impacts student reasoning, we compared the responses from SP12 and SP15. As shown in Figure 4, it is clear that the SP15 iteration has elicited a larger proportion of Lewis causal mechanistic responses. There is a clear (and significant) difference between the two iterations of the assessment tasks. For instance, the χ^2 analysis of the two groups showed a significant difference between SP12 and SP15, with a medium effect size, $\chi^2 = 48.55$, $p < 0.001$, $\varphi = 0.46$.[54]

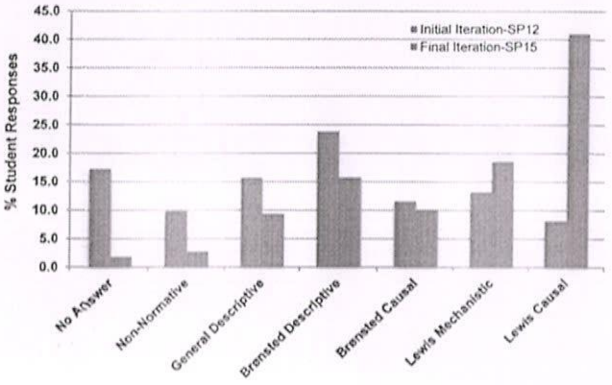

Figure 4. Classification of students' constructed explanations for SP12 and SP15 activities.

Analysis of the SP12 assessment showed that a large number of responses elicited (40%, $N = 48$) were descriptive (General Descriptive and Brønsted Descriptive), while 21% ($N = 26$) of the responses were mechanistic—that is, they invoked a Lewis model (Lewis Mechanistic and Lewis Causal), and 20% ($N = 24$) invoked some cause (Brønsted Causal and Lewis Causal). The largest group of students described, in varying detail, what they saw happening in the reaction scheme provided. In retrospect, this is not surprising. The nature of the prompt did not appear to provide students with enough structure to elicit an explanation for *how* or *why* the reaction is happening. We also note that 17% ($N = 21$) of the students did not have a response or wrote, "I do not know" which may also indicate that students were somewhat unsure of what was being asked of them.

In contrast, the SP15 assessment task required two separate responses from students. Students were asked to describe *what* is happening on the molecular level during the reaction and, then in a separate prompt, asked *why* the reaction occurs (Figure 2). Inherent in the structure of the prompts was the idea that merely describing *what* happens is not sufficient. It should be re-emphasized that we actually coded these responses together as one response since many students answered both tasks in the same response box. In this implementation, we see a significant shift in the pattern of responses. Now 60% ($N = 64$) of the students provide a mechanistic account, and in fact, 41% ($N = 44$) provide a causal mechanistic account. Only 2% ($N = 2$) of students did not answer and 3% ($N = 3$) provided non-normative ideas (as opposed to 10% ($N = 12$) of the SP12 activity).

We believe that the difference between the two iterations is primarily due to the change in prompt. By providing students with more scaffolding, we were able to help them structure their response to provide more evidence of understanding. While the two groups of students were from different universities, there were no major differences in the demographic data that we compared, as discussed in the Methods section (also shown in the Supporting Information Tables S2 and S3), except that students at University 1 (SP12) had a slightly higher incoming average ACT composite score. Both groups of students were enrolled in general chemistry courses that used the same curriculum materials,[45,55] had approximately the same time on task, similar homework assignments and examinations, and the same set of learning objectives. Therefore, though it was not feasible to administer the items in an identical manner to both cohorts, we believe that the difference in responses stemmed from a refinement of the task prompt.

RQ 3: In what ways does student reasoning about acid–base reactions relate to how they draw mechanistic arrows?

In SP15 assessment, students were also asked to draw mechanistic arrows for the acid–base reaction. The responses were coded simply for (1) is the first arrow correct? (i.e., starting on the lone pair of the oxygen and ending on the proton to be transferred), and (2) is the mechanism completely correct? In SP15, 73% of students drew the first arrow correctly and 71% of the students drew the complete mechanism correctly. That is, those students who drew the first arrow

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correctly were almost all able to provide a complete correct mechanism (97%). In contrast, our earlier mechanistic studies[36,56] showed that only about half the students even attempted to draw mechanisms, and only about 20–30% drew an appropriate full mechanism. While the tasks in our earlier studies were more difficult (e.g., electrophilic addition across a double bond), the students in those studies also had almost a full year of organic chemistry. The students in this study are enrolled in a general chemistry course.

As seen in Table 2, which shows the student type of reasoning paired with their success in drawing mechanistic arrows for the same reaction, students who invoke mechanistic (Lewis) explanations about acid–base reactions are more likely to construct a correct mechanism than those who provide Brønsted or general descriptions, and the ratio of correct to incorrect mechanisms for all responses. The trend is clear: as students move from general descriptive to Brønsted to Lewis models, they are more likely to draw a correct arrow pushing mechanism. Students who use a Lewis model to reason about acid–base reactions are around 3 times more likely to draw a correct arrow pushing mechanism for the reaction than those who use a Brønsted model or who give a general description. A similar but less pronounced pattern is seen for students who provide causal reasoning. The ratio for Lewis Causal is 4.5 and for Brønsted Causal is 2.7 (Table 2), indicating that while causal reasoning seems to be associated with correct arrow pushing, using a Lewis model is even better.

Table 2. Distribution of Students' Incorrect and Correct Mechanism Drawings and the Ratio of Correct to Incorrect Drawings by Each Type of Student Response[a]

	Student Responses by Type (*N*)							
Answer Category	NA	NN	GD	BD	BC	LM	LC	Total
Incorrect mechanism	2	2	5	7	3	4	8	31
Correct mechanism	0	1	5	10	8	16	36	76
Ratio correct/ incorrect	0	0.5	1.0	1.4	2.7	4.0	4.5	2.5

[a]NA = No Answer, NN = Non-normative, GD = General Descriptive, BD = Brønsted Descriptive, BC = Brønsted Causal, LM = Lewis Mechanistic, LC = Lewis Causal.

It is interesting to note that the ratio of incorrect to correct responses increases across Table 2, with students who provide Lewis Causal explanations being most likely to draw correct mechanisms and to provide the most scientifically sophisticated explanations. We believe that this provides support for the idea that our classifications actually correspond to levels of sophistication of student reasoning, and that they may be used to monitor trajectories for student understanding over time.

■ CONCLUSIONS AND IMPLICATIONS

The findings from this study indicate that students use a variety of ways to reason about acid–base reactions that can be characterized using a framework which allows responses to be classified according to the model used and whether the students invoke a causal explanation. In essence, by looking for how students describe *what* is happening, *how* it is happening, and *why* it is happening, we have also shown:

(1) The nature of the prompt can dramatically change the types of responses that students provide, and that explicitly asking both *what is happening on the molecular level during a reaction* and *why the* reaction *occurs* is more likely to trigger responses that provide mechanistic, rather than just descriptive explanations.

(2) Students who provide mechanistic (Lewis model) responses are more likely to construct appropriate mechanisms using curved arrows.

(3) Students who provide causal reasoning tend to have higher success at constructing mechanisms with curved arrows, than students who use the same model (e.g., Brønsted) but do not provide causal reasoning.

As discussed in the Introduction, a number of authors have hypothesized that helping students develop an understanding of Lewis acids and bases may support their ability to construct mechanisms as ways to predict and explain the course of many organic reactions, rather than memorizing reaction paths or "decorating" them with arrows. Here, we have provided evidence that students who use Lewis models are indeed more likely to construct appropriate mechanisms. However, as noted earlier, students in this study were enrolled in a transformed general chemistry course designed to emphasize causal mechanistic reasoning. As students progress through the course they are asked to articulate *what*, *how*, and *why* chemical phenomena occur and are expected to provide both written and drawn responses.[45] Since many instructors may not desire, or may not be in a position, to adopt transformed curricula, there are several suggestions resulting from our findings that instructors might incorporate into their teaching.

(1) Lewis acid–base models should be introduced and emphasized in general chemistry (especially for those students who are going on to organic chemistry). If this is not possible, organic chemistry instructors should take time to carefully introduce Lewis acid–base models at the beginning of organic chemistry and help students move flexibly between Brønsted and Lewis models. In our experience, this process takes time and repetition; that is, a one-shot "fly by" of the concept is unlikely to provide enough support for students to use Lewis models. This approach we recommend is important, not only to help students in learning about mechanisms but also to reinforce the idea that the use of appropriate models is part of the scientific enterprise, and the choice of model can influence subsequent learning.

(2) When the Lewis model is taught, it should be accompanied by an expectation that students provide written explanations for *why* the reaction is happening, while at the same time learning to draw mechanistic arrows. That is, students should be asked to articulate both what the arrows mean and *why* they are drawn from electron source to sink. As students become more expert in this process, the explanation step will be omitted, but if students are never asked to explain as they learn, they will tend to draw arrows without understanding their meaning.

(3) Instructors should think carefully about the structure of the prompts that they use to elicit student thinking. It is quite common to ask students to explain their thinking, but if we do not provide students with some structure about what we expect them to include in their response, it can be confusing. As noted earlier, there is a fine balance between providing enough scaffolding to indicate to students what is expected and providing too much scaffolding so that students do not really have to construct their own response. Over-prompting can

result in the same kind of overestimate of student understanding that has been reported with some multiple choice questions. We have found that it is particularly helpful to separate the prompts so that students understand that they should both describe what is happening and why it is happening.

■ FUTURE WORK

Since we believe that our characterizations correspond to levels of sophistication in student reasoning, it is possible that by administering the tasks to students at different places in the curriculum we may be able to identify student trajectories over time. We intend to monitor student responses by following cohorts of students throughout the curriculum. We will also investigate how students reason about more complex acid–base reactions; for example, the reaction of an amino acid with water may serve as a "transfer task". It may also be possible to use the task to evaluate the effects of interventions within a particular course, such as investigating the effect of introducing a Lewis acid–base module into a more traditional course structure. In addition, we plan to expand this type of assessment to other classes of reactions to investigate whether similar approaches can improve student mechanistic reasoning for other more complex reactions. We have a great deal of past data on how students, who have not been asked to provide mechanistic and or causal reasoning, draw mechanisms, and it will be interesting to investigate whether changes (improvements) can be made for future cadres of students by helping them articulate their understanding in words.

■ LIMITATIONS OF THE STUDY

A limitation of this study is that the student participants were enrolled in a transformed general chemistry curriculum, and it may well be that students in a more traditional curriculum do not respond to the prompts in the same way. In the transformed curriculum, mechanistic reasoning is emphasized and students are asked to draw and write responses to open-ended homework tasks on a regular basis. Acid–base chemistry also plays a prominent role. For example, the topic of equilibrium is introduced in the context of acid–base chemistry rather than in the context of gas-phase reactions, and the course ends with discussions of how networked acid–base reactions regulate blood pH. Students from traditional general chemistry programs who are not expected to support their assertions with reasoning may have trouble providing normative explanations for chemical phenomena. Lastly, students in the CLUE general chemistry curriculum are also taught to draw simple reaction mechanisms for acid–base reactions using curved arrows. Therefore, our results are almost certainly not typical. However, as previously noted, the construction of scientific explanations is one of the few pedagogies that has been shown to be strongly correlated with deeper learning, and the tasks we have developed may help other instructors monitor students' achievement as they design new curricular approaches.

■ ASSOCIATED CONTENT

Ⓢ Supporting Information

The Supporting Information is available on the ACS Publications website at DOI: 10.1021/acs.jchemed.6b00417.

Student populations who were administered the assessment task during the development process of the assessment; student demographic information for the two comparative groups of students SP12 and SP15 (PDF, DOCX)

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Notes

The authors declare no competing financial interest.

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DOI: 10.1021/acs.jchemed.6b00417
J. Chem. Educ. XXXX, XXX, XXX–XXX

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: F. Y. B.Sc. (2018-19)
Topic: Acid Base Theories

Duration :30 min. **Marks:10**

Name of the student:

Q. 1 Solve the Following Multiple choice Questions

1] An acid is a compound that gives H+ ion in water and base is a compound that gives OH ions in water. This concept is given by -----

a) Arrhenius b) Lewis c) Lowery d)Lux-Flood

2) A substance that accept proton according to Bronsted-lowery concept is --------

a) an acid b) a base c) a neutral substance d) free radical

3) In following reaction $H_2O + HCl \rightarrow H_3O^+ + Cl^-$ species which acts as a base is-------

a) H_2O b) HCl c) H_3O^+ d) H_2

4) A molecule or ion that can behave both as Bronsted acid and base are called ---------

a) mono protic acid b) amphiprotic acid c) polyprotic acid d) diprotic acid

5) According to Lewis concept an acid is ----------- acceptor.

a) proton b) electron pair c) base d) radical

6) HCO_3 is an example of

a) proton b) amphiprotic ion c) conjugated base d) conjugated acid

7) All cations and molecule that are short of an electron pair act as

a) Arrhenius acid b) Lewis acid c) Lewis base d) Lux-Flood base

8) In alkylation --------- increases the electrophilicity of the alkyl halide.

a) $AlCl_3$ b) HCl c) HNO_3 d) H_2

9) Alkyl halide reacts with the lewis acid and forms electrophilic

a) anion b) carbocation c) carbanion d) radical

10) Friedal craft acylation is impotant method of preparing --------

a) alcohol b) benzene c) ketone d) acid

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: F. Y. BSc. (Semester-II)
Paper-I
Topic: Acid Base Theories

Duration :60 min. Marks:10

Name of the student: --

Roll no.

Instruction:

- ✓ Tick correct option

Q. 1 Solve the Following Multiple choice Questions1] An acid is a compound that gives H+ ion in water and base is a compound that gives OH ions in water. This concept is given by -----

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Sahajeevan Shikshan Sanstha's
Estd.-1990

SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)

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Ref. No.: ICS/ **Date :**

Notice

Date- 02/01/2019

All F.Y.B.Sc. students are here by informed that class test will be conducted as on **05/01/2019** on **Topic Name-** 'Acid Base Theories' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: F. Y. BSc. (Semester-II)
Paper-I
Topic: Acid Base Theories

Duration :60 min. Marks:10

Name of the student: Ambre Adarsh Dashratha.

Roll no.

Instruction:

- ✓ Tick correct option

Q. 1 Solve the Following Multiple choice Questions1] An acid is a compound that gives H+ ion in water and base is a compound that gives OH ions in water. This concept is given by -----

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9) Alkyl halide reacts with the lewis acid and forms electrophilic

01 a) anion [✓ b) carbocation] c) carbanion d) radical

10) Friedal craft acylation is impotant method of preparing --------

a) alcohol b) benzene [✓ c) ketone] d) acid

01

07/10

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: F. Y. BSc. (Semester-II)
Paper-I
Topic: Acid Base Theories

Duration :60 min. Marks:10

Name of the student: Pawar Tejas' Vinayak.

Roll no.

Instruction:

- ✓ Tick correct option

Q. 1 Solve the Following Multiple choice Questions1] An acid is a compound that gives H+ ion in water and base is a compound that gives OH ions in water. This concept is given by -----

01 [✓ a) Arrhenius] b) Lewis c) Lowery d)Lux-Flood

2) A substance that accept proton according to Bronsted-lowery concept is --------

01 [✓ a) an acid] b) a base c) a neutral substance d) free radical

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7) All cations and molecule that are short of an electron pair act as

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8) In alkylation --------- increases the electrophilicity of the alkyl halide.

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9) Alkyl halide reacts with the lewis acid and forms electrophilic

01 a) anion [✓ b) carbocation] c) carbanion d) radical

10) Friedal craft acylation is impotant method of preparing --------

a) alcohol b) benzene c) ketone [✓ d) acid]

$\frac{07}{10}$.

I.C.S. College Khed
Department of Chemistry
Class: FY BSc (2018-19)
Name of Topic: Acid Base Theories

Sr. No.	Name of Student	Mark Obtained (10)
1	ADMANE AJAY JAYVIJAY	6
2	RAKESH GANGARAM AKHADE	5
3	AKHADE SURESH KASHIRAM	6
4	AMBRE ADARSHA DASHARATHA	7
5	AMBRE PRIYA VASANT	7
6	AMBRE MANDAR DILIP	7
7	AMBRE YASH SUDHIR	6
8	AMBRE SIDDHARAJ SUBHASH	6
9	AMBRE SIDDHI HARISHCHANDRA	5
10	AMBRE VEDA SACHIN	6
11	BAGAVE SIDDHESH SHEKHAR	7
12	BAIT RASIKA VILAS	6
13	BHORPE VAIBHAV NAMDEV	6
14	BHUVAD SUSHMA SITARAM	6
15	BOTHARE SUJIT SUNIL	5
16	CHALAKE VAIBHAV DILIP	6
17	CHALKE VISHWANATH SANTOSH	7
18	CHALKE YOGITA VINESH	4
19	CHAVAN PRATIK PRAMOD	4
20	CHAVAN SAKSHI SURESH	7
21	CHIKHALKAR SACHIN SANTOSH	8
22	DAPHALE MANISH MANOHAR	9
23	DERVANKAR SHUBHANGI SURESH	7
24	DHAPASE AJAY PRAKASH	6
25	DHOTRE AKSHAY ANIL	6
26	DIVEKAR SONAL RAJENDRA	5
27	FAKADE JYOTI SHRIKANT	5
28	GAIKAR PRANALI PRAVIN	5
29	GAMARE MANTHAN MILIND	5
30	GAMARE TUSHAR MOHAN	7
31	GARATE SWARUP KAMALAKAR	6
32	GHAG SAYALI VISHNU	6
33	GHAG MAHESH MARUTI	7
34	GONDHLEKAR NAMIRA ABIDDIN	5
35	GOTHAL SWAPNIL SUBHASH	5
36	HAJARE TEJASWINI DADASO	7
37	HATKAR ROMESH ANIL	7
38	JADHAV SAYALI SUNIL	6
39	JADHAV NANDINI RAVINDRA	5
40	JADHAV SONALI MANOHAR	7
41	JADHAV SHRUSTI ANANT	7
42	JADHAV DIPALI GANPAT	4
43	JADHAV MANISH RAMCHANDRA	5

I.C.S. College Khed
Department of Chemistry
Class: FY BSc (2018-19)
Name of Topic: Acid Base Theories

Sr. No.	Name of Student	Mark Obtained (10)
44	JADYAL YASH DILIP	7
45	JANGAM ADITI SUDHIR	6
46	JAWALE SANYOG SANJAY	6
47	KADAM AMOL ANIL	5
48	KADAM MAYURI MADHUKAR	5
49	KADAM DIPTI DIPAK	6
50	KADAM SAHIL SANTOSH	5
51	KADU KAUSHAL AJIT	7
52	KALAMKATE AMISHA BALIRAM	7
53	KAMBLE ROHIT PANDURANG	6
54	KANDEKAR PRASHANT ANANT	6
55	KASHTE PRIYANKA ATMARAM	6
56	KHAMKAR GANESH MAHENDRA	6
57	KHOPKAR ANKITA GANESH	5
58	KONDEKAR MARZIYA NISAR HUSSAIN	7
59	LAKHAM SWAPNIL SITARAM	7
60	LINGAYAT AKSHATA MAHENDRA	6
61	MAHADE NUTAN SANJAY	6
62	MAKHJANKAR MUZAMMIL FAKIR MAHMAD	5
63	MANDAVKAR NARESH RAMCHANDRA	4
64	MANDAVKAR KALPESH SATISH	7
65	MANDAVKAR PALLAVI PANDURANG	5
66	MANVAL HARSHADA RAMESH	5
67	MANVAL ROSHNI RAMCHANDRA	5
68	MARUF MISBA LIYAKAT	5
69	MENGADE YOGESH DIPAK	7
70	MHADALEKAR KALPESH DIPENDRA	6
71	MISAL RIMA VILAS	6
72	MISAL NILAM AJIT	7
73	MOHITE PRAFULL PRABHAKAR	4
74	MORE ANKITA VITTHAL	5
75	MORE SANJIVANI SANTOSH	6
76	MORE VRUSHABH BABARAM	6
77	MORE SAURABH AVINASH	7
78	NADKAR AYESHA KIFAYAT	7
79	NAYNAK VAIBHAV KERU	5
80	NIKAM SUPRIYA SANJAY	6
81	NIKAM PRATIKSHA SHARAD	6
82	NIKAM ABHISHEK SATISH	4
83	OVULKAR RUSHALI VILAS	7
84	PARKAR KHADIJA ALIMIYA	5
85	PATIL PRAFUL BALU	5
86	PAWAR SAURAV SUBHASH	5

I.C.S. College Khed
Department of Chemistry
Class: FY BSc (2018-19)
Name of Topic: Acid Base Theories

Sr. No.	Name of Student	Mark Obtained (10)
87	PAWAR TEJAS VINAYAK	7
88	PIRDHANKAR MAMATA SUDHIR	6
89	POMENDKAR SAURABH PRAKASH	5
90	POPHALKAR SHVETA SUBHASH	5
91	JIBRAN MOHAMMAD JAFAR RUMANE	6
92	SAKPAL SURAJ SUDHAKAR	4
93	SAKPAL AKANKASH SUNIL	4
94	SAVARATKAR DINESH JAYARAM	7
95	SAWANT PAYAL SURESH	6
96	SAWANT SHREEYA SUDESH	5
97	SHIGWAN SAMEER SANTOSH	5
98	SHINDE SAKSHI SANTOSH	5
99	SHINDE RAJANI RAJENDRA	7
100	SHINDE PRATIK SANJAY	7
101	SIDDIQI SANOBAR MAINUDDIN	6
102	SOLKAR MUSADDIK MURAD	5
103	SONAVANE SAYALI DIPAK	7
104	SURVE FAZILA NISAR	7
105	TAMBAT ANJALI RAJENDRA	5
106	TAMBE RENUKA GAUTAM	4
107	TAMBE SARA KAMALUDDIN	7
108	TAMBE SURAJ ASHOK	6
109	USARE AMISHA SANTOSH	6
110	VANKUDRE MANASI RAJAN	4
111	VELHAL AISHWARYA SANTOSH	5
112	VICHALE SAURABH SANJAY	6
113	YESARE MANOHAR VILAS	6
114	ZUJAM SHUBHAM SURESH	5

Mr. Ghumbre S.K.

Class:- T.Y. B.Sc.

Subject:- Chemistry - III

MOLECULAR SPECTROSCOPY

Spectroscopy

Dr. V. Chinnathambi,

Associate Professor of Physics

Sri K.G.S. Arts College,

Srivaikuntam-628 619

Unit - I

MOLECULAR SPECTROSCOPY

Unit 1 : Microwave Spectroscopy

Classification of molecules – Rotational spectra of rigid diatomic molecules – Isotope effect – Non rigid rotator – linear polyatomic molecules – symmetric top molecules – asymmetric top molecules – Microwave spectrometer – information derived from rotational spectra.

Unit II : Infrared Spectroscopy

Vibrational energy of diatomic molecule – Selection rules – vibrating diatomic molecule – diatomic vibrating rotator – asymmetry of rotation – vibration band – vibrations of polyatomic molecules – Rotation – vibration spectra of poly atomic molecules – interpretation of vibrational spectra – IR spectrophotometer – sample handling techniques – Fourier transform IR spectroscope – applications.

Unit III : Raman Spectroscopy

Theory of Raman scattering – rotational Raman spectra – vibrational Raman Spectra – Raman spectrometer – Structure determination using IR and Raman spectroscopy.

Hyper Raman effect – classical treatment of Raman effect – Experimental techniques for Hyper – Raman effect – stimulated Raman scattering – Inverse Raman scattering – CARS – PARS – SERS (basic ideas only).

Unit IV : Electronic spectroscopy

Vibrational coarse structure – Vibrational analysis of band systems – Deslanders table – Progressions and sequences – Franck condon principle – Rotational fine Structure of electronic vibration spectra – the Fortrat parabola – Dissociation – Pre dissociation – photoelectron spectroscopy – Instrumentation – information from photoelectron spectra.

Unit V: NMR, ESR, NQR, Mossbauer spectroscopy

NMR : Magnetic properties of nuclei – resonance condition – NMR instrumentation – relaxation systems – Bloch equations – chemical shift.

ESR :Principle – ESR spectrometer – Hyper fine structure – ESR spectra of Hydrogen atom.

NQR:The quadruple molecules – principle – transitions for axially and nonaxially symmetric systems – NQR instrumentation.

Mossbauer :Recoilless emission and absorption – Mossbauer spectrometer – Isomer shift – application.

Book for study and reference. :

1. G.Aruldhas, " Molecular structure and spectroscopy", second edition, practice – Hall of India, Pvt Ltd., New Delhi – 110001, 2007.
2. Fundamentals of Molecular spectroscopy – Colin N Banwell and Elaine M Mccash
3. Spectroscopy – GR Cghatwal and S.K Anand

Unit – I

Microwave Spectroscopy

1.1 Classification of Molecules

The molecules are usually classified into four groups based on the relative values of principal moments of Inertia I_a, I_b and I_c, where *a,b,c* are axes and are selected in such a way that $I_a > I_b > I_c$

(i) Linear Molecules :

In this type, all the atoms of the molecules are arranged in a straight line. For example, HCl, CO_2, OCS, HCN, C_2H_2 etc are some of the molecules of this category.

The three mutually perpendicular principal axes *a,b,c* of rotation may be taken as :

a → the molecular axis

b → the direction in the plane of the paper passing through the centre of gravity of the molecule and perpendicular to it a – axis.

c → the axis perpendicular to both a and b axes, and passing through the centre of gravity of the molecule.

For a linear molecule, the principal moments of Inertia are $I_a = 0$ and $I_b = I_c$. The moments of Inertia I_b and I_c correspond to the end over end rotation of the molecule and therefore they are equal, and $I_a = 0$. Since the nuclei of the atoms which give the main contribution of mass are situated in the axis *a*.

ii) Symmetric Tops :-

In a symmetric top, two of the principal moments of inertia are equal and all the three are non zero.

The molecule in this class are further subdivided into the groups probate symmetric top and oblate symmetric top. In probate, $I_a > I_b = I_c$ (Ex. CH_3Cl, CH_3F, CH_3CN, NH_3, etc.,) and in oblate , $I_a = I_b < I_c$ (Ex. BH_3, BCl_3, etc.,)

iii) Spherical Tops :

When all the three principal moments of inertia of a molecule are equal, it is called a spherical top. (Ex. CH_4, $O_S O_4$, SF_6, CCl_4, etc.,)

iv. Asymmetric Tops :-

In an asymmetric top molecule, all the three moments of Inertia are distinct $I_a \neq I_b \neq I_c$. Some of the examples are H_2O, CH_3OH, CH_2CHCl, etc., The majority of the molecules belong to this group.

1.2 Rotational Spectra of Rigid diatomic molecules

A diatomic molecule may be considered as a rigid rotator consisting of atomic masses m_1 and m_2 connected by a rigid bond of length r, (Fig.1.1)

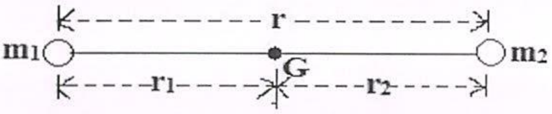

Fig.1.1 A rigid diatomic molecule

Consider the rotation of this rigid rotator about an axis perpendicular to its molecular axis and passing through the centre of gravity. The solution of the Schrodinger equation for the rigid rotator gives the energy eigen values,

$$E_J = \frac{\hbar^2}{2I} J(J+1) \quad \text{Joules,} \qquad J = 0,1,2... \qquad (1.1)$$

Where J is the rotational quantum number, I is the moment of Inertia of the molecule about an ax is passing through its centre of gravity G and perpendicular to the molecular axis.

$$I = m_1 r_1^2 + m_2 r_2^2 \; ; \qquad m_1 r_1 = m_2 r_2 \quad ; \quad r = r_1 + r_2 \qquad (1.2)$$

Expressing r_1 and r_2 interms of r and substituting in Eq. (1.2), We get,

$$r_1 = \frac{m_2 r}{m_1 + m_2}; \; r_1 = \frac{m_1 r}{m_1 + m_2} \tag{1.3}$$

$$\therefore I = \frac{m_1 m_2}{m_1 + m_2} r^2 = \mu r^2 \tag{1.4}$$

Where $$\mu = \frac{m_1 m_2}{m_1 + m_2} \tag{1.5}$$

In wave number units,

$$\varepsilon_J = \frac{E_J}{hc} = \frac{h}{8\pi^2 IC} J(J+1) cm^{-1} \tag{1.6}$$

$$= B\, J(J+1) cm^{-1}, \; J = 0,1,2..... \tag{1.7}$$

Where B is the rotational constant and is given by

$$B = \frac{h}{8\pi^2 IC} cm^{-1}, \;\; B = \frac{h^2}{8\pi^2 I} \;\; \text{Joules} \tag{1.8}$$

Let us denote J'' be the lower state and J' be the upper state. Therefore,

$$\Delta\varepsilon_J = \varepsilon_{J'} - \varepsilon_{J''} = B\left[(J'(J'+1) - J''(J''+1)\right]$$

Use of the selction rule , $\Delta J = +1$, ie., $J' - J'' = 1$, gives the frequency of the absorption line as,

$$\bar{\gamma}_J = \Delta\varepsilon_J = B[(J''+1)(J''+2) - J''(J''+1)]$$

$$\bar{\gamma}_J = 2B(J+1) cm^{-1}, \; J = 0,1,2,............... \tag{1.9}$$

The rotational constant B is assumed to be the same in both lower and upper rotational states and double prime is dropped from Eq. (1.9). J in Eq. (1.9) in the J value of the lower state. From Eq.(1.9), we get a series of spectral lines with wave number values $2B, 4B, 6B .... cm^{-1}$. The separation between any two adjacent line is 2B. The energy levels and the allowed transitions are shown in Fig (1.2). The value of B can be deduced from the spacing between the observed spectral lines. Use of Eqs. (1.8) and (1.4) immediately gives the internuclear distance of the diatomic molecule.

1.3 Selection rule of rotational spectrum :-

1. The molecule must have a permanent dipole moment.

2. Transitions are allowed only between adjacent rotational levels, ie., $\Delta J = \pm 1$ (plus sign for absorption and minus sign for emission).

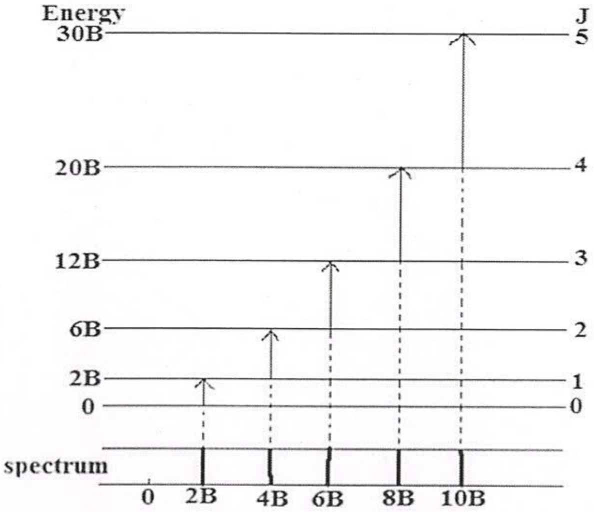

Fig. 1.2 Rotational energy levels and transitions for a rigid diatomic molecule

1.4 Isotope effect in rotational spectra :-

An atom when replaced by one of its isotopes, the interbond distance remains the same but the mass of the nucleus changes leading to a change in the moment of inertia.

Denoting the frequency of the isotopically substituted molecule by single prime

$$\bar{\gamma}' = 2B'(J+1)$$

$$\Delta\bar{\gamma} = \bar{\gamma} - \bar{\gamma}' = 2(J+1)(B-B')$$

$$= 2(J+1)\frac{h}{8\pi^2 IC}(1-\frac{I}{I'})\,cm^{-1} \qquad (1.10)$$

Where

$$\frac{I}{I'} = \frac{\mu}{\mu'} = \rho^2$$

$$\Delta\bar{\gamma} = 2B\ (J+1)(1-\rho^2) \qquad (1.11)$$

As $\rho = 1$ in most of the cases, the shift will be extremely small. When there is a mass increase, $\rho^2 < 1$ giving a +ve value for $\Delta\bar{\gamma}$. It is evident from Eq.(1.11) that isotope shift increases with the value of J. The effect of C^{13} isotope substitution on the rotational spectrum of diatomic molecule C^{12}, O^{16} is illustrated in Fig.1.3.

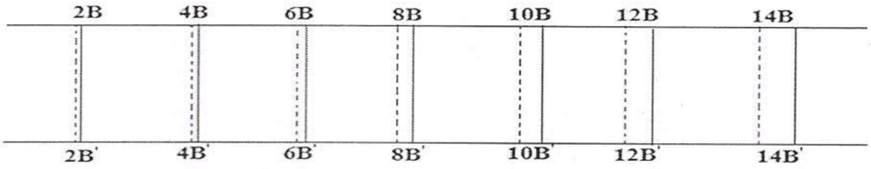

Fig.1.3 Rotational spectrum of (a) diatomic molecule (continuous line) and (b) isotopically substituted diatomic molecule having a mass increase.

1.4 Non- Rigid Rotator

All bonds are elastic to a certain extent and the bond is not rigid as we assumed. The solution of the corresponding Schrodinger equation gives the following energy expression for the energy levels of the non-rigid rotator.

$$\varepsilon_J = BJ(J+1) - DJ^2(J+1)^2\ cm^{-1},\ \ J=0,1,2,\ldots\ldots\ldots\ldots \tag{1.12}$$

Where D is the centrifugal distortion constant and D is a small +ve quantity.

For a diatomic molecule, D is related to B and the fundamental vibration frequency $\bar{\gamma}\,(cm^{-1})$ of the molecule by the relation

$$D = \frac{4B^3}{\bar{\gamma}^2}\ cm^{-1} \tag{1.13}$$

The fundamental frequency of vibration

$$\bar{\gamma} = \frac{\gamma}{c}\ \frac{1}{2\pi c}\sqrt{\frac{K}{\mu}} \tag{1.14}$$

Where K is the force constant and μ is the reduced mass of the molecule. Substitution of the values of B and $\bar{\gamma}$ gives

$$D = 4\left(\frac{h}{8\pi^2 IC}\right)^3 \frac{4\pi^2 C^2 \mu}{K} = \frac{h^3}{32\pi^4 \mu^2 r^6 CK} \tag{1.15}$$

From the above equation, it is evident that the centrifugal distortion effects are greatest for molecules with small moments of inertia and small force constants, In a given molecule, the effect of the centrifugal distortion is the decrease the rotational energy (Eq.1.12) which increases rapidly for higher rotational states.

The selection rule for the non-rigid rotator is again $\Delta J=\pm 1$. The frequency of the transition $J \to J+1$

$$\bar{\gamma}_J = \varepsilon_{J+1} - \varepsilon_J \quad = 2B(J+1) - 4D(J+1)^3 \; cm^{-1} \tag{1.16}$$

The first term is the same as the one due to a rigid molecule and the additional term gives the shift of the lines from that of the rigid molecules which increases with J as $(J+1)^3$. Fig.1.4 gives a schematic representation of the energy levels and the spectrum of non-rigid rotator. For comparison of the rigid case is also included.

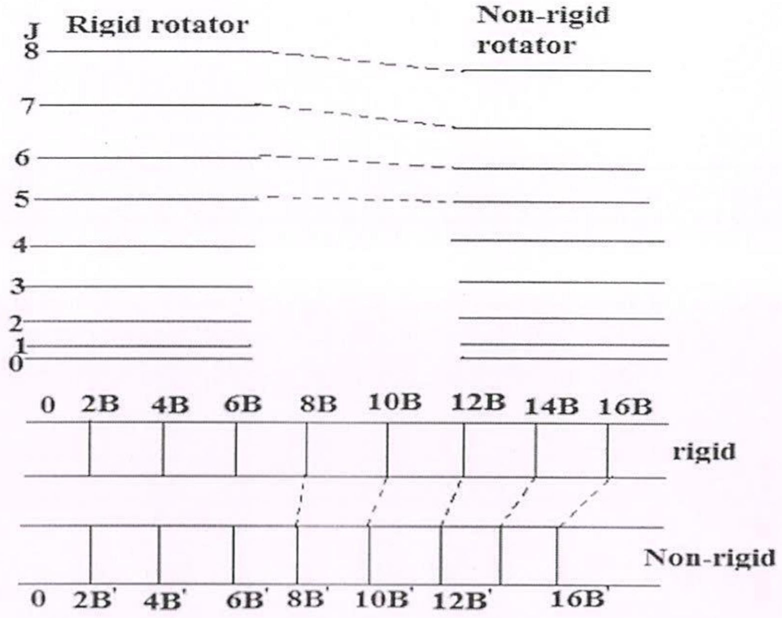

Fig.1.4 Schematic representation of the energy levels and spectrum of rigid and non-rigid rotors

1.5 Linear Polyatomic Molecules :-

A linear molecule containing *n* atoms altogether *(n-1)* individual bond lengths to be determined. Thus in the diatomic *XYZ* molecule, we have the distances r_{xy} and r_{yz}. The experiment will give only one moment of inertia for the end over end rotation. From this one

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T.Y. B.Sc. (2022-23)
Topic: Spectroscopy

Duration:30 min. **Marks:10**

Name of the student:

Q. Solve the following multiple choice questions

1] Magnetic anisotropy brings about ------- of acetylenic protons.

a) Shielding b) deshielding c) exchange d) splitting

2] Intense absorption band around 1700 cm-1 indicates presence of ---------- group.

a) OH b) CN c) SH d) C=O

3) The ---------- regions is known as the fingerprint region.

a) 2000-3000 cm^{-1} b) 2000-400 cm^{-1} c) 3000-1000 cm^{-1} d) 1400-600 cm^{-1}

4] A peak appears around -------- cm-1 due to carbon-carbon triple bond stretching vibration.

a) 3300 cm^{-1} b) 2100 cm^{-1} c) 1700 cm^{-1} d) 690 cm^{-1}

5] Which class of compound below would show an a strong IR absorption near 1700 cm^{-1}.

a) amine b) alcohol c) aldehyde d) anhydride

6] The derivative of carboxylic acid which shows two strong absorptions in the region around 1700 cm^{-1} is --------

a) amide b) ester c) acid halide d) anhydride

7] The type of radiation used in NMR spectroscopy is ---------

a) Ultraviolet light b) Visible light c) Radio waves d) Microwaves

8) ----------signals do you expect in an NMR spectrum of toluene

a) one b) two c) three d) four

9) The acidic proton of a carboxylic acid is found at ---------ppm in NMR.

a) 0 - 2.0 ppm b) 2.5 - 4.5 c) 8.0 - 10 d) 10 -12

10) Ethyl alcohol show ------- signal in NMR spectrum.

a) one b) two c) three d) four

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T.Y. BSc (Semester-V)
Paper-IV
Topic: Spectroscopy

Duration :30 min. Marks:10

Name of the student: --

Roll no.

Instruction:

- ✓ Tick correct option

Q. Solve the following multiple choice questions

1] Magnetic anisotropy brings about ------- of acetylenic protons.

a) Shielding b) deshielding c) exchange d) splitting

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a) Ultraviolet light b) Radio waves c) Visible d) Microwaves

8] How many signals you expect in an NMR spectrum of toluene?

a) One b) two c) three d) four

9] The acidic proton of a carboxylic acid is found at ---------- ppm in NMR.

a) 0-2 ppm b) 2.5 to 4.5 c) 8 to 10 ppm d) 10 to 12 ppm

[6] How many signals you expect in an NMR spectrum of ethyl alcohol?

a) One b) two c) three d) four

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B++ Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date- 22/02/2020

All T.Y.B.Sc. students are here by informed that class test will be conducted as on **25/08/20** on **Topic Name-** 'Spectroscopy' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T.Y. BSc (Semester-V)
Paper-IV
Topic: Spectroscopy

Duration :30 min. Marks:10

Name of the student: Borkar Harshad Harishchandra.

Roll no.

Instruction:

- ✓ Tick correct option

Q. Solve the following multiple choice questions

1] Magnetic anisotropy brings about ------- of acetylenic protons.

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7] The type of radiation used in NMR spectroscopy is --------

01 a) Ultraviolet light [✓ b) Radio waves] c) Visible d) Microwaves

8] How many signals you expect in an NMR spectrum of toluene?

00 a) One b) two c) three [✓ d) four]

9] The acidic proton of a carboxylic acid is found at ---------- ppm in NMR.

00 a) 0-2 ppm b) 2.5 to 4.5 [✓ c) 8 to 10 ppm] d) 10 to 12 ppm

10] How many signals you expect in an NMR spectrum of ethyl alcohol?

00

a) One b) two c) three [✓ d) four]

$\frac{08}{10}$

I.C. S. College of Arts, Commerce & Science, Khed
Department of Chemistry
Unit Test
Class: T.Y. BSc (Semester-V)
Paper-IV
Topic: Spectroscopy

Duration :30 min. Marks:10

Name of the student: Chalke Sanika Satish.

Roll no.

Instruction:

✓ Tick correct option

Q. Solve the following multiple choice questions

1] Magnetic anisotropy brings about ------- of acetylenic protons.

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00

10] How many signals you expect in an NMR spectrum of ethyl alcohol?

a) One b) two c) three d) four

09.

09/10

I.C.S. College Khed
Department of Chemistry
Class: TY BSc (2022-23)
Name of Topic: Spectroscopy

Sr. No.	Name of Student	Mark Obtained (10)
1	BAIKER HARSHAD HARISHCHANDRA	8
2	BAIT PRATIKSHA LAXMAN	7
3	BATE FIZA HUSAIN	8
4	BHAGANE SAMRUDDHI SANTOSH	7
5	BHAGANE SADANAND BARKU	6
6	CHALKE SANIKA SATISH	9
7	CHAVAN ROHAN SANJAY	8
8	DAYALKAR SNEHA SANTOSH	8
9	DHAGE SHREYASH UDAY	7
10	DIVEKAR SURAJ RAJENDRA	9
11	DUDUKE BAZILA ASIF	8
12	GAMARE TEJASWI RAHUL	7
13	GAMARE PREM SUNIL	7
14	GHARE SAKIB BASHIR	6
15	GOKHALE PARTH ANIRUDDHA	8
16	HUMANE SOHAM SANTOSH	6
17	JADHAV YOGESH VISHVNATH	6
18	KADAM ATHARV SHARAD	8
19	KADU TEJAS DASHRATH	7
20	KAMBLE YASH SANTOSH	9
21	KAZI FIZA ASHRAF	8
22	KHAIRE HARSHADA PRAKASH	8
23	KHEDEKAR SHRADDHA HARISHCHANDRA	7
24	KOLEKAR SONALI SURESH	6
25	LAD SAHIL SUBHASH	7
26	MAHADE ROSHANI RAVINDRA	8
27	MAHADIK HALIM MAQBOOL	9
28	RAWAL HUZAIFA ABDUL HAMID	8
29	REWALE SAMPADA ANIL	8
30	SALUNKHE BHUSHAN YASHWANT	8
31	SANSARE VAISHNAVI SHRIDHAR	7
32	SARGUROH MOHAMMED SABIR ABDUL RASHID KHAN	6
33	SHAIKH SHIRIN MAHMED	5
34	SHIGWAN JAYDEEP JITENDRA	7
35	SHINDE SHAILAJA SHANTARAM	7
36	SHIRKE SNEHAL JITENDRA	8
37	SUNGE AIMAN MUNIR	6
38	TAMBE SAKSHI DIPAK	6
39	TAMBE ARADHANA ASHOK	5
40	TANDALEKAR VINAY PRAKASH	5

Dr. Bhagat S.M.

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,
Shriman Chandulal Sheth College of Commerce,
Shrimati Shobhanatai Chandulal Sheth College of Science,
Khed-Ratnagiri, Maharashtra, India.

TEACHING LEARNING BEYOND CURRICULUM FILE

- **NAME OF THE TEACHER –**

  MR. ROHIT RAMESH KAMBLE

- **QUALIFICATION –**

  M.A.(ECONOMICS), D.ED., B.ED.,
  M.B.A. (MARKETING)

- **SUBJECT –**

  ECONOMICS & FOUNDATION COURSE

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,

Shriman Chandulal Sheth College of Commerce, ShrimatiShobhanatai Chandulal Sheth College of Science,

Khed-Ratnagiri, Maharashtra, India.

Evidences of teacher taught beyond curriculum

- **Extended updated curriculum with the support of internet, curriculum related extended contents online prints sample copies of few teachers are attached.**
- **Evidence of test examination on the basis of extended / updated curriculum conducted**

Academic Year 2018-19
To 2022-23

I/C PRINCIPAL,
Shrimati Indira Mahadev Beharay College of Arts
Shriman Chandulal Sheth College of Commerce &
Shrimati Shobhanatai Chandulal Sheth College of Scie
Khed, Dist. Ratnagiri (M.S.) - 415 709.

F C.

Sem - I, II

FY Bcom

Topic - Amendments

The Constitution (125th Amendment) Bill, 2019

Why in News

Recently, the **Ministry of Home Affairs (MHA)** informed the Lok Sabha that presently, there is no proposal to implement **Panchayati Raj System** in **Sixth Schedule** areas of Assam.

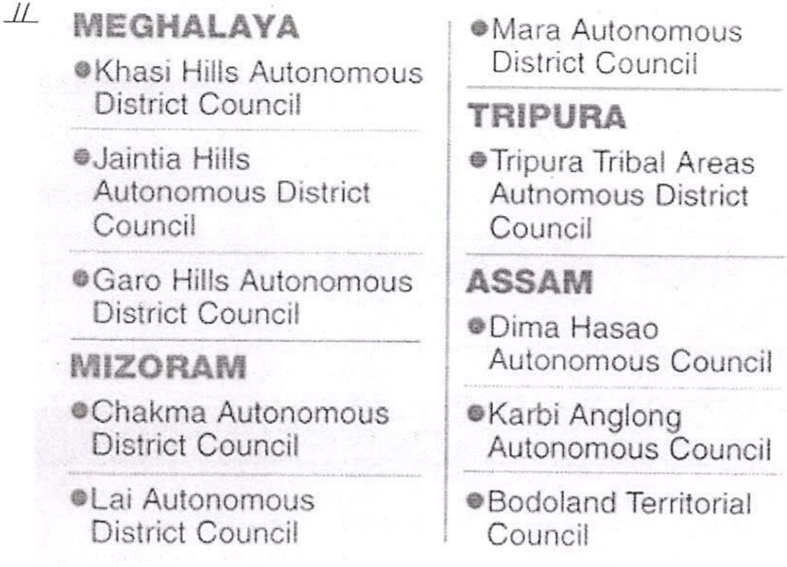
- In January 2019, **the Constitution (125th Amendment) Bill, 2019** was introduced in the Rajya Sabha to **amend** the provisions related to the **Finance Commission** and the **Sixth Schedule of the Constitution.**
- The **Sixth Schedule** relates to the **administration of tribal areas** in the states of **Assam, Meghalaya, Tripura and Mizoram.**

Key Points

- **Proposed Amendments:**
  - **Village and Municipal Councils:**
    - **Village and Municipal Councils:**
      - It provides for **Village and Municipal Councils in addition to the District and Regional Councils.** Village Councils will be established for villages or groups of villages in rural areas, and Municipal Councils will be established in urban areas of each district.
    - **Structure of the Village and Municipal Councils:**
      - The **District Councils may make laws** on various issues, including:
        - Number of Village and Municipal Councils to be formed, and their composition,
        - Delimitation of constituencies for election to the Village and Municipal Councils.
        - Powers and functions of Village and Municipal Councils.
    - **Rules for Devolution of Powers:**
      - **Governor may make rules** for devolution of powers and responsibilities to the Village and Municipal Councils.
      - Such rules may be framed in relation to:
        - Preparation of plans for economic development.
        - Implementation of land reforms.
        - Urban and town planning.
        - Regulation of land-use, among other functions.
  - **State Finance Commission:**
    - The Bill provides the appointment of a Finance Commission for these states, to review the financial position of District, Village, and Municipal Councils.

    jurisdiction.
    - The **district and regional councils within their territorial jurisdictions can constitute village councils** or courts for trial of suits and cases between the tribes. They hear appeals from them.
    - The jurisdiction of the high court over these suits and cases is specified by the Governor.
- **Sixth Schedule Areas:**

II



MEGHALAYA

- Khasi Hills Autonomous District Council
- Jaintia Hills Autonomous District Council
- Garo Hills Autonomous District Council

MIZORAM

- Chakma Autonomous District Council
- Lai Autonomous District Council
- Mara Autonomous District Council

TRIPURA

- Tripura Tribal Areas Autnomous District Council

ASSAM

- Dima Hasao Autonomous Council
- Karbi Anglong Autonomous Council
- Bodoland Territorial Council

Panchayati Raj Institutions

- **About:**
    - Panchayats were included in **Article 40** under the Directive Principles of the Constitution of India.
    - Government in 1992 introduced the **73rd Amendment** to make the Panchayati Raj Institutions (PRIs) Constitutional machinery.
- **Scheduled Areas:**
    - The tribal dominated states under 5th and 6th schedules of the Constitution were, however, **given the option either to introduce Panchayati Raj institutions or to continue with their traditional self-government institutions.**
    - All the states of India including 5th and 6th schedule states **except Jammu & Kashmir, Nagaland, Meghalaya, Mizoram** and the **autonomous areas of Assam and Tripura** amended their Panchayati Raj Act to accommodate the provisions of the 73rd Amendment Act.
- **Provisions of PRIs:**
    - Establishment of a **three-tier structure** (Village Panchayat, Panchayat Samiti or intermediate level Panchayat and Zilla Parishad or district level Panchayat).
    - Establishment of Gram Sabhas at the village level. **Regular elections to Panchayats every five years.**
    - Proportionate seat reservation for **SCs/STs.**
    - Reservation of not less than **1/3 seats for women.**
    - Constitution of State Finance Commissions to recommend measures to improve the finances of Panchayats.
- **Power to Panchayats:**
    - The Constitution (73rd Amendment) Act, 1992 vests power in the State Government to

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SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- III**
Class: S.Y.B. Com **Total Marks: 10**
Sub-FC **Topic-** ***Indian Constitutional Amendment System***

Name of the student: ____________________
Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1.What is the minimum majority required in both houses of Parliament to pass a constitutional amendment in India?

a) Simple majority

b) Two-thirds majority

c) Absolute majority

d) Majority of states

2.Which Article of the Indian Constitution deals with the procedure for amending the Constitution?

a) Article 356

b) Article 368

c) Article 370

d) Article 356A

3.Who can initiate the process of amending the Indian Constitution?

a) The President

b) The Prime Minister

c) The Parliament

d) The Supreme Court

4.Which of the following statements is true regarding the Constitution (Amendment) Bill?

a) It requires approval from all states.

b) It can only be introduced in the Lok Sabha.

c) It must be ratified by the President before being debated.

d) It needs to be passed by a special majority.

5.What is the maximum time limit for ratification by states for a constitutional amendment?

a) 1 month

b) 3 months

c) 6 months

d) 1 year

6.Which Amendment Act extended the reservation of seats for Scheduled Castes and Scheduled Tribes in the Lok Sabha and State Assemblies?

a) 73rd Amendment Act

b) 95th Amendment Act

c) 99th Amendment Act

d) 101st Amendment Act

7.Which amendment introduced the Panchayat Raj System in India?

a) 42nd Amendment Act

b) 73rd Amendment Act

c) 86th Amendment Act

d) 91st Amendment Act

8.Which article of the Indian Constitution allows the President to promulgate ordinances during the recess of Parliament?

a) Article 123

b) Article 370

c) Article 356

d) Article 368

9.Which Constitutional Amendment abolished the Privy Purse for the erstwhile princely states?

a) 42nd Amendment Act

b) 44th Amendment Act

c) 52nd Amendment Act

d) 73rd Amendment Act

10.Who has the power to amend the provisions related to the distribution of legislative powers between the Union and the States?

a) The President

b) The Parliament

c) The Prime Minister

d) The Governor

Answer key

1.d) Majority of states
2.b) Article 368
3.c) The Parliament
4.d) It needs to be passed by a special majority.
5.d) 1 year
6.c) 99th Amendment Act
7.b) 73rd Amendment Act
8.a) Article 123
9.c) 52nd Amendment Act
10.b) The Parliament

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
Ph No. 02356-260100
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E-mail : principalics@yahoo.co.in • principal@icskhed.edu.in • icscmit@gmail.com • cmit@icskhed.edu.in • Web : www.icskhed.edu.in • www.icskhed.org

Ref. No.: ICS/ **Date :**

Notice

Date-10/09/2019

All F.Y.B.com students are here by informed that class test will be conducted as on **13/09/2019** on **Topic Name-** 'Constitutional amendments' as part of teaching learning beyond curriculum.

AnilAJ.
I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- III**
Class: S.Y.B. Com **Total Marks: 10**
Sub-FC **Topic-** ***Indian Constitutional Amendment System***

Name of the student: Bhalekar Ruchika krushna
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1.What is the minimum majority required in both houses of Parliament to pass a constitutional amendment in India?

a) Simple majority

b) Two-thirds majority

c) Absolute majority

[✓ d) Majority of states]

2.Which Article of the Indian Constitution deals with the procedure for amending the Constitution?

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c) 6 months

[✓ d) 1 year]

6.Which Amendment Act extended the reservation of seats for Scheduled Castes and Scheduled Tribes in the Lok Sabha and State Assemblies?

[✓ a) 73rd Amendment Act]

b) 95th Amendment Act

c) 99th Amendment Act

d) 101st Amendment Act

7.Which amendment introduced the Panchayat Raj System in India?

a) 42nd Amendment Act

b) 73rd Amendment Act

[✓ c) 86th Amendment Act]

d) 91st Amendment Act

8.Which article of the Indian Constitution allows the President to promulgate ordinances during the recess of Parliament?

a) Article 123

b) Article 370

c) Article 356

d) Article 368

9.Which Constitutional Amendment abolished the Privy Purse for the erstwhile princely states?

a) 42nd Amendment Act

b) 44th Amendment Act

c) 52nd Amendment Act

d) 73rd Amendment Act

10.Who has the power to amend the provisions related to the distribution of legislative powers between the Union and the States?

a) The President

b) The Parliament

c) The Prime Minister

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SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- III**
Class: S.Y.B. Com **Total Marks: 10**
Sub-FC **Topic-** ***Indian Constitutional Amendment System***

Name of the student: Bhilare divya Shripat
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1.What is the minimum majority required in both houses of Parliament to pass a constitutional amendment in India?

a) Simple majority

b) Two-thirds majority

c) Absolute majority

d) Majority of states

2.Which Article of the Indian Constitution deals with the procedure for amending the Constitution?

a) Article 356

b) Article 368

c) Article 370

d) Article 356A

3.Who can initiate the process of amending the Indian Constitution?

a) The President

b) The Prime Minister

c) The Parliament

d) The Supreme Court

4.Which of the following statements is true regarding the Constitution (Amendment) Bill?

a) It requires approval from all states.

b) It can only be introduced in the Lok Sabha.

c) It must be ratified by the President before being debated.

d) It needs to be passed by a special majority.

5.What is the maximum time limit for ratification by states for a constitutional amendment?

a) 1 month

b) 3 months

c) 6 months

d) 1 year

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Sub-FC **Topic-** ***Indian Constitutional Amendment System***

Name of the student: Bhilave Nikita Nilesh
Roll no.

Instruction:

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Time: 1 hrs **SEMESTER- III**
Class: S.Y.B. Com **Total Marks: 10**
Sub-FC **Topic-** ***Indian Constitutional Amendment System***

Name of the student: Bhosale Soham Anant
Roll no.

Instruction:

- ✓ Tick correct option

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Exam: - Practical based Class test mark list

1	Bait Vaishnavi Vilas	7
2	Bhalekar ruchika krushna	6
3	Bhilare divya shripat	8
4	Bhilare Nikita Nilesh	8
5	Bhosale Soham Anant	8
6	Bhosle Harsh Rajendra	7
7	Bhuvad Nikita Vijay	5
8	Bhuvad omkar ankush	6
9	Bijle Rim Noor Ahmed	9
10	Chavan mayuri vijay	5
11	Chikhale Nihar Rohan	6
12	Chikhalkar Kalpesh Dipak	6
13	Chikte Arshiya Siddiq	6
14	Chinchgharkar mrudula mangesh	9
15	Dasare rutesh Balaji	8
16	Dervankar vaishnavi babu	7
17	Dhanse Suhana Zaheer	7
18	Duduke Nashua Aslam	7
19	Gamare Karina Vilas	5
20	Ghag Sakshi Sandip	6
21	Gosavi Tapan Tukaram	6
22	Gurav Suraj Nathuram	6
23	Hamdulay Ramisa Hishamuddin	6
24	Hamdulay Rukhsana Mohammed Hussain	6
25	Harkulkar Bhakti Mahanand	7
26	Humane sahil sanjay	7
27	Jadhav Ankush Pradip	5
28	Jadhav Asmita Suryakant	6
29	Jadhav Digambar Umesh	6
30	Jadhav Jay Jogesh	8
31	Jadhav lav pradip	9
32	Jadhav nisha nitin	8
33	JADHAV PRIYANKA BABAN	8
34	Jadhav Punam Sandip	8
35	Jadhav sangita chandrakant	7
36	Jadhav Shivani Shivaji	5
37	JADHAV SHRADDHA NETAJI	6

38	Jadhav sumit suresh	9
39	JADHAV SUVEK BHIKU	5
40	Jadhav Tushar Dilip	6
41	Jadhav vaishnavi shashikant	6
42	Jain Drushti Mahavir	6
43	Jasnaik shazeb shakil	9
44	Jawale Neha Sudhir	8
45	Chougule Amal Usman	7
46	JUVALE MEGHA JAYRAM	7
47	Kadam Prajakta Vijay	6
48	Kadam urmila shivaji	6
49	Kadri Nadiya Ismail	6
50	Kadvekar sumaiya yaseen	7
51	Katmale faiza farooq	7
52	Kauchali Jumana M.hanif	5
53	Kolambe Rohit Ravindra	6
54	Kurmure sakshi dilip	6
55	Kushte Tanmay Mohan	8
56	Mahadik Almeera Kadir	9
57	Mahadik Rida Rafik	8
58	Mahadik Roziya Badiuzzaman	8
59	Makhjankar saqlain ismail	8
60	Mandlekar Umama Shuaib	7
61	Maniyar Ruaida Imtiyaz	5
62	Manval Manu sanjay	6
63	Mohite Ketaki Nandkumar	9
64	Mohite Riya Milind	5
65	Momere Adnan Kausar Ali	6
66	More amol bramhanand	6
67	MORE ANIKET BALAJI	6
68	More pranali chandrakant	9
69	Sahil Sanjay more	5
70	More Shruti Shashikant	7
71	More Tejas shankar	6
72	MUKADAM RUHEE ANWAR	5
73	Mukadam uzma anwar	6
74	Nadkar Afiya Abdul Kadir	7
75	Nadkar Bisma Azeem	5
76	Nikam Abhijeet Dattaram	6
77	Pacharekar sanika sunil	6
78	Parkar Khadeja Amir	6
79	Parkar Nabil Samir	9
80	Parkar Saba Sagir	5
81	Parkar Zahid Zakir	7
82	Parte Ankita Anant	6

83	Patil Darshan Ramchandra	5
84	Patil disha arjun	6
85	Pawar pravin sunil	7
86	Pawar Rohit Ramesh	6
87	Pawar sahil laxman	6
88	Pimpare Siddhi Sandip	9
89	POMENDKAR PRITAM GANESH	8
90	POPHALKAR ABHISHEK KRUSHNA	7
91	Pophalkar Akanksha Krushna	7
92	Pophalkar prachi pramod	6
93	Potrick Samiya Abdul Salam	6
94	Ramane Manish Manohar	6
95	Rawal Mehjabin Salim	7
96	Rumane Safa A.Aziz	7
97	Sahibole Muskan Abdul Salam	5
98	Sakpal Samiksha Subhash	6
99	Sawant Anish Shashikant	6
100	Shigavan varsha vijay	8
101	Shigwan siddhesh Dattaram	9
102	Shinde avishkar bijay	8
103	Shinde pranjal vasant	8
104	Shinde Shravani Sanjay	8
105	Shirke jitendra minakshi	7
106	Surve Afsa Isa	5
107	Surve Sakshi Rajendra	6
108	Surve Sara Abdul Vahab	9
109	Surve shaheen Mohammad waheed	5
110	Surve shalini suresh	6
111	SUTAR GANESH SANTOSH	6
112	Sutar Rahul Anant	6
113	Tambe Akanksha Ravindra	9
114	Tambe Ayesha wajuddin	5
115	Tambe pratiksha prabhakar	7
116	Tambitkar pandurang prakash	6
117	Tambutkar swamini ganesh	5
118	TEMKAR KISHOR RAMCHANDRA	6
119	Todkari Anura Ajay	7
120	Vangule Pranit Bharat	5

Name & Sign of subject Teacher-: Prof. Kamble Rahul R.

TYB.com Sem-VI
Sub- Business Economics
Topic- Types of foreign exchange rate

Foreign exchange spot

A **foreign exchange spot** transaction, also known as **FX spot**, is an agreement between two parties to buy one currency against selling another currency at an agreed price for settlement on the spot date. The exchange rate at which the transaction is done is called the **spot exchange rate**. As of 2010, the average daily turnover of global FX spot transactions reached nearly US$1.5 trillion, counting 37.4% of all foreign exchange transactions.[1] FX spot transactions increased by 38% to US$2.0 trillion from April 2010 to April 2013.[2]

Settlement date

The standard settlement timeframe for foreign exchange spot transactions is T+2; i.e., two business days from the trade date. Notable exceptions are USD/CAD, USD/TRY, USD/PHP, USD/RUB, and offshore USD/KZT and offshore USD/PKR currency pairs, which settle at T+1. USD/COP settles T+0. [3] Majority of SME FX payments are made through Spot FX, partially because businesses aren't aware of alternatives.[4]

Execution methods

Common methods of executing a spot foreign exchange transaction include the following:[1]

- *Direct* – Executed between two parties directly and not intermediated by a third party. For example, a transaction executed via direct telephone communication or direct electronic dealing systems such as Reuters Conversational Dealing
- *Electronic broking systems* – Executed via automated order matching system for foreign exchange dealers. Examples of such systems are EBS and Reuters Matching 2000/2
- *Electronic trading systems* – Executed via a single-bank proprietary platform or a multibank dealing system. These systems are generally geared towards customers. Examples of multibank systems include Fortex Technologies, Inc., 360TGTX, FXSpotStream LLC, Integral, FXall, HotSpotFX, Currenex, LMAX Exchange, FX Connect, Prime Trade, Globalink, Seamless FX, and eSpeed
- *Voice broker* – Executed via telephone with a foreign exchange voice broker

See also

- Foreign exchange market
- Foreign exchange option
- Foreign exchange derivative
- Financial instruments

Forward exchange rate

The **forward exchange rate** (also referred to as **forward rate** or **forward price**) is the exchange rate at which a bank agrees to exchange one currency for another at a future date when it enters into a forward contract with an investor.[1][2][3] Multinational corporations, banks, and other financial institutions enter into forward contracts to take advantage of the forward rate for hedging purposes.[1] The forward exchange rate is determined by a parity relationship among the spot exchange rate and differences in interest rates between two countries, which reflects an economic equilibrium in the foreign exchange market under which arbitrage opportunities are eliminated. When in equilibrium, and when interest rates vary across two countries, the parity condition implies that the forward rate includes a premium or discount reflecting the interest rate differential. Forward exchange rates have important theoretical implications for forecasting future spot exchange rates. Financial economists have put forth a hypothesis that the forward rate accurately predicts the future spot rate, for which empirical evidence is mixed.

Introduction

The forward exchange rate is the rate at which a commercial bank is willing to commit to exchange one currency for another at some specified future date.[1] The forward exchange rate is a type of forward price. It is the exchange rate negotiated today between a bank and a client upon entering into a forward contract agreeing to buy or sell some amount of foreign currency in the future.[2][3] Multinational corporations and financial institutions often use the forward market to hedge future payables or receivables denominated in a foreign currency against foreign exchange risk by using a forward contract to lock in a forward exchange rate. Hedging with forward contracts is typically used for larger transactions, while futures contracts are used for smaller transactions. This is due to the customization afforded to banks by forward contracts traded over-the-counter, versus the standardization of futures contracts which are traded on an exchange.[1] Banks typically quote forward rates for major currencies in maturities of one, three, six, nine, or twelve months, however in some cases quotations for greater maturities are available up to five or ten years.[2]

Relation to covered interest rate parity

Covered interest rate parity is a no-arbitrage condition in foreign exchange markets which depends on the availability of the forward market. It can be rearranged to give the forward exchange rate as a function of the other variables. The forward exchange rate depends on three known variables: the spot exchange rate, the domestic interest rate, and the foreign interest rate. This effectively means that the forward rate is the price of a forward contract, which derives its value from the pricing of spot contracts and the addition of information on available interest rates.[4]

The following equation represents covered interest rate parity, a condition under which investors eliminate exposure to foreign exchange risk (unanticipated changes in exchange rates) with the use of a forward contract – the exchange rate risk is effectively *covered*. Under this condition, a domestic investor would earn equal returns from investing in domestic assets or converting currency at the spot exchange rate, investing in foreign currency assets in a country with a different interest rate, and exchanging the foreign currency for domestic currency at the negotiated forward exchange rate. Investors will be indifferent to the interest rates on deposits in these countries due to the equilibrium resulting from the forward exchange rate.

N represents the maturity of a given forward exchange rate quote
d represents the number of days to delivery

For example, to calculate the 6-month forward premium or discount for the euro versus the dollar deliverable in 30 days, given a spot rate quote of \$1.2238/€ and a 6-month forward rate quote of \$1.2260/€:

$$P_6 = \left(\frac{1.2260}{1.2238} - 1\right)\frac{360}{30} = 0.021572 = 2.16\%$$

The resulting 0.021572 is positive, so one would say that the euro is trading at a 0.021572 or 2.16% premium against the dollar for delivery in 30 days. Conversely, if one were to work this example in euro terms rather than dollar terms, the perspective would be reversed and one would say that the dollar is trading at a discount against the Euro.

Forecasting future spot exchange rates

Unbiasedness hypothesis

The unbiasedness hypothesis states that given conditions of rational expectations and risk neutrality, the forward exchange rate is an unbiased predictor of the future spot exchange rate. Without introducing a foreign exchange risk premium (due to the assumption of risk neutrality), the following equation illustrates the unbiasedness hypothesis.[3][5][6][7]

$$F_t = E_t(S_{t+k})$$

where

F_t is the forward exchange rate at time t
$E_t(S_{t+k})$ is the expected future spot exchange rate at time $t+k$
k is the number of periods into the future from time t

The empirical rejection of the unbiasedness hypothesis is a well-recognized puzzle among finance researchers. Empirical evidence for cointegration between the forward rate and the future spot rate is mixed.[5][8][9] Researchers have published papers demonstrating empirical failure of the hypothesis by conducting regression analyses of the realized changes in spot exchange rates on forward premiums and finding negative slope coefficients.[10] These researchers offer numerous rationales for such failure. One rationale centers around the relaxation of risk neutrality, while still assuming rational expectations, such that a foreign exchange risk premium may exist that can account for differences between the forward rate and the future spot rate.[11]

The following equation represents the forward rate as being equal to a future spot rate and a risk premium (not to be confused with a *forward premium*):[12]

$$F_t = E_t(S_{t+1}) + P_t$$

The current spot rate can be introduced so that the equation solves for the forward-spot differential (the difference between the forward rate and the current spot rate):

$$F_t - S_t = E_t(S_{t+1} - S_t) + P_t$$

Based on the SSAP 20 in the UK GAAP, the foreign currency translation that provides the option of translating a transaction at the prevailing rate at the date the transaction happened then a matching forward contract rate should be created. In a situation where the forward rate is used, then no losses of exchange gains should be recognized in the books of accounts when both parties are recording the sale and eventual settlement (Parameswaran, 2011).

In this situation recording the transaction between Pamela and Tommy

Date

Date of Currency exchange rate	Spot exchange rate	Forward contract exchange rate
1.25	1.27	1.26

Here, assuming that Pamela applies the forward rate of translation the accounting entries will be as follows

DR (£) CR (£)

Debtors 3,968,254

Sales 3,968,254

To record the sale of 5 million euros at the forward rate of $1.26 = $1 U.S dollar.

After the end of the first month on the balance sheet date, no transaction with the debtor is recorded since the forward rate has been used. At the end of the agreed period, the journals that will be recorded to recognise receiving of the sales money will be as follows

As at the date of settlement

DR (£) CR (£)

Cash 3,968,254

Debtors 3,968,254

To record the receipt of 5 million euros at the forward rate of $1.26 = $1 U.S. dollar.

In this transaction, there is no difference that arises as the sale of goods in a foreign currency and forward contract are effectively treated as one transaction. Here the rate of $1.26 = $1 U.S dollar is used throughout the recording of both transactions.

Accounting Treatment under the FRS 102

The FRS accounting procedure takes a different route of execution in treating the sale and the forward contract as two separate transactions

According to section 30 of foreign currency translation, foreign exchange transaction should be recorded at the spot rate. The transactions are also recorded at the date of the transaction while the monetary items should be treated by translating them through the use of a closing rate at the balance sheet date. In this case,

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Time: 1 hrs **SEMESTER- VI**
Class: T.Y.B.Com **Total Marks: 10**

Topic-spot and forward exchange

Name of the student: ____________________

Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is the spot exchange rate?
(a) The price of one currency in terms of another for immediate delivery, usually within two business days.
(b) The price of a future contract for a currency at a specific date in the future.
(c) The average exchange rate over a given period, such as a month or a year.
(d) The official exchange rate set by a government.

2. What factors influence the spot exchange rate?
(a) Interest rates, inflation rates, economic stability, political stability, and trade balance.
(b) Supply and demand for the currencies, speculation, and intervention by central banks.
(c) Both (a) and (b).
(d) None of the above.

3. How is the spot exchange rate quoted?
(a) As the amount of one currency required to buy one unit of another currency (e.g., USD/EUR = 1.20).
(b) As the amount of one currency received for selling one unit of another currency (e.g., EUR/USD = 0.83).
(c) Both (a) and (b) are common depending on the country.
(d) It depends on the type of currency market used.

4. What is the difference between the bids and ask price for a spot exchange rate?
(a) The bid price is always lower than the ask price.
(b) The ask price is always lower than the bid price.
(c) The difference represents the spread, the profit margin for the market maker.
(d) There is no difference in the bid and ask price for spot rates.
5. What happens to the spot exchange rate when there is a high demand for a currency?
(a) The value of the currency increases (appreciates).
(b) The value of the currency decreases (depreciates).
(c) There is no change in the value of the currency.
(d) It depends on the supply of the currency.

6. How can forward exchange contracts be used for speculation?
(a) By taking a long position in a currency expected to appreciate.
(b) By taking a short position in a currency expected to depreciate.

(c) By entering into risky, leveraged forward contracts.
(d) All of the above.

7. What are some ethical considerations when using forward contracts?
(a) Avoiding market manipulation tactics like cornering the market.
(b) Disclosing forward market positions accurately to investors.
(c) Not using inside information to gain unfair advantage.
(d) All of the above.

8. How is the forward exchange market regulated?
(a) Primarily by individual country's central banks.
(b) Through international cooperation and agreements.
(c) By self-regulatory organizations within the financial industry.
(d) All of the above.

9. What are some historical examples of major events affecting forward exchange markets?
(a) Global financial crises like the 2008 crisis.
(b) Political uncertainties like Brexit.
(c) Central bank interventions to influence exchange rates.
(d) All of the above.

10. How can technology and data analysis improve the use of forward contracts?
(a) By providing more accurate forecasts of future exchange rates.
(b) By developing
(c) None of the above
(d) All the above

Answer Key

1. Answer: **(a)** The price of one currency in terms of another for immediate delivery, usually within two business days.
2. Answer: (**c**) Both (a) and (b).
3. Answer: (**c**) Both (a) and (b) are common depending on the country.
4. Answer: (**c**) The difference represents the spread, the profit margin for the market maker.
5. Answer: (a) The value of the currency increases (appreciates).6.(d) All of the above are ways to use forward contracts for speculation. However, speculative strategies carry significant risks.
7. (D) All of the above are ethical considerations when using forward contracts. Market manipulation, information disclosure, and fair trading practices are important.
8. (D) All of the above play a role in regulating the forward exchange market. Central banks, international agreements, and self-regulatory organizations contribute to market stability and fairness.
9. (D) All of the above examples can significantly impact forward exchange markets.
10.(a) And (b) Technology and data analysis can improve forward contract usage by providing better exchange rate forecasts, optimizing hedging strategies, and automating some trading processes.

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
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Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date-22/03/2021

All T.Y.B.com students are here by informed that class test will be conducted as on **24/03/2021** on **Topic Name-** 'Foreign exchange rate' as part of teaching learning beyond curriculum.

Anal A.J.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

Sahajeevan Shikshan Sanstha's

SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- VI**
Class: T.Y.B.Com **Total Marks: 10**

Topic-spot and forward exchange

Name of the student: Ambre Sahil Santosh
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is the spot exchange rate?
[✓ (a) The price of one currency in terms of another for immediate delivery, usually within two business days.]
1 (b) The price of a future contract for a currency at a specific date in the future.
(c) The average exchange rate over a given period, such as a month or a year.
(d) The official exchange rate set by a government.

2. What factors influence the spot exchange rate?
(a) Interest rates, inflation rates, economic stability, political stability, and trade balance.
(b) Supply and demand for the currencies, speculation, and intervention by central banks.
1 [✓ (c) Both (a) and (b).]
(d) None of the above.

3. How is the spot exchange rate quoted?
(a) As the amount of one currency required to buy one unit of another currency (e.g., USD/EUR = 1.20).
(b) As the amount of one currency received for selling one unit of another currency (e.g., EUR/USD = 0.83).
1 [✓ (c) Both (a) and (b) are common depending on the country.]
(d) It depends on the type of currency market used.

4. What is the difference between the bids and ask price for a spot exchange rate?
(a) The bid price is always lower than the ask price.
(b) The ask price is always lower than the bid price.
(c) The difference represents the spread, the profit margin for the market maker.
(d) There is no difference in the bid and ask price for spot rates.

5. What happens to the spot exchange rate when there is a high demand for a currency?
(a) The value of the currency increases (appreciates).
(b) The value of the currency decreases (depreciates).
1 [✓ (c) There is no change in the value of the currency.]
(d) It depends on the supply of the currency.

6. How can forward exchange contracts be used for speculation?
[✓ (a) By taking a long position in a currency expected to appreciate.]
(b) By taking a short position in a currency expected to depreciate.

(c) By entering into risky, leveraged forward contracts.
(d) All of the above.

7. What are some ethical considerations when using forward contracts?
(a) Avoiding market manipulation tactics like cornering the market.
(b) Disclosing forward market positions accurately to investors.
(c) Not using inside information to gain unfair advantage.
[✓ (d) All of the above.]

8. How is the forward exchange market regulated?
(a) Primarily by individual country's central banks.
(b) Through international cooperation and agreements.
(c) By self-regulatory organizations within the financial industry.
[✓ (d) All of the above.]

9. What are some historical examples of major events affecting forward exchange markets?
(a) Global financial crises like the 2008 crisis.
[✓ (b) Political uncertainties like Brexit.]
(c) Central bank interventions to influence exchange rates.
(d) All of the above.

10. How can technology and data analysis improve the use of forward contracts?
[✓ (a) By providing more accurate forecasts of future exchange rates.]
(b) By developing
(c) None of the above
(d) All the above

06/10

Sahajeevan Shikshan Sanstha's
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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- VI**
Class: T.Y.B.Com **Total Marks: 10**

Topic-spot and forward exchange

Name of the student: Amre viraj vijay.
Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is the spot exchange rate?
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07/10

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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- VI**
Class: T.Y.B.Com **Total Marks: 10**

Topic-spot and forward exchange

Name of the student: ANJULEY AFIYA ATTAULLAH
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is the spot exchange rate?
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07/10

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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- VI**
Class: T.Y.B.Com **Total Marks: 10**

Topic-spot and forward exchange

Name of the student: Ayre shivani Dilip
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is the spot exchange rate?
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[✓ (c) None of the above]
(d) All the above

$\frac{07}{10}$

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Khed, Ratnagiri.

Exam: - Practical based Class test mark list

Sr.	Name of the Students	Marks
1	AMBRE SAHIL SANTOSH	8
2	Ambre viraj vijay	7
3	Antuley Aafiya Attaullah	7
4	Ayre shivani Dilip	7
5	Bade Gausiya A.Sattar	5
6	Bade Parveen Tahir	6
7	Badirake Arati Ashok Badirake	6
8	Bait Sagar Bhiku	6
9	Bhadwalkar sagar santosh	6
10	Bhagane runali ramesh	6
11	Bhagane sakshi shantaram	7
12	Bhalekar omkar dhananjay	7
13	Bhilare Dipti Dattaram	5
14	Bhosale sanjana santosh	6
15	Bhosale sejal shashikant	6
16	Bhuvad siddhesh santosh	8
17	Chinkate nikhita suresh	9
18	Chitale Ruchira Sachin	8
19	Chougle Zafar Afroz	8
20	CHOUGULE AL ZAEEM SAEED	8
21	Chougule Amal Usman	7
22	Chougule Fahad Ridwan	5
23	Chougule Muskan Irfan	6
24	Devhare Pradnya Ramesh	9
25	Dhanshe namira hasham	5
26	fansupkar Bushra Yusuf	6
27	Gandhi Swaraj Vikrant	6
28	Gawade Vrushali Sandip	6
29	Gavankar Jayesh Jayram	9
30	Ghadashi Saloni Bhagawan	8
31	Gole Dipraj Dipak	7
32	Gurav sahil balaji.	7
33	Hambir Ketan Pandurang	6
34	Hamdule Raeed Salahuddin	6
35	Jadhav Akshata Anil	6
36	Jadhav Harshada sunil	7
37	Jadhav sakshi manghesh	7
38	Jadhav shweta anant	5

39	Jasnaik samiya rafik	6
40	KADAM ANIKET SANTOSH	6
41	Kadam omkar rahul	8
42	Kadam rohini rajaram	9
43	Kadam sangram mahesh	8
44	Kadavekar Darshana Ananda	8
45	Kadiri Arsalan Vazir	8
46	Kadvekar Nawaf Murad	7
47	Faisal hidayat kawchali	5
48	Khatib Nauman Nizam	6
49	Khedekar shivani shailesh	9
50	Khot Rahil Rafique	5
51	Khot shaizan abbasmiya	6
52	Kolambe Ninad Naresh	6
53	Kolambe Rohan Ramesh	6
54	Koltharkar Ibtesam tanveer	9
55	Kondekar aqsa karamat	5
56	Mahadik Adnan Irfan	7
57	Maniyar Bushra Nasir.	6
58	Mapkar Azmina A.Aziz	5
59	Mapkar kaisar Jahan shaukat	6
60	Metkar Alfiya Salim	7
61	Metkar Salman Salim	5
62	Mirajkar Shraddha Sunil	6
63	Mohite Hrutik subhash	6
64	More manali rajendra	6
65	MORE MANASI SANTOSH	9
66	More Roshan Ganesh	5
67	More Roshani Rajendra	7
68	More Rushikesh Babaram	6
69	More shravani sandip	5
70	Motlekar sufiyan Aizaz	6
71	Mukadam M kaif Abdul kalam	7
72	Mukadam samiya yasin	6
73	Mulla Adnan Akbar Ali	6
74	Nadkar Afreen Abdul karim	9
75	NADKAR REHAN A.SALAM	8
76	Nadkar Simran Nisar	7
77	Nore Juwairiyah Jameel	7
78	Palekar Zain M Amin	6
79	Pardale amar suresh	6
80	Pardesi shagufta saeed	6
81	Parkar Anam Asif.	7
82	Parkar ilham iqbal	7
83	Pashte vaishnavi viththal	5
84	Pawar Sandesh Santosh	6

85	Payare Nita Sanjay	6
86	Potrick Mehran A Rauf	8
87	Potrick Naved Barkat	9
88	Quraishi ummehaani gulamemustafa	8
89	RAWAL ADAM ABDUL RAHIM	8
90	Ishtiyaque sultan rawal	8
91	Rawal Mohammad Yasin	7
92	Rawal Mohammed Zeeshan Usman	7
93	Sahibole umaira hidayat	6
94	Sangle Aayrsha Shabbir	8
95	Sawant Sanket Dilip	8
96	SHAIKH IBRAHIM JAVED	8
97	Shaji arbaz Noor Mohd	7
98	Shinde vighanesh Rajesh	5
99	ROSHAN RAJENDRA SINKAR	6
100	Surve ashwaq Mainuddin	9
101	Surve shritika Dilip	5
102	Tambitkar Rohan Pandurang	6
103	Vaidya shraddha vaibhav	6
104	Velhal Tejashree Sangam	6
105	Walopkar sahil shafi	9

Name and the signature of Subject Teacher- Ast. Prof. Kamble Rohit .R.

FYBcom FC. Sem-I

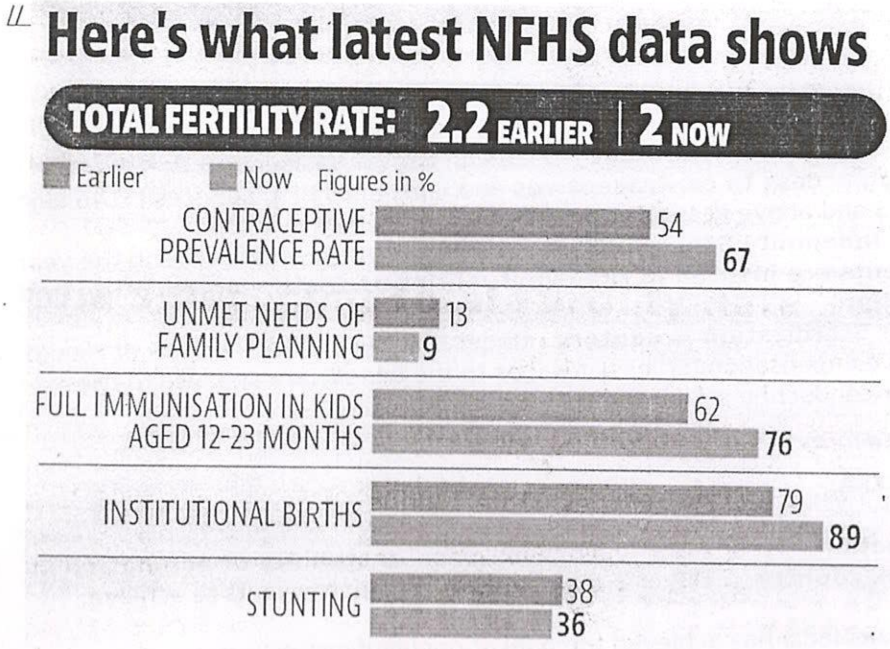
Topic- Sex ratio, Declining total fertility Rate

India's Declining Total Fertility Rate

Why in News

Recently, the latest data from the **National Family Health Survey (NFHS 2019-21)** has been released.

- The data shows a **declining trend** regarding <u>Total Fertility Rate</u> (TFR: the average number of children per woman).



Key Points

- **About TFR:**
    - **Total fertility rate (TFR)** in simple terms refers to the **total number of children born or likely to be born to a woman in her lifetime** if she were subject to the prevailing rate of age-specific fertility in the population.
    - TFR of about **2.1 children per woman** is called **Replacement-level fertility**. TFR **lower than 2.1** children per woman — indicates that a **generation is not producing enough children to replace itself**, eventually leading to an outright reduction in population.
- **Declining Trend of TFR:**
    - Due to the **sustained family planning programme** spanning decades, the TFR, has declined further from 2.2 reported in 2015-16 to **2.0 at the all-India level.**
        - The **TFR is at 1.6 in urban areas and 2.1 in rural India.**

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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- VI**
Class: F.Y.B. Com **Total Marks: 10**

Topic-Sex ratio in India

Name of the student: ____________________

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1.As of the 2011 census, what was the sex ratio in India?

A) 940 females per 1000 males

B) 955 females per 1000 males

C) 970 females per 1000 males

D) 985 females per 1000 males

2.Which Indian state had the highest sex ratio as per the 2011 census?

A) Kerala

B) Haryana

C) Tamil Nadu

D) Uttar Pradesh

3.What does the Total Fertility Rate (TFR) measure?

A) The number of children born to a woman in her lifetime

B) The number of children born per year

C) The number of children born per 1000 people

D) The number of children born to men in a given year

4.Which of the following factors can influence fertility rates in a population?

A) Economic development

B) Literacy rate

C) Access to healthcare

D) All of the above

5.The Child Sex Ratio (CSR) typically measures the ratio of girls to boys in which age group?

A) 0-5 years

B) 6-10 years

C) 11-15 years

D) 16-20 years

6.In India, what is the primary objective of the "Beti Bachao, Beti Padhao" campaign?

A) Promoting female foeticide

B) Encouraging female education

C) Reducing the number of girls in the population

D) None of the above

7.Which state in India has traditionally faced challenges related to a skewed sex ratio with a higher number of males?

A) Kerala

B) Punjab

C) West Bengal

D) Karnataka

8.What is the sex ratio at birth (SRB) typically expressed as?

A) Females per 100 males

B) Males per 100 females

C) Children per couple

D) Adults per household

9.Which stage of demographic transition is characterized by high birth rates and high death rates?

A) Stage 1

B) Stage 2

C) Stage 3

D) Stage 4

10.What factors can affect the sex ratio in a population?

A) Migration patterns

B) Gender-based discrimination

C) Healthcare access

D) All of the above

Answer Key

1. 1000 females per 1000 males
2. Kerala
3. Fertility rate
4. The number of children born to a woman in her lifetime
5. All of the above
6. 3.0
7. More males than females in the population
8. Stage 2
9. 0-5 years
10. Punjab
11. All of the above
12. All of the above
13. Encouraging female education
14. Males per 100 females
15. Kerala
16. It indicates an aging population
17. All of the above
18. Total Fertility Rate (TFR)
19. Stage 3
20. They help in understanding the age distribution of the population

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
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KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date-6/07/2019

All F.Y.B.com students are here by informed that class test will be conducted as on **8/07/2019** on **Topic Name-** 'declining sex ratio in India' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- VI**

Class: F.Y.B. Com **Total Marks: 10**

Topic-Sex ratio in India

Name of the student: Alvi Saim Ashfaq

Roll no.

Instruction:

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[✓ C) Healthcare access]

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05/10

Sahajeevan Shikshan Sanstha's

SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- VI**
Class: F.Y.B. Com **Total Marks: 10**

Topic-Sex ratio in India

Name of the student: Alware Tahura Aslam

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1.As of the 2011 census, what was the sex ratio in India?

[✓ A) 940 females per 1000 males]

B) 955 females per 1000 males

C) 970 females per 1000 males

D) 985 females per 1000 males

2.Which Indian state had the highest sex ratio as per the 2011 census?

[✓ A) Kerala]

B) Haryana

C) Tamil Nadu

D) Uttar Pradesh

3.What does the Total Fertility Rate (TFR) measure?

[✓ A) The number of children born to a woman in her lifetime]

B) The number of children born per year

C) The number of children born per 1000 people

D) The number of children born to men in a given year

4.Which of the following factors can influence fertility rates in a population?

A) Economic development

B) Literacy rate

[✓ C) Access to healthcare]

D) All of the above

5.The Child Sex Ratio (CSR) typically measures the ratio of girls to boys in which age group?

A) 0-5 years

B) 6-10 years

[✓ C) 11-15 years]

D) 16-20 years

6.In India, what is the primary objective of the "Beti Bachao, Beti Padhao" campaign?

A) Promoting female foeticide

[✓ B) Encouraging female education]

C) Reducing the number of girls in the population

D) None of the above

7.Which state in India has traditionally faced challenges related to a skewed sex ratio with a higher number of males?

A) Kerala

B) Punjab

[✓ C) West Bengal]

D) Karnataka

8.What is the sex ratio at birth (SRB) typically expressed as?

[✓ A) Females per 100 males]

B) Males per 100 females

C) Children per couple

D) Adults per household

9.Which stage of demographic transition is characterized by high birth rates and high death rates?

[✓ A) Stage 1]

B) Stage 2

C) Stage 3

D) Stage 4

10.What factors can affect the sex ratio in a population?

A) Migration patterns

B) Gender-based discrimination

C) Healthcare access

[✓ D) All of the above]

08/10

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SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- VI**
Class: F.Y.B. Com **Total Marks: 10**
Topic-Sex ratio in India

Name of the student: Ambavle Akbhada Hanumant
Roll no.

Instruction:

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1

06/10

ICS Arts, Commerce and Science College Khed(Ratnagiri)

Class-SYBCOM A

Subject-Foundation course

Exam: - Integrated Syllabus-Based Class test mark list

Roll No	Student Name(Start with surname).	Out of 10
1	Akhade akshata babu	5
2	Alvi saim ashfaq	5
3	Alware tahura aslam	8
4	Ambavale Akshada Hanumant	6
5	AMBEKAR ABHISHEK MANGESH	6
6	Ambre Kajal Vijay	7
7	ANTULE JABAR IBRAHIM	5
8	Apte Mahesh Sharad	5
9	Bagwan Saniya Gulab	9
10	Bait Roshan Vasant	5
11	Bargude saloni sanjay	6
12	Beig Najwa Hasan	5
13	Bhagane sushant shantaram	6
14	Bhekare vaibhav Shantaram	7
15	Bhise Rina vishwas.	8
16	BHOSALE PRATIKSHA PRABHAKAR	8
17	BHOSALE PRIYANKA PRATAP	4
18	Bhosale siddhi sadanand	5
19	Bhuvad Nikita Ulhas	6
20	Bijle Aman A Sattar	8
21	Sapana Dilip Burte	9
22	Chandivade susmita sudhakar	8
23	GANDHAR GURUDATTA CHAUDHARI	5
24	Chavan jyotsna sachidanand	6
25	Chavan Shweta Uday	8
26	Chavan suraj sahadev	6
27	Gauresh Chikhale	9
28	Chikhale madhur Satyendra	7
29	Choughule saif mushatque	8
30	Chougle iram mohammad riyaz	8
31	Chougle Zaid Adam	7
32	Dalvi Abhay Lavu	9
33	Dalvi akshay baban	6
34	Dalvi Amol Pramod	7
35	Dalvi Faizan Ashik	5
36	Dalvi Puja Dattaram	5
37	Dalvi Trupti Dinesh	9
38	wakar sadullah dalvi	5
39	Darekar Aniket Sushil	6
40	Darekar Prathamesh Sunil	5
41	Darekar Rutika vinayak	6
42	Dayalkar Rutika Mahadev	7

43	Deorukhkar Amisha Anil	8
44	Desai Khansa Khalil	8
45	Dhapse Roshani Ravindra	4
46	Dhapse Ruchita Barku	5
47	Dhotre Nilima Anil	6
48	Dinware Uneja Abdulsalam	8
49	Duduke Iram Rafik	6
50	Faki sara salim	6
51	Fakih Ibaad Rafique	7
52	Fakir Gulshan Anwar	5
53	Falke sunali suryakant	5
54	Gaiykar prachi sunil	9
55	Gajabhare Vishal Sahebrao	5
56	Gamare Aditi Dada	6
57	Gandhi Sakshi Anant	5
58	Gawde rutik dilip	6
59	GHADSHI SUREKHA DILIP	7
60	Ghanekar Aakanksha Ashok	8
61	Ghanekar Arpita Kishor	8
62	Ghanekar Prachi Prabhakar	4
63	Ghanekar Tejas Ravindra	5
64	Gharte Huda Mohamed Hanif	6
65	GHARTE HUZAIFA SHAKIL	8
66	Gharve shubham Narendra	9
67	Gorule Sonali Vijay	8
68	Halde Roshani Vijay	5
69	HAMDULAY ARFAT SALAUDDIN	6
70	Husaini Asad Ali Sayyed Kadir	8
71	Jadhav omkar anant	6
72	JADHAV PAYAL HARI	9
73	Jadhav Pratiksha Sunil	7
74	Shruti Jadhav	8
75	Jadhav Siddhi Sunil	8
76	Jadhav Sonali Rahul	7
77	Jadyal Mamta Manoj	9
78	Jangam Gaurav Ganesh	6
79	Sagar Nandkumar jangam	7
80	Jasnaik Nida Shakil	5
81	Jasnaik Sadika Nazir	5
82	Jasnaik uveda ishaque	9
83	JOGALE PRATIK PARSHURAM	5
84	Juvale suraj sunil	6
85	Kadam Nikita Sahadev	5
86	Kadam Pournima Dilip	6
87	Kadam Pradnya Mahadev	7
88	Kadam Rutuja shivaji	8
89	Kadam Shital Suhas	8
90	Kadiri Bilal Abdul Hamid	4
91	Kamble Shweta Ravindra	5
92	Kandekar Ajit Uday	6

93	Kandekar Dipika Sanjay	8
94	Kanekar Shailesh Shridhar	8
95	Kanhekar Akshay Avinash	8
96	KAPSE KASHYAP SUNIT	7
97	KARANJAVKAR ADITYA VIJAY	9
98	Kate Sankesh Ramchandra	6
99	Kavankar Shweta subhash	7
100	Kawchali Asmina Rafique	5
101	Kawchali Ifrah Bilal	5
102	Kawchali Nabhan Nasar	9
103	Kawchali Sahar Hidayat	5
104	Nihal irfan kawlekar	6
105	Khan kasid Ayyaz	5
106	Khanvilkar Shraddha sachin	9
107	Khapare ankita ramesh	5
108	Khdedekar Anita Ramdas	6
109	Khedekar Anmol Nazir	5
110	Khedekar Iqra Khalid	6
111	Khedekar Yash Manohar	7
112	Kherade Ritesh Ramesh	8
113	Khot Aaseem Zameeruddin	8
114	Khot safwan razzak	4
115	Kolambe mahesh madan	5
116	Kolambe Sarvesh Mahesh	6
117	Kotere Rohit Rajaram	8

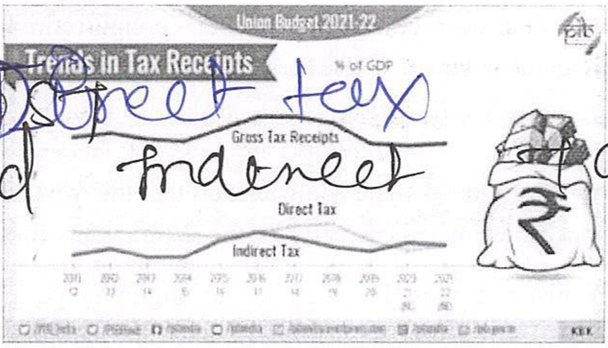
Name & Sign of subject Teacher-: Ast. Prof. Kamble Rohit Ramesh

SY Bcom Bus. Eco - Sem IV

10/12/2022

Topic - Direct tax

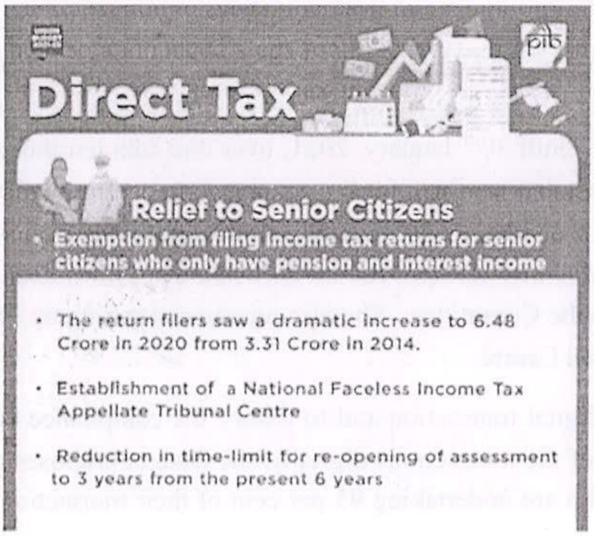
Direct and Indirect tax



DIRECT TAX PROPOSALS

The Finance Minister provided relief to senior citizens in filing of income tax returns, reduced time limit for income tax proceedings announced setting up of the Dispute Resolution Committee, faceless ITAT, relaxation to NRIs, increase in exemption limit from audit and relief for dividend income. She also announced steps to attract foreign investment into infrastructure, relief to affordable housing and rental housing, tax incentives to IFSC, relief to small charitable trusts, and steps for incentivizing Start-ups in the country.

Smt.Nirmala Sitharaman, in her Budget speech, said that post-pandemic, a new world order seems to be emerging and India will have a leading role therein. She said in this scenario, our tax system has to be transparent, efficient and should promote investment and employment in the country. The Minister said that at the same time, it should put minimum burden on our tax payers. She said that a series of reforms had been introduced by the Government for the benefit of tax payers and economy, including slashing of corporate tax rate, abolition of dividend distribution tax, and increasing of rebate for small tax payers. In the year 2020, the income tax return filers saw a dramatic increase to 6.48 crore from 3.31 crore in 2014.



Direct Tax

Relief to Senior Citizens

- Exemption from filing income tax returns for senior citizens who only have pension and interest income

- The return filers saw a dramatic increase to 6.48 Crore in 2020 from 3.31 Crore in 2014.
- Establishment of a National Faceless Income Tax Appellate Tribunal Centre
- Reduction in time-limit for re-opening of assessment to 3 years from the present 6 years

The Budget seeks to reduce compliance burden on senior citizens who are of 75 years of age and above. Such senior citizens having only pension and interest income will be exempted from filing their income tax return. The paying Bank will deduct the necessary tax on their income. The Budget proposes to notify rules for removing the hardship of non-Resident Indians returning coupon bonds, the Budget proposes to make notified infrastructure debt funds eligible to raise funds by issuing tax efficient zero coupon bonds.

In order to promote International Financial Services Centre (IFSC) in GIFT City, the Budget proposes more tax incentives.

The Budget proposes that details of capital gains from listed securities, dividend income and interest from banks, post office etc. will also be pre-filled to ease filing of returns. Details of salary income, tax payment, TDS etc already come pre-filled in returns.

In order to reduce compliance burden on the small charitable trust running educational institutions and hospitals, the Budget proposes to increase the limit on annual receipts for these trusts from present Rs.1 Crore to Rs. 5 Crore for non-applicability of various compliances.

INDIRECT TAX PROPOSALS

On the issue of Indirect Tax proposals, the Minister said that record GST collections have been made in the last few months. She said several measures have been taken to further simplify the GST. The capacity of GSTN system has been announced. Deep analytics and artificial intelligence have been deployed to identity tax evaders and fake billers, launching special drives against them. The Finance Minister assured the House that every possible measure shall be taken to smoothen the GST further and remove anomalies such as the inverted duty structure.

With respect to the custom duty policy, the Finance Minister said that it has the twin objectives of promoting domestic manufacturing and helping India get on to global value change and export better. She said that the thrust now has to be on easy access to raw materials and exports of value added products. In this regard, she proposed to review 400 old exemptions in the custom duty structure this year. She announced that extensive consultation will be conducted and from 1st October, 2021, a revised custom duty structure free of distortions will be put in place. She also proposed that any new custom duty exemptions henceforth will have validity upto to the 31st March following 2 years of the date of its issue.

The Finance Minister announced withdrawal of a few exemptions on parts of chargers and sub-parts of mobile phones further some parts of mobiles will move from "NIL" rate to a moderate 2.5 per cent. She also announced reducing custom duty uniformly to 7.5 per cent on semis, flat, and long products of non-alloy and stainless steel. She also announced exempting duty on steel scrap for a period upto 31st March 2022.

Stressing on the need to rationalize duty on raw material inputs to man-made textile, the Finance Minister announced bringing nylon chain on par with polyester and other man-made fibers. Announcing uniform deduction of the BCD rates on Caprolactam, nylon chips and nylon fiber and yarn to 5 per cent, the Minister said this will help the textile industry, MSMEs and exports too. She also announced calibration of customs duty rate on chemical to encourage domestic value addition and to remove inversions. The Minister also announced rationalization of custom duty on gold and silver.

The Finance Minister said that a phased manufacturing plan for solar cells and solar panels will be notified to build up domestic capacity. She announced raising duty on solar inverter from 5 per cent to 20 percent and on solar lanterns from 5 per cent to 15 per cent.

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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- IV**
Class: S.Y.B. Com **Total Marks: 10**
Sub-Bus Eco Topic- *Direct Tax*

Name of the student: ____________________
Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. 10M

1.Which section of the Income Tax Act defines the scope of the Act and applies to all taxpayers in India?

a) Section 2(69)
b) Section 1(1)
c) Section 4(1)
d) Section 139(1)

2.Which income is completely exempt from income tax in India?

a) Agricultural income
b) Salary income
c) House rent allowance
d) Interest income from saving accounts

3.The basic exemption limit for individuals for the financial year 2023-24 is:

a) ₹2.5 lakhs
b) ₹3 lakhs
c) ₹3.5 lakhs
d) ₹5 lakhs

4.Which type of deduction can be claimed against income from salary for health insurance premiums paid?

a) Standard deduction
b) Section 80D deduction
c) Professional tax deduction
d) Leave travel allowance

5.Capital gains are taxed at a different rate than income from other sources. Which of the following types of capital gains are taxed at a lower rate (10% with indexation or 20% without)?

a) Short-term capital gains on equity shares
b) Long-term capital gains on debt instruments

c) Short-term capital gains on immovable property
d) Long-term capital gains on equity shares exceeding ₹1 lakh

6.Which tax filing form is used by salaried individuals earning income below ₹5 lakhs and having income from only one source?

a) ITR-1
b) ITR-2
c) ITR-3
d) ITR-4

7.Advance tax is payable in installments throughout the financial year by individuals whose tax liability is expected to exceed a certain amount. What is that minimum limit?

a) ₹10,000
b) ₹20,000
c) ₹30,000
d) ₹40,000

8.The Goods and Services Tax (GST) has replaced many indirect taxes, but which of the following direct taxes still exist in India?

a) Excise duty
b) Service tax
c) Wealth tax
d) Gift tax

9.Which document acts as proof of tax payment and is required for various financial transactions?

a) PAN card
b) Aadhaar card
c) Form 16
d) Bank statement

10.The Central Board of Direct Taxes (CBDT) is responsible for what key function related to direct taxes in India?

a) Tax law drafting
b) Tax policy formulation
c) Tax administration and enforcement
d) Dispute resolution

Answer key

1. b)
2. a)
3. c)
4. b)
5. d)
6. a)
7. d)
8. a)
9. c)
10. c)

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
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KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date-12/12/2022

All S.Y.B.com students are here by informed that class test will be conducted as on **14/12/2022** on **Topic Name-** 'Direct and indirect taxes' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri.

Sahajeevan Shikshan Sanstha's
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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- IV**
Class: S.Y.B. Com **Total Marks: 10**
Sub-Bus Eco **Topic- *Direct Tax***

Name of the student: Vithmal Alka Gangaram
Roll no.

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a) ₹2.5 lakhs
b) ₹3 lakhs
[✓ c) ₹3.5 lakhs]
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[✓ a) Short-term capital gains on equity shares]
b) Long-term capital gains on debt instruments

7

c) Short-term capital gains on immovable property
d) Long-term capital gains on equity shares exceeding ₹1 lakh

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[✓ c) Tax administration and enforcement]
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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER- IV**
Class: S.Y.B. Com **Total Marks: 10**
Sub-Bus Eco **Topic-** ***Direct Tax***

Name of the student: Walopkar Iqra Inayat
Roll no.

Instruction:

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Khed, Ratnagiri.

Time: 1 hrs

Class: S.Y.B. Com **SEMESTER- IV**

Sub-Bus Eco **Topic-** ***Direct Tax*** **Total Marks: 10**

Name of the student: Yadav Vrushali Pandurang

Roll no.

Instruction:

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b) Long-term capital gains on debt instruments

c) Short-term capital gains on immovable property

[✓ d) Long-term capital gains on equity shares exceeding ₹1 lakh]

6.Which tax filing form is used by salaried individuals earning income below ₹5 lakhs and having income from only one source?

[✓ a) ITR-1]

b) ITR-2

c) ITR-3

d) ITR-4

7.Advance tax is payable in installments throughout the financial year by individuals whose tax liability is expected to exceed a certain amount. What is that minimum limit?

[✓ a) ₹10,000]

b) ₹20,000

c) ₹30,000

d) ₹40,000

8.The Goods and Services Tax (GST) has replaced many indirect taxes, but which of the following direct taxes still exist in India?

a) Excise duty

[✓ b) Service tax]

c) Wealth tax

d) Gift tax

9.Which document acts as proof of tax payment and is required for various financial transactions?

[✓ a) PAN card]

b) Aadhaar card

c) Form 16

d) Bank statement

10.The Central Board of Direct Taxes (CBDT) is responsible for what key function related to direct taxes in India?

a) Tax law drafting

[✓ b) Tax policy formulation]

c) Tax administration and enforcement

d) Dispute resolution

06/10

ICS Arts, Commerce and Science College Khed(Ratnagiri)

Class-SYBCOM B

Subject- Business Economics

Exam: - Integrated Syllabus-Based Class test mark list

1	Vithmal Alka Gangaram	6
2	Walopkar iqra inayat	6
3	Yadav Vrushali Pandurang	6
4	Yelve Dikshita Dilip	9
5	Ambre Sahil Santosh	5
6	Ambre viraj vijay	7
7	Antuley Aafiya Attaullah	6
8	Ayre shivani dilip	5
9	Bade Gausiya A.Sattar	6
10	Bad Parveen Tahir	7
11	Badirake Arati Ashok	6
12	Bait Sagar Bhiku	9
13	Bhadwalkar sagar santosh	5
14	Bhagane runali ramesh	6
15	Bhagane sakshi shantaram	6
16	Bhalekar omkar Dhananjay	6
17	Bhilare Dipti Dattaram	9
18	Bhosale sanjana Santosh	8
19	Bhosale sejal Shashikant	7
20	Bhuvad siddhesh santosh	7
21	Chinkate nikhita suresh	7
22	Jadyar aditya anant	5
23	Chitale ruchira sachin	6
24	Chougle Zafar Afroz	6
25	Chougule Al Zaeem Saeed	6
26	Chougule Fahad Ridwan	6
27	Chougule Muskan Irfan	6
28	Devhare Pradnya Ramesh	7
29	Dhanshe namira hasham	7
30	fansupkar bushra yusuf	5
31	Gandhi Swaraj Vikrant	6
32	Gavade Vrushali sandip	6
33	Gavankar Jayesh Jayram	8
34	Saloni bhagawan Ghadashi	9
35	Gole Dipraj Dipak	8
36	Gurav sahil balaji.	9
37	Hambir Ketan Pandurang	5
38	Hamdule Raeed Salahuddin	7
39	Jadhav Akshata Anil	6
40	Jadhav Harshada Sunil	5
41	Jadhav sakshi manges	6

42	Jadhav shweta anant	7
43	Jasnaik samiya rafik	5
44	KADAM ANIKET SANTOSH	6
45	Kadam omkar rahul	6
46	Kadam Rohini Rajaram	6
47	KADAM SANGRAM MAHESH	9
48	Kadavekar Darshana Ananda	5
49	Kadiri Arsalan Vazir	7
50	Kadwekar Nawaf Murad	6
51	Kauchali faisal hidayat	5
52	Khatib Nauman Nizam	6
53	Khedekar shivani shailesh	7
54	Khot rahil rafique	6
55	Khot Shaizan Abbasmiya	6
56	K4olambe Ninad Naresh	9
57	Kolambe Rohan Ramesh	8
58	Koltharkar ibtesam tanveer	7
59	Kondekar aqsa karamat	7
60	Mahadik Adnan Irfan	6
61	Maniyar Bushra Nasir.	6
62	Mapkar Azmina A.Aziz	6
63	Mapkar kaiser jahan shaukat	7
64	Metkar Alfiya Salim	6
65	Metkar Salman Salim	9
66	Mirajkar Shraddha Sunil	5
67	Mohite Hrutik Subhash	6
68	More manali rajendra	6
69	MORE MANSI SANTOSH	6
70	More Roshan Ganesh	9
71	More Roshani Rajendra	5
72	More Rushikesh Babaram	7
73	More Shravani Sandip	6
74	Motlekar sufiyan aizaz	5
75	Mukadam M kaif Abdul kalam	6
76	Mukadam samiya yasin	7
77	Mulla Adnan Akbar Ali	5
78	Nadkar Afreen Abdul Karim	6
79	Nadkar rehan salam	6
80	Nadkar Simran Nisar	6
81	Nore Juwairiyah Jameel	9
82	Palekar Zain M Amin	5
83	Pardale amar suresh	7
84	Pardesi shagufta saeed	6
85	Parkar Anam Asif	5
86	PARKAR ILHAM IQBAL	6
87	Pashte vaishnavi viththal	7

88	Pawar Sandesh Santosh	6
89	Payare Nita Sanjay	9
90	Potrick Mehran A Rauf	5
91	Patrick Naveed Barkat	6
92	Quraishi ummehani gulam Mustafa	6
93	RAWAL ADAM ABDUL RAHIM	6
94	Rawal Afnan Saeed	5
95	Rawal Ishtiyaque sultan	6
96	Rawal Mohammad Yasin	6
97	Rawal Mohammad Zeeshan Usman	6
98	Sahibole umaira hidayat	9
99	Sangle Aayesha Shabbir	5
100	Sangle bushra A. Rahim	7
101	Sawant sanket Dilip	6
102	SHAIKH IBRAHIM JAVED	5
103	Shaji arbaz Noor mohd	6
104	Shinde vighanesh Rajesh	7
105	Sinkar Roshan Rajendra	6
106	Surve ashwaq Mainuddin	6
107	Surve shritika dilip	9
108	TAMBITKAR ROHAN PANDURANG	8
109	Vaidya shraddha vaibhav	7
110	Velhal Tejashree Sangam	7
111	Walopkar sahil shafi	6

Name & Sign of subject Teacher-: Ast. Prof. Kamble Rohit Ramesh

SYB.com - Sem - IV Bus. Eco

Topic - Indirect Taxes in India. (Revised)

PRODUCT WISE GST RATES OF FOOD PRODUCTS

GST-28%

1. Molasses
2. Chewing gum/bubble gum and white chocolate
3. Cocoa butter, fat and oil
4. Cocoa powder
5. Cocoa chocolates
6. Malt extract (other than for infant use and mixes and doughs of bakers)
7. Waffles and wafers coated with or containing chocolate
8. Extract, essences and concentrates of coffee
9. Mustard flour and sauces thereof
10. Sugar, lactose and glucose syrups
11. Food flavoring material
12. Churan for pan
13. Custard powder
14. Aerated waters containing added sugar or other sweeting matter

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GST-18%

1. Condensed milk
2. Malt, whether or not roasted
3. Refined sugar, sugar cubes
4. Sugar confectionery
5. All preparations of cereals, flour, starch or milk for infant use and sold retail
6. Pasta, spaghetti, macaroni, noodles
7. Corn flakes and other cereal flakes
8. Waffles and wafers (other than chocolate coating)
9. Pastries and cakes
10. Extracts, essences and concentrates of tea or mate
11. Soups and broths
12. Ice cream and other edible ice
13. Instant food mixes, soft drink concentrates, sharbat, betel, supari, packaged food
14. Water, including natural or artificial mineral waters and aerated waters not sweetened
15. Ethyl alcohol and other spirits
16. Vinegar and substitutes
17. Curry paste, mayonnaise and salad dressing; mixed condiments and mixed seasoning

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GST – 12 %

1. All meat in unit containers put up in frozen, salted, dried, smoked state
2. All meat and marine products, prepared or preserved.
3. Butter, ghee, butter oil, cheese
4. All goods under Chapter 20 (preparations of vegetables, fruits, nuts or other parts of plants, including pickle, murabba, chutney, jam, jelly)
5. Ketch-up & sauces, Mustard sauces
6. Dry fruits

35. Ice and snow

GST – Nil %

1. Meat (Other than in frozen state and put up in container)
2. Bones and horn cores, bone grist, bone meal etc., hoof meal, horn meal, etc
3. Fish, prawn and shrimp seeds
4. All fish, fresh or chilled (but not processed, cured and frozen)
5. Fresh milk, pasteurized milk but not concentrated, sweetened
6. Eggs (in shell)
7. Curd, lassi, buttermilk
8. Chena or paneer (except in unit container with brand name)
9. Natural honey (no container-no brand)
10. Fresh fruits and vegetables, roots and tubers (except in frozen state or preserved)
11. Dried fruits
12. Leguminous vegetables, shelled or unshelled
13. Dried leguminous vegetables, shelled, whether or not skinned or split (pulses)
14. Coffee beans, unprocessed tea leaves, fresh spices
15. All cereals (no container-no brand)
16. Cereal grains hulled
17. Flour
18. Atta, maida, besan (no container-no brand)
19. Wheat or meslin flour
20. Cereal flour, groats and meals (no container-no brand)
21. Flour of potato, dried leguminous vegetables (no container-no brand)
22. Oilseeds of seed quality
23. Cane jiggery (gur)
24. Palmyra jaggery
25. Puffed, flattened and parched rice
26. Pappad (except when served for consumption)
27. Bread (branded or otherwise) (except when served for consumption and pizza bread)
28. Prasadam
29. Water (other than aerated, sealed etc)
30. Non-alcoholic toddy
31. Tender coconut powder
32. Acquatic, poultry and cattle feed
33. Salt, all types

Note: The bold items indicate the revisions made on 11.06.2017

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER-IV**
Class: S.Y.B.Com **Total Marks: 10**

Topic-Goods and Service tax

Name of the student: ______________________________

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. Which of the following food products was exempt from GST in 2017?
(a) Milk
(b) Paneer
(c) Packaged wheat flour
(d) Condensed milk

2. What was the GST rate on fresh vegetables and fruits in 2017?
(a) 0%
(b) 5%
(c) 12% (d) 18%

3. Which type of restaurants attracted a 12% GST rate in 2017?
(a) All restaurants
(b) Air-conditioned restaurants with liquor license
(c) Five-star hotel restaurants
(d) Non-air-conditioned restaurants

4. Which of the following food items had a 5% GST rate in 2017?
(a) Sugar
(b) Honey
(c) Pasta
(d) Ice cream

5. What was the GST rate on packaged biscuits and cookies in 2017?
(a) 0%
(b) 5%
(c) 12%
(d) 18%

6. Which of the following was NOT included in the 18% GST slab for food products in 2017?
(a) Refined sugar
(b) Instant food mixes

(c) Packaged pickles
(d) Corn flakes

7. Identify the food product subject to the highest GST rate of 28% in 2017.
(a) Chewing gum
(b) Tea leaves
(c) Butter
(d) Rice

8. What was the GST rate applicable to aerated water with added sugar in 2017?
(a) 0%
(b) 5%
(c) 12%
(d) 28%

9. Which of the following statements is TRUE about bottled mineral water in 2017?
(a) Exempt from GST
(b) 5% GST
(c) 12% GST
(d) 18% GST

10. How did the implementation of GST in 2017 affect the price of most basic food items?
(a) Significant increase
(b) Slight increase
(c) No change
(d) Moderate decrease

Answer Key

1. (a) Milk was exempt from GST in 2017.
2. (a) Fresh vegetables and fruits were exempt from GST (0% rate) in 2017.
3. (d) non-air-conditioned restaurants attracted a 12% GST rate in 2017.
4. (a) Sugar had a 5% GST rate in 2017.
5. (c) Packaged biscuits and cookies had a 12% GST rate in 2017.
6. (c) Packaged pickles were in the 5% GST slab, not 18%.
7. (a) Chewing gum was subject to the highest GST rate of 28% in 2017.
8. (d) Aerated water with added sugar had a 28% GST rate in 2017.
9. (a) exempt from GST in 2017.
10. (c) no change.

।। राष्ट्रोध्दारार्थ सेवामहे ।।
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date-20/12/2022

All S.Y.B.com students are here by informed that class test will be conducted as on **24/12/2022** on **Topic Name-** 'Indirect taxes' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER-IV**
Class: S.Y.B.Com **Total Marks: 10**

Topic-Goods and Service tax

Name of the student: Akhade Akshata Babu

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. Which of the following food products was exempt from GST in 2017?
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(d) Condensed milk

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(c) 12% (d) 18%

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(c) Five-star hotel restaurants
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(c) Pasta
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(d) 18%

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(a) Refined sugar
[✓ (b) Instant food mixes]

(c) Packaged pickles
(d) Corn flakes

7. Identify the food product subject to the highest GST rate of 28% in 2017.
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(c) Butter
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8. What was the GST rate applicable to aerated water with added sugar in 2017?
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[✓ (b) 5%]
(c) 12%
(d) 28%

9. Which of the following statements is TRUE about bottled mineral water in 2017?
[✓ (a) Exempt from GST]
(b) 5% GST
(c) 12% GST
(d) 18% GST

10. How did the implementation of GST in 2017 affect the price of most basic food items?
(a) Significant increase
(b) Slight increase
[✓ (c) No change]
(d) Moderate decrease

05/10

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER-IV**

Class: S.Y.B.Com **Total Marks: 10**

Topic-Goods and Service tax

Name of the student: Alvi saim Ashfaq

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. Which of the following food products was exempt from GST in 2017?
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(c) Packaged wheat flour
(d) Condensed milk

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[✓ (b) 5%]
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7

3. Which type of restaurants attracted a 12% GST rate in 2017?
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(c) Five-star hotel restaurants
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(d) 18% GST

10. How did the implementation of GST in 2017 affect the price of most basic food items?
(a) Significant increase
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$\frac{05}{10}$

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
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Khed, Ratnagiri.

Time: 1 hrs **SEMESTER-IV**
Class: S.Y.B.Com **Total Marks: 10**

Topic-Goods and Service tax

Name of the student: Alware Tahura Aslam

Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. Which of the following food products was exempt from GST in 2017?
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[✓ (c) No change]
(d) Moderate decrease

08/10

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time: 1 hrs **SEMESTER-IV**

Class: S.Y.B.Com **Total Marks: 10**

Topic-Goods and Service tax

Name of the student: Ambavle Akshada Hanumant

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. Which of the following food products was exempt from GST in 2017?
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(d) Moderate decrease

06/10

Sahajeevan Shikshan Sanstha's
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Khed, Ratnagiri.

Exam: - Integrated Syllabus-Based Class test mark list

Roll No	Student Name(Start with surname).	Out of 10
1	Akhade akshata babu	5
2	Alvi saim ashfaq	5
3	Alware tahura aslam	8
4	Ambavale Akshada Hanumant	6
5	AMBEKAR ABHISHEK MANGESH	6
6	Ambre Kajal Vijay	7
7	ANTULE JABAR IBRAHIM	5
8	Apte Mahesh Sharad	5
9	Bagwan Saniya Gulab	9
10	Bait Roshan Vasant	5
11	Bargude saloni sanjay	6
12	Beig Najwa Hasan	5
13	Bhagane sushant shantaram	6
14	Bhekare vaibhav Shantaram	7
15	Bhise Rina vishwas.	8
16	BHOSALE PRATIKSHA PRABHAKAR	8
17	BHOSALE PRIYANKA PRATAP	4
18	Bhosale siddhi sadanand	5
19	Bhuvad Nikita Ulhas	6
20	Bijle Aman A Sattar	8
21	Sapana Dilip Burte	9
22	Chandivade susmita sudhakar	8
23	GANDHAR GURUDATTA CHAUDHARI	5
24	Chavan jyotsna sachidanand	6
25	Chavan Shweta Uday	8
26	Chavan suraj sahadev	6
27	Gauresh Chikhale	9
28	Chikhale madhur Satyendra	7
29	Choughule saif mushatque	8
30	Chougle iram mohammad riyaz	8
31	Chougle Zaid Adam	7
32	Dalvi Abhay Lavu	9
33	Dalvi akshay baban	6
34	Dalvi Amol Pramod	7
35	Dalvi Faizan Ashik	5
36	Dalvi Puja Dattaram	5
37	Dalvi Trupti Dinesh	9
38	wakar sadullah dalvi	5

39	Darekar Aniket Sushil	6
40	Darekar Prathamesh Sunil	5
41	Darekar Rutika vinayak	6
42	Dayalkar Rutika Mahadev	7
43	Deorukhkar Amisha Anil	8
44	Desai Khansa Khalil	8
45	Dhapse Roshani Ravindra	4
46	Dhapse Ruchita Barku	5
47	Dhotre Nilima Anil	6
48	Dinware Uneja Abdulsalam	8
49	Duduke Iram Rafik	6
50	Faki sara salim	6
51	Fakih Ibaad Rafique	7
52	Fakir Gulshan Anwar	5
53	Falke sunali suryakant	5
54	Gaiykar prachi sunil	9
55	Gajabhare Vishal Sahebrao	5
56	Gamare Aditi Dada	6
57	Gandhi Sakshi Anant	5
58	Gawde rutik dilip	6
59	GHADSHI SUREKHA DILIP	7
60	Ghanekar Aakanksha Ashok	8
61	Ghanekar Arpita Kishor	8
62	Ghanekar Prachi Prabhakar	4
63	Ghanekar Tejas Ravindra	5
64	Gharte Huda Mohamed Hanif	6
65	GHARTE HUZAIFA SHAKIL	8
66	Gharve shubham Narendra	9
67	Gorule Sonali Vijay	8
68	Halde Roshani Vijay	5
69	HAMDULAY ARFAT SALAUDDIN	6
70	Husaini Asad Ali Sayyed Kadir	8
71	Jadhav omkar anant	6
72	JADHAV PAYAL HARI	9
73	Jadhav Pratiksha Sunil	7
74	Shruti Jadhav	8
75	Jadhav Siddhi Sunil	8
76	Jadhav Sonali Rahul	7
77	Jadyal Mamta Manoj	9
78	Jangam Gaurav Ganesh	6
79	Sagar Nandkumar jangam	7
80	Jasnaik Nida Shakil	5
81	Jasnaik Sadika Nazir	5
82	Jasnaik uveda ishaque	9
83	JOGALE PRATIK PARSHURAM	5
84	Juvale suraj sunil	6
85	Kadam Nikita Sahadev	5
86	Kadam Pournima Dilip	6
87	Kadam Pradnya Mahadev	7
88	Kadam Rutuja shivaji	8

89	Kadam Shital Suhas	8
90	Kadiri Bilal Abdul Hamid	4
91	Kamble Shweta Ravindra	5
92	Kandekar Ajit Uday	6
93	Kandekar Dipika Sanjay	8
94	Kanekar Shailesh Shridhar	8
95	Kanhekar Akshay Avinash	8
96	KAPSE KASHYAP SUNIT	7
97	KARANJAVKAR ADITYA VIJAY	9
98	Kate Sankesh Ramchandra	6
99	Kavankar Shweta subhash	7
100	Kawchali Asmina Rafique	5
101	Kawchali Ifrah Bilal	5
102	Kawchali Nabhan Nasar	9
103	Kawchali Sahar Hidayat	5
104	Nihal irfan kawlekar	6
105	Khan kasid Ayyaz	5
106	Khanvilkar Shraddha sachin	9
107	Khapare ankita ramesh	5
108	Khdedekar Anita Ramdas	6
109	Khedekar Anmol Nazir	5
110	Khedekar Iqra Khalid	6
111	Khedekar Yash Manohar	7
112	Kherade Ritesh Ramesh	8
113	Khot Aaseem Zameeruddin	8
114	Khot safwan razzak	4
115	Kolambe mahesh madan	5
116	Kolambe Sarvesh Mahesh	6
117	Kotere Rohit Rajaram	8

Name & Sign of subject Teacher-: Ast. Prof. Kamble Rohit-R.

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,
Shriman Chandulal Sheth College of Commerce,
Shrimati Shobhanatai Chandulal Sheth College of Science,
Khed-Ratnagiri, Maharashtra, India.

TEACHING LEARNING BEYOND CURRICULUM FILE

- **NAME OF THE TEACHER –**

  MRS. SUPRIYA ASHOK GUHAGARKAR

- **QUALIFICATION –**

  M.SC. (PLANT TAXANOMY)

- **SUBJECT –**

  BOTONY

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,
Shriman Chandulal Sheth College of Commerce,
Shrimati Shobhanatai Chandulal Sheth College of Science,
Khed-Ratnagiri, Maharashtra, India.

TEACHING LEARNING BEYOND CURRICULUM FILE

- **NAME OF THE TEACHER –**

  MRS. JYOTI SAMIR KIRATKAR

- **QUALIFICATION –**

  M.SC., B.ED., (BIODIVERSITY)

- **SUBJECT –**

  BOTONY

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,

Shriman Chandulal Sheth College of Commerce, ShrimatiShobhanatai Chandulal Sheth College of Science,

Khed-Ratnagiri, Maharashtra, India.

Evidences of teacher taught beyond curriculum

- **Extended updated curriculum with the support of internet, curriculum related extended contents online prints sample copies of few teachers are attached.**
- **Evidence of test examination on the basis of extended / updated curriculum conducted**

Academic Year 2018-19
To 2022-23

I/C PRINCIPAL,
Shrimati Indira Mahadev Beharay College of Arts
Shriman Chandulal Sheth College of Commerce &
Shrimati Shobhanatai Chandulal Sheth College of Science
Khed, Dist. Ratnagiri (M.S.) - 415 709.

S.Y.B.Sc. Paper IInd Sem - III
Unit II - Cytogenetics.

Unit II (Paper ii) : Cytogenetic

1. **Molecular Cytogenetics**: Molecular techniques, such as fluorescence in situ hybridization (FISH) and comparative genomic hybridization (CGH), have become integral in cytogenetic research. FISH allows for the visualization and mapping of specific genes or DNA sequences on chromosomes, while CGH is used to detect chromosomal imbalances associated with diseases like cancer.
2. **Next-Generation Sequencing (NGS)**: NGS has revolutionized cytogenetics by enabling whole-genome sequencing and the identification of genetic variations at high resolution. It allows for the detection of structural chromosomal abnormalities and has enhanced our understanding of the genetic basis of many diseases.
3. **Non-Invasive Prenatal Testing (NIPT)**: NIPT is a form of cytogenetic testing that uses cell-free fetal DNA from a pregnant woman's blood to screen for chromosomal abnormalities in the developing fetus. It has become a safer and more accurate alternative to traditional invasive procedures like amniocentesis.
4. **Cancer Cytogenetics**: Cytogenetic analysis is crucial in cancer research and diagnostics. Techniques like karyotyping and FISH help identify specific chromosomal abnormalities associated with various types of cancer. Understanding these abnormalities can inform treatment decisions.
5. **Genome Editing**: Technologies like CRISPR-Cas9 have opened up new possibilities in cytogenetics. Researchers can manipulate chromosomes to study their functions, correct genetic defects, and develop potential gene therapies for genetic disorders.
6. **Telomere Research**: Telomeres, the protective caps at the ends of chromosomes, have gained significant attention in cytogenetics. Understanding telomere dynamics is essential for aging research and studying diseases associated with telomere dysfunction.
7. **Single-Cell Cytogenetics**: Single-cell analysis has become increasingly important in cytogenetics, allowing researchers to study genetic diversity within populations. This is particularly useful for understanding diseases with heterogeneous genetic characteristics.
8. **Epigenetics and Chromatin Structure**: Cytogenetics has expanded to include the study of epigenetic modifications and chromatin structure, which play a crucial role in gene regulation. This broader view of cytogenetics helps us understand gene expression and cell differentiation.
9. **Functional Cytogenomics**: Researchers are now combining cytogenetic techniques with functional genomics to better understand how chromosomal changes impact gene expression and cell function. This approach is critical in cancer research and the development of targeted therapies.
10. **Personalized Medicine**: Cytogenetic information is increasingly used in personalized medicine, where an individual's genetic profile, including chromosomal variations, is considered in disease diagnosis and treatment decisions.
11. **Bioinformatics and Data Analysis**: The field of cytogenetics has become highly reliant on bioinformatics and data analysis tools to manage and interpret the vast amount of genetic data generated through modern techniques.

Sahajeevan Shikshan Sanstha's

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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- III** **Date:**
Class:S.Y.B.Sc **Total Marks : 10**

Q.1 Choose the correct option. **10M**

1. What is the primary focus of cytogenetics?
   a) The study of genetic mutations
   b) The study of gene expression
   c) The study of chromosomes and their role in genetics
   d) The study of epigenetic modifications
2. Which molecular technique is used to visualize and map specific genes or DNA sequences on chromosomes?
   a) PCR (Polymerase Chain Reaction)
   b) Microarray analysis
   c) FISH (Fluorescence In Situ Hybridization)
   d) NGS (Next-Generation Sequencing)
3. What is the primary application of non-invasive prenatal testing (NIPT) in cytogenetics?
   a) Screening for chromosomal abnormalities in developing fetuses
   b) Detecting cancer-related chromosomal abnormalities
   c) Analyzing telomere dynamics
   d) Studying epigenetic modifications
4. How has next-generation sequencing (NGS) impacted cytogenetics?
   a) It allows for karyotyping of chromosomes.
   b) It enables whole-genome sequencing and high-resolution genetic variation detection.
   c) It is used for epigenetic research.
   d) It focuses on gene editing.
5. In the context of cytogenetics, what is telomere research primarily concerned with?
   a) Identifying genetic variations in cancer
   b) Understanding gene expression
   c) Studying the protective caps at the ends of chromosomes
   d) Detecting epigenetic modifications

6. Which technology has revolutionized the manipulation of chromosomes for research and potential gene therapies?
   a) Karyotyping
   b) FISH (Fluorescence In Situ Hybridization)
   c) CRISPR-Cas9
   d) Comparative genomic hybridization (CGH)
7. What is the key focus of cancer cytogenetics?
   a) Studying telomere dynamics
   b) Detecting non-invasive prenatal abnormalities
   c) Identifying chromosomal abnormalities associated with various types of cancer
   d) Analyzing epigenetic modifications
8. Why is single-cell cytogenetics important in cytogenetic research?
   a) It is used to study chromosomal structure.
   b) It helps understand cancer genetics.
   c) It allows for the study of genetic diversity within populations.
   d) It focuses on gene editing.
9. How does cytogenetics integrate with functional genomics?
   a) By studying gene expression patterns
   b) By analyzing genetic mutations
   c) By understanding how chromosomal changes impact gene expression and cell function
   d) By identifying telomere dysfunction
10. In personalized medicine, how is cytogenetic information applied?
   a) To study gene expression
   b) To diagnose chromosomal abnormalities
   c) To consider an individual's genetic profile in disease diagnosis and treatment decisions
   d) To analyze epigenetic modifications

Answers:

1. c) The study of chromosomes and their role in genetics
2. c) FISH (Fluorescence In Situ Hybridization)
3. a) Screening for chromosomal abnormalities in developing fetuses
4. b) It enables whole-genome sequencing and high-resolution genetic variation detection.
5. c) Studying the protective caps at the ends of chromosomes
6. c) CRISPR-Cas9
7. c) Identifying chromosomal abnormalities associated with various types of cancer
8. c) It allows for the study of genetic diversity within populations.
9. c) By understanding how chromosomal changes impact gene expression and cell function
10. c) To consider an individual's genetic profile in disease diagnosis and treatment decisions

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date- 11/08/2018

All S.Y.B.Sc. students are here by informed that class test will be conducted as on **14/08/2018** on **Topic Name-** 'Cytogenetics' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sc
Khed, Dist Ratnagiri

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- III** **Date:**
Class:S.Y.B.Sc **Total Marks : 10**

Name of the student: Aklade Jitesh Yashwant .
Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is DNA barcoding used for in the study of plant diversity?
   [✓ a) Assessing plant root structures]
   b) Identifying and classifying plant species
   c) Analyzing plant functional traits
   d) Mapping plant distribution in GIS
2. Metabarcoding is a technique primarily employed for:
   a) Sequencing entire plant genomes
   b) Monitoring plant communities using satellite imagery
   [✓ c) High-throughput DNA sequencing of multiple samples]
   d) Digitizing herbarium collections
3. Next-Generation Sequencing (NGS) has significantly expanded our knowledge of:
   [✓ a) Plant distribution in GIS]
   b) Plant anatomy using high-resolution imaging
   c) Plant diversity, evolution, and adaptation
   d) Environmental DNA (eDNA) analysis
4. Which technology is best suited for mapping plant diversity across large geographical areas?
   a) Remote sensing and GIS
   [✓ b) Herbarium digitization]
   c) Citizen science initiatives
   d) Stable isotope analysis
5. How can citizen science contribute to the study of plant diversity?
   a) By analyzing plant genomes

b) By digitizing herbarium collections
c) By providing data on plant species and locations
d) By using stable isotope analysis

6. What is the primary purpose of herbarium digitization in studying plant diversity?
    a) Analyzing plant functional traits
    b) Mapping plant distributions using GIS
    [✓ c) Making plant specimens and data available online]
    d) Remote sensing and satellite imagery
7. High-resolution imaging techniques are useful for studying:
    a) Plant ecophysiology
    b) Plant evolutionary relationships
    [✓ c) Plant DNA barcodes]
    d) Plant root structures
8. What role do bioinformatics tools and databases play in the study of plant diversity?
    a) Analyzing plant genomes
    b) Digitizing herbarium collections
    [✓ c) Managing and analyzing genetic data]
    d) Collecting eDNA samples
9. Stable isotope analysis is used to study:
    a) Plant functional traits
    b) Plant DNA barcodes
    [✓ c) Plant ecophysiology and interactions within ecosystems]
    d) Plant distribution in GIS
10. What is the primary purpose of phylogenomics in the study of plant diversity?
    a) Identifying plant species
    b) Analyzing plant functional traits
    [✓ c) Constructing comprehensive phylogenetic trees]
    d) Sequencing entire plant genomes

09/10

Sahajeevan Shikshan Sanstha's

SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- III** **Date:**

Class:S.Y.B.Sc **Total Marks : 10**

Name of the student: Ambre Bhakti Vinod

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

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    b) Analyzing plant functional traits
    [✓ c) Constructing comprehensive phylogenetic trees]
    d) Sequencing entire plant genomes

10/10

Sahajeevan Shikshan Sanstha's

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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- III** **Date:**
Class:S.Y.B.Sc **Total Marks : 10**
Name of the student: Ambresushant Sheshikant
Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is DNA barcoding used for in the study of plant diversity?
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   [✓ c) High-throughput DNA sequencing of multiple samples]
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$\frac{08}{10}$

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SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

RESULT OF TEST 2018-19

SR.NO	NAME OF THE STUDENT	MARKS /10
1	AKHADE JITESH YASHWANT	09
2	AMBRE BHAKTI VINOD	10
3	AMBRE SUSHANT SHASHIKANT	08
4	BHADAVALKAR YASH MANGESH	08
5	BHALEKAR MRUNALI SANJAY	10
6	CHALKE MANISH MAHENDRA	09
7	CHINCHAVILKAR RAJANI JAYANT	10
8	DEVLEKAR MANGESH ANIL	09
9	DIWALE ALPESH ASHOK	09
10	PULEKAR GANESH SHRIPAT	10
11	JADHAV GAURAV GANPAT	10
12	JADYAL SHAMBHAVI ANIL	09
13	KADAM SAYALI SANTOSH	10
14	KADU SAYALI SHASHIKANT	08
15	MORE PRAJAL PRADIP	08
16	NARALKAR SONALI LAXMAN	10
17	PASHTE PANKAJ NAMDEV	09
18	PAWAR ROSHAN SUDHIR	10
19	SHELAR AJAY VIJAY	09
20	SUTAR ASMITA ANANT	09

F.Y.B.Sc paper Ist sem - I
Unit - I - Algae (Spirogyra)

Unit I ALGAE *SPIROGYRA* 2018-19 (PAPER 1ST)

Spirogyra is a genus of green filamentous algae belonging to the family Zygnemataceae. These algae are commonly found in freshwater environments, especially in slow-moving or stagnant bodies of water like ponds, lakes, and streams. They are known for their characteristic spiral or helical appearance due to the chloroplasts arranged in a spiral pattern within their cells.

Here is some updated information about Spirogyra as of my last knowledge update in September 2021:

1. **Morphology:** Spirogyra is filamentous in structure, with individual cells forming long, unbranched chains. Each cell contains a distinct nucleus, a central vacuole, and the characteristic spiral chloroplast. The chloroplasts are responsible for photosynthesis, and their arrangement is a key feature of Spirogyra.
2. **Reproduction:** Spirogyra reproduces both sexually and asexually. Asexual reproduction occurs through fragmentation, where a filament breaks into pieces, each of which can grow into a new filament. Sexual reproduction involves the formation of conjugation tubes that connect adjacent filaments. This process allows for the exchange of genetic material between cells, leading to the formation of zygospores.
3. **Habitat:** Spirogyra is commonly found in freshwater habitats with slow or stagnant water, as it thrives in nutrient-rich conditions. It can form dense mats on the water's surface or near the bottom.
4. **Ecological Importance:** Spirogyra is an essential part of freshwater ecosystems. It plays a role in nutrient cycling and can serve as a food source for various aquatic organisms, such as protozoans and aquatic invertebrates.
5. **Research Significance:** Spirogyra has been studied extensively in the context of photosynthesis and chloroplast structure. Researchers have used Spirogyra to investigate topics related to cell biology, genetics, and ecological interactions in aquatic ecosystems.
6. **Potential for Biofuel Production:** Some research has explored the potential of Spirogyra and other algae as a source of biofuels due to their rapid growth and high lipid content. Algae-based biofuels are considered a sustainable alternative to fossil fuels.

Please note that research in the field of algae biology, including Spirogyra, is ongoing, and new discoveries may have emerged since my last update. To access the most current and specific information on Spirogyra, I recommend consulting recent scientific literature and academic sources.

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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- I** **Date:**
Class:F.Y.B.Sc **Total Marks : 10**

Q.1 Choose the correct option. 10M

1. What is the characteristic appearance of Spirogyra due to the arrangement of chloroplasts?
   a. Circular
   b. Linear
   c. Spiral or helical
   d. Star-shaped
2. In what type of water environments is Spirogyra commonly found?
   a. Saltwater oceans
   b. Fast-flowing rivers
   c. Stagnant or slow-moving freshwater
   d. Desert lakes
3. How does Spirogyra reproduce asexually?
   a. Through the formation of zygospores
   b. By exchanging genetic material through conjugation tubes
   c. Via fragmentation, where filaments break into pieces
   d. Through binary fission
4. Which component is primarily responsible for photosynthesis in Spirogyra?
   a. Nucleus
   b. Vacuole
   c. Spiral chloroplasts
   d. Cell wall
5. What is the ecological importance of Spirogyra in freshwater ecosystems?
   a. It serves as a predator of small fish.
   b. It contributes to nutrient cycling and can be a food source for various aquatic organisms.
   c. It prevents the growth of other algae species.
   d. It has no significant ecological role.
6. In Spirogyra's sexual reproduction, what is the purpose of conjugation tubes connecting adjacent filaments?

a. Nutrient transport
b. Chloroplast exchange
c. Genetic material exchange
d. Filament support

7. Why is Spirogyra of research interest in the context of biofuels?
   a. It contains no lipids.
   b. It has slow growth rates.
   c. It is a potential source of biofuels due to its high lipid content and rapid growth.
   d. It cannot be cultivated outside of the lab.
8. Which family does Spirogyra belong to?
   a. Zygnemataceae
   b. Rosaceae
   c. Fabaceae
   d. Solanaceae
9. Spirogyra is typically found in which type of water bodies?
   a. Fast-flowing rivers
   b. Oceanic environments
   c. Stagnant or slow-moving freshwater bodies
   d. Desert ecosystems
10. What is the function of the central vacuole in Spirogyra cells?
    a. Energy production
    b. Storage of genetic material
    c. Storage of water, nutrients, and waste products
    d. Reproduction

Answers:

1. c. Spiral or helical
2. c. Stagnant or slow-moving freshwater
3. c. Via fragmentation, where filaments break into pieces
4. c. Spiral chloroplasts
5. b. It contributes to nutrient cycling and can be a food source for various aquatic organisms.
6. c. Genetic material exchange
7. c. It is a potential source of biofuels due to its high lipid content and rapid growth.
8. a. Zygnemataceae
9. c. Stagnant or slow-moving freshwater bodies
10. c. Storage of water, nutrients, and waste products

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date- 23/07/2018

All S.Y.B.Sc. students are here by informed that class test will be conducted as on **27/07/2018** on **Topic Name-** 'Algae-Spirogyra" part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time : 1 hrs	**SEMESTER- I**	**Date:**
Class:F.Y.B.Sc		**Total Marks : 10**

Name of the student: Admane Ajay Jayvijay

Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is the characteristic appearance of Spirogyra due to the arrangement of chloroplasts?
   a. Circular
   b. Linear
   [✓ c. Spiral or helical]
   d. Star-shaped
2. In what type of water environments is Spirogyra commonly found?
   a. Saltwater oceans
   b. Fast-flowing rivers
   [✓ c. Stagnant or slow-moving freshwater]
   d. Desert lakes
3. How does Spirogyra reproduce asexually?
   a. Through the formation of zygospores
   b. By exchanging genetic material through conjugation tubes
   [✓ c. Via fragmentation, where filaments break into pieces]
   d. Through binary fission
4. Which component is primarily responsible for photosynthesis in Spirogyra?
   a. Nucleus
   b. Vacuole
   [✓ c. Spiral chloroplasts]
   d. Cell wall
5. What is the ecological importance of Spirogyra in freshwater ecosystems?
   [✓ a. It serves as a predator of small fish.]
   b. It contributes to nutrient cycling and can be a food source for various aquatic organisms.
   c. It prevents the growth of other algae species.

    d. It has no significant ecological role.

6. In Spirogyra's sexual reproduction, what is the purpose of conjugation tubes connecting adjacent filaments?
    a. Nutrient transport
    b. Chloroplast exchange
    [✓ c. Genetic material exchange]
    d. Filament support
7. Why is Spirogyra of research interest in the context of biofuels?
    a. It contains no lipids.
    b. It has slow growth rates.
    [✓ c. It is a potential source of biofuels due to its high lipid content and rapid growth.]
    d. It cannot be cultivated outside of the lab.
8. Which family does Spirogyra belong to?
    [✓ a. Zygnemataceae]
    b. Rosaceae
    c. Fabaceae
    d. Solanaceae
9. Spirogyra is typically found in which type of water bodies?
    a. Fast-flowing rivers
    b. Oceanic environments
    [✓ c. Stagnant or slow-moving freshwater bodies]
    d. Desert ecosystems
10. What is the function of the central vacuole in Spirogyra cells?
    a. Energy production
    b. Storage of genetic material
    [✓ c. Storage of water, nutrients, and waste products]
    d. Reproduction

09/10

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Time : 1 hrs **SEMESTER- I** **Date:**
Class:F.Y.B.Sc **Total Marks : 10**

Name of the student: Ambre Mandar Dilip
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

7

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$$\frac{08}{10}$$

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Time : 1 hrs **SEMESTER- I** **Date:**
Class:F.Y.B.Sc **Total Marks : 10**

Name of the student: Ambre priya vasant.
Roll no.

Instruction:

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Khed, Ratnagiri.

RESULT OF TEST 2018-19

SR. NO	NAME OF THE STUDENT	MARKS/10
1	ADMANE AJAY JAYVIJAY	09
2	AMBRE MANDAR DILIP	08
3	AMBRE PRIYA VASANT	07
4	AMBRE SIDDHARAJ SUBHASH	10
5	AMBRE VEDA SACHIN	06
6	BAGAVE SIDDHESH SHEKHAR	07
7	BAIT RASIKA VILAS	08
8	BHOTHRE SUJIT SUNIL	10
9	CHALAKE VAIBHAV DILIP	09
10	CHALKE VISHWANATH SANTOSH	08
11	CHALKE YOGITA VINESH	07
12	CHAVAN PRATIK PRAMOD	09
13	CHAVAN SAKSHI SURESH	08
14	DERVANKAR SHUBHANGI SURESH	07
15	DHAPASE AJAY PRAKASH	09
16	DHAPHALE MANISH MANOHAR	08
17	DHOTARE AKSHAY ANIL	07
18	DIVEKAR SONAL RAJENDRA	09
19	GAIKAR PRANALI PRAVIN	06
20	GHAG MAHESH MARUTI	10
21	GHAG SAYALI VISHNU	07
22	GONDHLEKAR NAMIRA ABIDDIN	09
23	GOTHAL SWAPNIL SUBHASH	08
24	HAJARE TEJASWINI DADASO	07
25	JAADHAV DIPALI GANPAT	10
26	JADHAV MANISH RAMCHANDRA	08
27	JADHAV NANADINI RAVINDRA	09
28	JADHAV SAYLI SUNIL	07
29	JADHAV SHRUSTI ANANT	10
30	JADHAV SONALI MANOHAR	08
31	JADYAL YASH DILIP	09
32	JANGAM ADITI SUDHIR	07
33	KADAM AMOL ANIL	06
34	KADAM DIPTI DIPAK	09
35	KADAM MAYURI MADHUKAR	08
36	KADAM SAHIL SANTOSH	07
37	KADU KAUSHAL AJIT	09
38	KALMBATE AMISHA BALIRAM	08
39	KAMBALE ROHIT PANDURANG	07

40	KANDEKAR PRASHANT ANANT	10
41	KASHTE PRIYANKA ATMARAM	07
42	KHAMKAR GANESH MAHENDRA	08
43	KHOPKAR ANKITA GANESH	09
44	LAKHAM SWAPNIL SITARAM	08
45	LINGAYAT AKSHATA MAHENDRA	07
46	MAKHAJANKAR MUZAMMIL FAKIR MAHMAD	09
47	MANDAVKAR PALLAVI PANDURANG	10
48	MANVAL HARSHADA RAMESH	07
49	MANVAL ROSHANI RAMCHANDRA	08
50	MARUF MISBA LIYAKAT	09
51	MISAL NILAM AJIT	07
52	MISAL RIMA AJIT	08
53	MOHITE PRAFULL PRABHAKAR	09
54	MORE ANKITA VITTHAL	09
55	MORE SANJIVANI SANTOSH	09
56	MORE SAURABH AVINASH	9
57	MORE VRUSHABH BABARAM	08
58	NADKAR AYESHA KIFAYAT	08
59	NAYNAK VAIBHAV KERU	09
60	NIKAM ABHISHEK SATISH	07
61	NIKAM PRATESH RAVINDRA	07
62	NIKAM PRATIKSHA SHARAD	08
63	NIKAM SUPRIYA SANJAY	07
64	OVULKAR VRUSHASLI VILAS	09
65	PARKAR KHATIJA ALIMIYA	09
66	PAWAR SAURAV SUBHASH	09
67	PIRDHANKAR MAMATA SUDHIR	09
68	POMENDKAR SAURABH PRAKASH	08
69	POPHALKAR SHVETA SUBHASH	07
70	RUMANE JIBRAN MOHAMMAD JAFAR	08
71	SAKPAL AKANKSHA SUNIL	10
72	SAWANT PAYAL SURESH	08
73	SHIGAVAN SAMEER SANTOSH	07
74	SHINDE PRATIK SANJAY	07
75	SHINDE RAJANI RAJENDRA	09
76	SHINDE SAKSHI SANTOSH	09
77	SIDDIQI SANOBAR MAINUDDIN	09
78	SOLKAR MUSADDIK MURAD	09
79	SONAVANE SAYALI DIPAK	08
80	SURVE FAZILA NISAR	07
81	TAMBAT ANJALI RAJENDRA	08
82	TAMBE RENUKA GAUTAM	10
83	TAMBE SURAJ ASHOK	08
84	USARE AMISHA SANTOSH	07
85	VANKURDE MANSI RAJAN	07
86	VELHAL AISHWARYA SANTOSH	09

F.Y.B.Sc Paper II Sem - I
Unit I - cell Biology

Unit I : Cell Biology 2018-19

1. **CRISPR-Cas9 and Gene Editing:** The CRISPR-Cas9 technology continued to be a game-changer in cell biology. Researchers were using it for precise gene editing, not only in cell lines but also in whole organisms, which had far-reaching implications for studying gene function and potential therapeutic applications.
2. **Single-Cell RNA Sequencing:** Advances in single-cell RNA sequencing allowed scientists to examine gene expression at the individual cell level. This technology revealed cellular heterogeneity and provided insights into various biological processes, such as development and disease.
3. **Organelle Function:** Ongoing research was uncovering more about the functions of various organelles within cells, including the endoplasmic reticulum, Golgi apparatus, and lysosomes. This had implications for understanding cellular processes and diseases related to these organelles.
4. **Cell Signaling:** Signaling pathways within cells, such as those involving kinases and G protein-coupled receptors, remained a central focus. Research in this area was aimed at understanding how cells communicate and respond to external cues.
5. **Cancer Biology:** Cell biology played a crucial role in cancer research, particularly in understanding the genetic and molecular mechanisms that drive the development and progression of cancer. New therapeutic approaches were also being explored, including immunotherapy.
6. **Stem Cells:** Stem cell research was continuously advancing, with a focus on understanding the biology of stem cells and their potential applications in regenerative medicine and disease treatment.
7. **Cellular Immunology:** The study of immune cells, their functions, and their interactions with pathogens was a growing area of research, especially with the development of novel immunotherapies and vaccines.
8. **Autophagy and Protein Degradation:** Autophagy, the process by which cells degrade and recycle cellular components, was a topic of ongoing research. Understanding autophagy had implications for aging, neurodegenerative diseases, and metabolic disorders.
9. **Synthetic Biology:** Researchers were designing and engineering cells for various purposes, such as creating biofuels, biopharmaceuticals, and new materials. Synthetic biology was blurring the lines between traditional cell biology and engineering.
10. **Emerging Technologies:** Advancements in microscopy and imaging techniques, as well as the integration of computational approaches, were enabling scientists to explore the inner workings of cells at unprecedented levels of detail.

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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- I** **Date:**
Class:F.Y.B.Sc **Total Marks : 10**

Q.1 Choose the correct option. **10M**

1. **What is the primary function of the CRISPR-Cas9 technology in cell biology?**
   a. Protein synthesis
   b. Gene expression profiling
   c. Organelle structure analysis
   d. Cell signaling studies
2. **What does single-cell RNA sequencing allow researchers to examine?**
   a. Whole organisms
   b. Gene expression at the cellular level
   c. The entire genome of a cell
   d. Protein interactions within a cell
3. **Which organelles were highlighted in ongoing research as of the last update?**
   a. Mitochondria and nucleus
   b. Nucleus and ribosomes
   c. Endoplasmic reticulum and Golgi apparatus
   d. Golgi apparatus and lysosomes
4. **What central focus does cell signaling research have?**
   a. Understanding cell division
   b. Understanding how cells communicate and respond to external cues c.
   Investigating cell motility
   d. Studying cell adhesion
5. **In which field of biology does cell biology play a crucial role, especially in understanding genetic and molecular mechanisms?**
   a. Botany
   b. Virology
   c. Cancer biology
   d. Entomology
6. **How can stem cells be potentially applied in medicine?**
   a. To create genetically modified organisms
   b. For regenerative medicine and disease treatment
   c. As a source of biofuels
   d. In synthetic biology experiments
7. **Which process involves cells degrading and recycling cellular components?**
   a. Protein synthesis
   b. Autophagy
   c. Apoptosis

   d. DNA replication
8. What is the main focus of synthetic biology in cell biology?
   a. Understanding natural biological processes
   b. Engineering cells for various purposes
   c. Creating artificial intelligence models
   d. Studying ecosystem dynamics
9. What role did microscopy and imaging techniques play in cell biology? a. They are used for genetic editing.
   b. They helped create stem cells.
   c. They allowed scientists to explore cell structures in more detail.
   d. They primarily support vaccine development.
10. To stay updated on the latest developments in cell biology, where can researchers find the most current information?
    a. Public libraries
    b. Social media platforms
    c. Scientific journals and research institution websites
    d. Supermarket magazines

Answers:

1. **b. Gene expression profiling**
2. **b. Gene expression at the cellular level**
3. **c. Endoplasmic reticulum and Golgi apparatus**
4. **b. Understanding how cells communicate and respond to external cues**
5. **c. Cancer biology**
6. **b. For regenerative medicine and disease treatment**
7. **b. Autophagy**
8. **b. Engineering cells for various purposes**
9. **c. They allowed scientists to explore cell structures in more detail.**
10. **c. Scientific journals and research institution websites**

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
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KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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E-mail : principalics@yahoo.co.in • principal@icskhed.edu.in • icscmit@gmail.com • cmit@icskhed.edu.in • Web : www.icskhed.edu.in • www.icskhed.org

Ref. No.: ICS/ **Date :**

Notice

Date- 02/08/2018

All F.Y.B.Sc. students are here by informed that class test will be conducted as on **05/08/2018** on **Topic Name-** 'Cell biology' as part of teaching learning beyond curriculum.

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I.C.S. College of Arts, Commerce & Sci.
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Class:F.Y.B.Sc		**Total Marks : 10**

Name of the student: Admane Ajay Jayvijay

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   a. Mitochondria and nucleus
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   a. Understanding cell division
   [✓ b. Understanding how cells communicate and respond to external cues] c. Investigating cell motility
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5. **In which field of biology does cell biology play a crucial role, especially in understanding genetic and molecular mechanisms?**

a. Botany
b. Virology
[✓ c. Cancer biology]
d. Entomology

6. **How can stem cells be potentially applied in medicine?**
a. To create genetically modified organisms
[✓ b. For regenerative medicine and disease treatment]
c. As a source of biofuels
d. In synthetic biology experiments

7. **Which process involves cells degrading and recycling cellular components?**
[✓ a. Protein synthesis]
b. Autophagy
c. Apoptosis
d. DNA replication

8. **What is the main focus of synthetic biology in cell biology?**
a. Understanding natural biological processes
[✓ b. Engineering cells for various purposes]
c. Creating artificial intelligence models
d. Studying ecosystem dynamics

9. **What role did microscopy and imaging techniques play in cell biology?**
a. They are used for genetic editing.
b. They helped create stem cells.
[✓ c. They allowed scientists to explore cell structures in more detail.]
d. They primarily support vaccine development.

10. **To stay updated on the latest developments in cell biology, where can researchers find the most current information?**
a. Public libraries
b. Social media platforms
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RESULT OF TEST 2018-19

SR. NO	NAME OF THE STUDENT	MARKS/10
1	ADMANE AJAY JAYVIJAY	09
2	AMBRE MANDAR DILIP	08
3	AMBRE PRIYA VASANT	07
4	AMBRE SIDDHARAJ SUBHASH	10
5	AMBRE VEDA SACHIN	06
6	BAGAVE SIDDHESH SHEKHAR	07
7	BAIT RASIKA VILAS	08
8	BHOTHRE SUJIT SUNIL	10
9	CHALAKE VAIBHAV DILIP	09
10	CHALKE VISHWANATH SANTOSH	08
11	CHALKE YOGITA VINESH	07
12	CHAVAN PRATIK PRAMOD	09
13	CHAVAN SAKSHI SURESH	08
14	DERVANKAR SHUBHANGI SURESH	07
15	DHAPASE AJAY PRAKASH	09
16	DHAPHALE MANISH MANOHAR	08
17	DHOTARE AKSHAY ANIL	07
18	DIVEKAR SONAL RAJENDRA	09
19	GAIKAR PRANALI PRAVIN	06
20	GHAG MAHESH MARUTI	10
21	GHAG SAYALI VISHNU	07
22	GONDHLEKAR NAMIRA ABIDDIN	09
23	GOTHAL SWAPNIL SUBHASH	08
24	HAJARE TEJASWINI DADASO	07
25	JAADHAV DIPALI GANPAT	10
26	JADHAV MANISH RAMCHANDRA	08
27	JADHAV NANADINI RAVINDRA	09
28	JADHAV SAYLI SUNIL	07
29	JADHAV SHRUSTI ANANT	10
30	JADHAV SONALI MANOHAR	08
31	JADYAL YASH DILIP	09
32	JANGAM ADITI SUDHIR	07
33	KADAM AMOL ANIL	06
34	KADAM DIPTI DIPAK	09
35	KADAM MAYURI MADHUKAR	08
36	KADAM SAHIL SANTOSH	07
37	KADU KAUSHAL AJIT	09
38	KALMBATE AMISHA BALIRAM	08
39	KAMBALE ROHIT PANDURANG	07
40	KANDEKAR PRASHANT ANANT	10
41	KASHTE PRIYANKA ATMARAM	07
42	KHAMKAR GANESH MAHENDRA	08
43	KHOPKAR ANKITA GANESH	09
44	LAKHAM SWAPNIL SITARAM	08
45	LINGAYAT AKSHATA MAHENDRA	07
46	MAKHAJANKAR MUZAMMIL FAKIR MAHMAD	09
47	MANDAVKAR PALLAVI PANDURANG	10
48	MANVAL HARSHADA RAMESH	07

49	MANVAL ROSHANI RAMCHANDRA	08
50	MARUF MISBA LIYAKAT	09
51	MISAL NILAM AJIT	07
52	MISAL RIMA AJIT	08
53	MOHITE PRAFULL PRABHAKAR	09
54	MORE ANKITA VITTHAL	09
55	MORE SANJIVANI SANTOSH	09
56	MORE SAURABH AVINASH	9
57	MORE VRUSHABH BABARAM	08
58	NADKAR AYESHA KIFAYAT	08
59	NAYNAK VAIBHAV KERU	09
60	NIKAM ABHISHEK SATISH	07
61	NIKAM PRATESH RAVINDRA	07
62	NIKAM PRATIKSHA SHARAD	08
63	NIKAM SUPRIYA SANJAY	07
64	OVULKAR VRUSHASLI VILAS	09
65	PARKAR KHATIJA ALIMIYA	09
66	PAWAR SAURAV SUBHASH	09
67	PIRDHANKAR MAMATA SUDHIR	09
68	POMENDKAR SAURABH PRAKASH	08
69	POPHALKAR SHVETA SUBHASH	07
70	RUMANE JIBRAN MOHAMMAD JAFAR	08
71	SAKPAL AKANKSHA SUNIL	10
72	SAWANT PAYAL SURESH	08
73	SHIGAVAN SAMEER SANTOSH	07
74	SHINDE PRATIK SANJAY	07
75	SHINDE RAJANI RAJENDRA	09
76	SHINDE SAKSHI SANTOSH	09
77	SIDDIQI SANOBAR MAINUDDIN	09
78	SOLKAR MUSADDIK MURAD	09
79	SONAVANE SAYALI DIPAK	08
80	SURVE FAZILA NISAR	07
81	TAMBAT ANJALI RAJENDRA	08
82	TAMBE RENUKA GAUTAM	10
83	TAMBE SURAJ ASHOK	08
84	USARE AMISHA SANTOSH	07
85	VANKURDE MANSI RAJAN	07
86	VELHAL AISHWARYA SANTOSH	09

T.Y.B.SC Paper II^nd . Unit-IV^th.
Palynology.

T.Y.B.SC paper IInd 2018-19

Palynology is the scientific study of pollen grains and spores found in sedimentary rocks and soils. It has applications in various fields, including geology, archaeology, ecology, and climate science. Advances in palynology have been driven by technological innovations and interdisciplinary research. Here are some notable advances in the field of palynology:

1. **High-Resolution Imaging:** Advanced imaging techniques, such as scanning electron microscopy (SEM) and transmission electron microscopy (TEM), have allowed for high-resolution imaging of pollen and spore structures, enabling detailed morphological analysis.
2. **Molecular Palynology:** DNA analysis of pollen and spores, known as molecular palynology, has become a powerful tool for identifying plant species and reconstructing past vegetation based on genetic information.
3. **Palynofacies Analysis:** Palynofacies analysis involves the examination of the composition and distribution of organic matter within sediments, providing insights into the depositional environment and sedimentary processes.
4. **Pollen-Based Climate Reconstruction:** Palynologists use pollen records to reconstruct past climate conditions, including temperature and precipitation, providing valuable data for paleoclimate research.
5. **Archaeological Applications:** Palynology is used in archaeology to study ancient landscapes, human impact on vegetation, and the history of agriculture and land use in different regions.
6. **Forensic Palynology:** In forensic science, pollen analysis can help link individuals to specific geographic locations based on the pollen found on their clothing or belongings.
7. **Environmental Monitoring:** Palynological studies of modern pollen assemblages help monitor changes in vegetation and ecosystems, which can inform conservation efforts and environmental management.
8. **Pollen Allergens:** Advances in identifying pollen allergens and their distribution have improved our understanding of pollen-related allergies and asthma.

9. **Pollen in Sedimentary Records:** The analysis of pollen in sedimentary records, such as lake and peat deposits, provides information about vegetation changes over geological timescales.
10. **Quantitative Palynology:** Quantitative techniques, including pollen percentage and pollen accumulation rate calculations, have enhanced the precision of palynological studies and climate reconstructions.
11. **Pollen Fossilization Studies:** Research on the fossilization of pollen and spores has led to a better understanding of preservation processes and biases in the fossil record.
12. **Palynological Databases:** The development of palynological databases and online resources has made it easier for researchers to access and share pollen data from various regions and time periods.
13. **Integrated Studies:** Palynology is increasingly integrated with other scientific disciplines, such as geology, ecology, and genetics, to provide a more comprehensive understanding of past and present environments.
14. **Climate Change Research:** Palynological studies contribute valuable data to climate change research by documenting past vegetation responses to climate variability and helping to predict future vegetation changes.
15. **Pollen in Archaeological Contexts:** Analysis of pollen from archaeological sites provides insights into ancient agriculture, diet, and human-environment interactions.

These advances in palynology continue to expand our knowledge of Earth's history, climate dynamics, environmental changes, and human impacts on landscapes. Palynological research also plays a crucial role in addressing contemporary issues, such as climate change and allergen-related health concerns.

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Khed, Ratnagiri.

Time : 2 hrs **SEMESTER- V** **Date:**
Class:T.Y.B.Sc **Total Marks : 10**

Q.1 Choose the correct option. **10M**

1. **What is the primary focus of palynology?**
   a) Study of ancient animals
   b) Analysis of pollen and spores
   c) Investigation of sedimentary rocks
   d) Examination of tree rings
2. **Which advanced imaging technique allows for high-resolution imaging of pollen and spore structures?**
   a) DNA analysis
   b) Transmission electron microscopy (TEM)
   c) X-ray diffraction
   d) Satellite imaging
3. **What is molecular palynology?**
   a) The study of ancient climates
   b) The analysis of sedimentary rocks
   c) DNA analysis of pollen and spores
   d) The study of plant fossils
4. **What is palynofacies analysis used for in palynology?**
   a) Dating archaeological sites
   b) Identifying pollen species
   c) Reconstructing past climates
   d) Understanding sedimentary environments
5. **How is palynology used in archaeology?**
   a) To analyze rock formations
   b) To study ancient animal fossils
   c) To understand human impact on vegetation
   d) To date sedimentary layers

6. **What is the main application of forensic palynology?**
   a) Reconstructing ancient climates
   b) Analyzing sedimentary rocks
   c) Identifying individuals' geographic locations
   d) Dating archaeological sites
7. **In which field is palynology used to monitor changes in modern vegetation and ecosystems?**
   a) Geology
   b) Astronomy
   c) Environmental science
   d) Meteorology
8. **Pollen records are used in palynology to reconstruct past what?**
   a) Rock formations
   b) Climate conditions
   c) Human populations
   d) Animal migrations
9. **What is the primary purpose of pollen percentage calculations in palynology?**
   a) Identifying pollen allergens
   b) Quantifying pollen in sedimentary records
   c) Analyzing ancient DNA
   d) Dating archaeological sites
10. **What aspect of palynology focuses on the study of pollen and spore preservation processes?**
   a) Quantitative palynology
   b) Taphonomy
   c) Archaeological palynology
   d) Forensic palynology

Answers:

1. b) Analysis of pollen and spores
2. b) Transmission electron microscopy (TEM)
3. c) DNA analysis of pollen and spores
4. d) Understanding sedimentary environments
5. c) To understand human impact on vegetation
6. c) Identifying individuals' geographic locations
7. c) Environmental science
8. b) Climate conditions
9. b) Quantifying pollen in sedimentary records
10. b) Taphonomy

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
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Ph No. 02356-260100
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Ref. No.: ICS/ **Date :**

Notice

Date- 21/09/2022

All T.Y.B.Sc. students are here by informed that class test will be conducted as on **24/09/2022** on **Topic Name-** 'Paleobotany' as part of teaching learning beyond curriculum.

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Khed, Ratnagiri.

Time : 2 hrs **SEMESTER- V** **Date:**
Class:T.Y.B.Sc **Total Marks : 10**

Name of the student: ---
Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. **What is the primary focus of paleobotany?**
   a) Studying ancient animals
   ~~b)~~ Investigating past geological events
   c) Examining ancient plant life
   d) Analyzing meteorite impacts
2. **Which imaging technology allows for non-destructive analysis of fine details in fossilized plant specimens?**
   a) CT scan
   ~~b)~~ Radiocarbon dating
   c) High-resolution X-ray CT (HRCT)
   d) Electron microscopy
3. **How do paleobotanists use molecular phylogenetics in their research?**
   a) To date fossilized plants
   b) To study ancient climates
   ~~c)~~ To refine evolutionary relationships among plant groups
   d) To analyze rock formations
4. **What does aDNA stand for in paleobotany?**
   a) Ancient Digital Analysis
   b) Advanced Data Networks in Archaeology
   c) Ancient DNA
   ~~d)~~ Aged Plant Nucleotides
5. **Which type of plant fossil analysis is used to reconstruct past climates?**
   a) Leaf morphology analysis
   b) Stable isotope analysis
   ~~c)~~ Diatom analysis
   d) Pollen analysis

6. **What are phytoliths?**
   a) Fossilized pollen grains

b) Tiny plant fossils
~~c)~~ Silica structures found in plants
d) Plant-based antibiotics

7. **What type of fossil analysis provides information about ancient ecosystems and biogeochemical cycles?**
   a) Microfossil analysis
   b) Macrofossil analysis
   ~~c)~~ Radiocarbon dating
   d) Petrography
8. **Where is the Rhynie Chert known for its exceptionally preserved early land plants located?**
   a) Antarctica
   ~~b)~~ Africa
   c) Scotland
   d) Australia
9. **Which of the following is an example of an early land plant group studied in paleobotany?**
   a) Dinosaurs
   ~~b)~~ Mosses
   c) Trilobites
   d) Fish
10. **What do fossilized insect damage patterns on ancient plant fossils reveal?**
   a) Plant growth patterns
   ~~b)~~ Evolution of insects
   c) Plant-insect interactions
   d) Geological events

10/10

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Khed, Ratnagiri.

RESULT OF TEST 2018-19

SR.NO.	NAME OF THE STUDENT	MARKS /10
1	SHITAL MAHADEV MORE	10

S.Y. B.Sc Paper - III Sem - IV

Unit - III - Biostatistics & Bioinformatics.

Unit III (paper 3rd) : Biostatistics And Bioinformatics

Biostatistics:

1. **Big Data in Biostatistics**: With the advent of high-throughput technologies in genomics, proteomics, and other -omics fields, biostatistics has had to adapt to handle massive datasets. Modern biostatisticians use advanced statistical methods and machine learning techniques to extract meaningful information from these data.
2. **Precision Medicine**: Biostatistics is central to the field of precision medicine. It involves tailoring medical treatment to the individual characteristics of each patient, and biostatistical methods are used to analyze and interpret the complex genetic and clinical data required for personalized treatment decisions.
3. **Bayesian Statistics**: Bayesian methods have gained prominence in biostatistics. These techniques are used for modeling and analyzing complex biological systems, especially in areas like pharmacokinetics, epidemiology, and disease modeling.
4. **Clinical Trial Design**: Biostatisticians are critical in designing clinical trials, determining sample sizes, and analyzing trial data. There is an increasing emphasis on adaptive clinical trial design to improve the efficiency of drug development.
5. **Open Science and Reproducibility**: Biostatistics has seen a growing emphasis on transparency, open data sharing, and reproducibility. Tools like R and Python, along with open-access journals and preprint servers, have contributed to this trend.

Bioinformatics:

1. **Advancements in Sequencing**: Bioinformatics is closely tied to genomics, and the field continues to benefit from advancements in DNA sequencing technologies. High-throughput sequencing techniques like nanopore sequencing have emerged, enabling rapid and cost-effective sequencing of entire genomes.
2. **Single-Cell Sequencing**: Single-cell RNA sequencing has gained prominence in bioinformatics. It allows researchers to analyze individual cells' gene expression, providing insights into cellular diversity and function.
3. **Metagenomics and Microbiome Research**: Bioinformatics is essential in studying the microbiome and metagenomics. Researchers use computational

tools to analyze complex microbial communities, shedding light on their roles in human health and disease.

4. **Structural Bioinformatics**: Structural bioinformatics plays a crucial role in drug discovery. Advances in computational biology have improved our ability to predict protein structures and simulate protein-ligand interactions, facilitating drug development.
5. **Artificial Intelligence and Machine Learning**: Bioinformatics is leveraging AI and machine learning for tasks like protein structure prediction, drug discovery, and identifying genetic variants associated with diseases.
6. **Biological Network Analysis**: Researchers use bioinformatics to analyze biological networks, such as protein-protein interaction networks and gene regulatory networks. Network-based approaches help uncover the complexity of biological systems.
7. **Phylogenomics**: The integration of genomics and phylogenetics has allowed for more accurate reconstruction of evolutionary relationships among species. This is particularly relevant in fields like evolutionary biology and epidemiology.
8. **Personalized Genomics**: Bioinformatics tools are being used to interpret individuals' genetic data, providing insights into their health risks, ancestry, and potential responses to medications.
9. **Data Integration**: Integrative bioinformatics involves combining data from multiple sources and platforms to gain a more comprehensive understanding of complex biological systems.
10. **Data Privacy and Ethics**: Bioinformatics has had to address ethical concerns and data privacy issues related to the handling of large-scale genomic and health data, resulting in the development of guidelines and regulations.

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Time : 1 hrs **SEMESTER- IV** **Date:**
Class:S.Y.B.Sc **Total Marks : 10**

Q.1 Choose the correct option. **10M**

1. What role does biostatistics play in precision medicine?
    a) Analyzing large-scale biological datasets
    b) Designing clinical trials
    c) Tailoring medical treatment to individual patient characteristics
    d) Identifying protein-protein interactions
2. In the context of clinical trials, what is the purpose of adaptive trial design?
    a) Analyzing clinical trial data
    b) Determining sample sizes
    c) Continuously adjusting trial parameters based on interim results
    d) Designing preclinical experiments
3. Which statistical approach is gaining prominence in modeling complex biological systems in biostatistics?
    a) Descriptive statistics
    b) Frequentist statistics
    c) Bayesian statistics
    d) Inferential statistics
4. How has open science and reproducibility been promoted in biostatistics?
    a) Through the use of proprietary software
    b) By restricting access to research data
    c) By using open-access journals and preprint servers
    d) By keeping research methods confidential
5. What technology has significantly advanced DNA sequencing in bioinformatics?
    a) Sanger sequencing
    b) Polymerase chain reaction (PCR)
    c) High-throughput sequencing technologies

d) Electron microscopy

6. Single-cell RNA sequencing is primarily used for:
   a) Analyzing whole organisms
   b) Studying individual cells' gene expression
   c) Sequencing entire genomes
   d) Predicting protein structures
7. How does bioinformatics contribute to drug discovery in structural biology?
   a) By simulating protein-ligand interactions
   b) By conducting clinical trials
   c) By analyzing microbiome data
   d) By studying protein-protein interactions
8. In which field does bioinformatics leverage artificial intelligence (AI) and machine learning techniques?
   a) Epidemiology
   b) Phylogenomics
   c) Drug discovery
   d) Structural biology
9. What does integrative bioinformatics involve?
   a) Combining data from multiple sources and platforms
   b) Developing new sequencing technologies
   c) Analyzing single-cell RNA sequencing data
   d) Predicting protein structures
10. What ethical concerns have arisen in bioinformatics related to genomic and health data? a) Data sharing and data integration
    b) Data privacy and data security
    c) Data visualization and data interpretation
    d) Data acquisition and data storage

Answers:

1. c) Tailoring medical treatment to individual patient characteristics
2. c) Continuously adjusting trial parameters based on interim results
3. c) Bayesian statistics
4. c) By using open-access journals and preprint servers
5. c) High-throughput sequencing technologies
6. b) Studying individual cells' gene expression
7. a) By simulating protein-ligand interactions
8. c) Drug discovery
9. a) Combining data from multiple sources and platforms
10. b) Data privacy and data security

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Ref. No.: ICS/ **Date :**

Notice

Date- 02/01/2020

All S.Y.B.Sc. students are here by informed that class test will be conducted as on **05/01/2020** on **Topic Name-** 'Biostatistics' as part of teaching learning beyond curriculum.

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Time : 1 hrs **SEMESTER- IV** **Date:**
Class:S.Y.B.Sc **Total Marks : 10**

Name of the student: Shigawan Sameer Santosh
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What role does biostatistics play in precision medicine?
   a) Analyzing large-scale biological datasets
   b) Designing clinical trials
   [✓ c) Tailoring medical treatment to individual patient characteristics]
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   [✓ c) Drug discovery]
   d) Structural biology
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   [✓ a) Combining data from multiple sources and platforms]
   b) Developing new sequencing technologies
   c) Analyzing single-cell RNA sequencing data
   d) Predicting protein structures
10. What ethical concerns have arisen in bioinformatics related to genomic and health data? a) Data sharing and data integration
   [✓ b) Data privacy and data security]
   c) Data visualization and data interpretation
   d) Data acquisition and data storage

10/10

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Time : 1 hrs **SEMESTER- IV** **Date:**
Class:S.Y.B.Sc **Total Marks : 10**

Name of the student: Dhapase Ajay Prakash
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What role does biostatistics play in precision medicine?
    a) Analyzing large-scale biological datasets
    b) Designing clinical trials
    [✓ c) Tailoring medical treatment to individual patient characteristics]
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    d) Structural biology
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    b) Developing new sequencing technologies
    c) Analyzing single-cell RNA sequencing data
    d) Predicting protein structures
10. What ethical concerns have arisen in bioinformatics related to genomic and health data? a) Data sharing and data integration
    [✓ b) Data privacy and data security]
    c) Data visualization and data interpretation
    d) Data acquisition and data storage

09/10

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RESULT OF TEST 2019-20

SR. NO	NAME OF STUDENT	MARKS /10
1	DHAPASE AJAY PRAKASH	09
2	POMENDKAR SAURABH PRAKASH	10
3	SHIGAVAN SAMEER SANTOSH	10

F.Y.B.SC Paper I Sem - II
Unit - III - Angiosperm

Unit III : PAPER 1 2019-20

Inflorescence refers to the arrangement of flowers on a plant stem, and it can vary greatly among different plant species. Here's some updated information on inflorescence:

1. Classification: Inflorescences can be categorized into various types based on their arrangement. The primary types include racemose (indeterminate) and cymose (determinate) inflorescences. Racemose inflorescences have flowers forming along a central stem, with the older flowers at the base and younger ones at the top. In cymose inflorescences, the growing point terminates with a flower.
2. Variability: Inflorescences can take on many different forms. They may be simple, with a single axis bearing flowers, or compound, with multiple branches and sub-branches. Additionally, the arrangement of flowers can be diverse, such as spikes (flowers tightly packed on an unbranched stem), panicles (branched clusters of flowers), and umbels (multiple flowers arising from a common point).
3. Floral Symmetry: The arrangement of flowers in an inflorescence can exhibit different types of symmetry, such as actinomorphic (radial symmetry) or zygomorphic (bilateral symmetry), depending on the species.
4. Bracts: Bracts are modified leaves that subtend or surround the flowers in an inflorescence. They can be small and inconspicuous or highly colorful and serve various functions, including protection and attraction of pollinators.
5. Reproductive Structures: In most inflorescences, you will find both male (stamens) and female (pistils) reproductive structures. The arrangement of these structures can vary and may affect the plant's pollination strategy.
6. Pollination Strategies: The inflorescence structure can influence the type of pollinators a plant attracts. Some plants have evolved specific inflorescence characteristics to attract particular pollinators, such as bees, butterflies, or wind.
7. Adaptations to Environmental Conditions: Inflorescence structures can be adapted to various environmental conditions. For instance, plants in arid regions might have compact inflorescences to conserve water, while those in humid environments may have more open arrangements to maximize pollination.
8. Inflorescence in Agriculture: Understanding inflorescence types and patterns is important in agriculture. Farmers and horticulturists use this knowledge to improve crop yields and quality by selecting for specific inflorescence characteristics.

9. Genetic and Molecular Research: Advances in genetics and molecular biology have allowed scientists to study the genetic and molecular mechanisms underlying inflorescence development in different plant species. This research provides insights into the evolution and regulation of inflorescence architecture.
10. Conservation: In some cases, inflorescence characteristics can be used to help identify and conserve plant species. Botanists and conservationists use these features to catalog and protect rare and endangered plants.

Understanding inflorescence is vital in botany and plant science as it provides insights into plant reproduction, ecology, evolution, and agriculture.

Sahajeevan Shikshan Sanstha's

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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- I** **Date:**
Class:F.Y.B.Sc **Total Marks : 10**

Q.1 Choose the correct option. **10M**

1. What does the term "inflorescence" refer to in botany?
   a. The arrangement of leaves on a stem
   b. The arrangement of flowers on a plant stem
   c. The color of flower petals
   d. The shape of a plant's roots
2. How are inflorescences categorized based on arrangement?
   a. By color
   b. By fragrance
   c. By flower size
   d. By type (racemose or cymose)
3. In what type of inflorescence do the older flowers appear at the base and the younger ones at the top of the stem?
   a. Racemose
   b. Cymose
   c. Spike
   d. Panicle
4. What are bracts in an inflorescence?
   a. Male reproductive structures
   b. Modified leaves associated with flowers
   c. Female reproductive structures
   d. Stems supporting the flowers
5. Which type of symmetry can be found in flowers with radial symmetry?
   a. Actinomorphic
   b. Zygomorphic
   c. Bilateral
   d. Asymmetrical
6. How do inflorescence characteristics influence a plant's choice of pollinators?

a. They have no effect on pollinators.
b. They determine the flower's color.
c. They attract specific types of pollinators.
d. They repel pollinators.

7. Why is understanding inflorescence important in agriculture?
   a. It affects the plant's water requirements.
   b. It determines the flower's fragrance.
   c. It influences the choice of soil.
   d. It helps improve crop yields and quality.
8. What do scientists study using genetics and molecular biology in relation to inflorescence?
   a. Inflorescence fragrance
   b. Inflorescence symmetry
   c. Inflorescence architecture development
   d. Inflorescence color
9. How do some inflorescence characteristics aid in plant identification and conservation efforts?
   a. They can be used to determine the plant's age.
   b. They indicate the plant's water requirements.
   c. They help identify and protect rare and endangered species.
   d. They are irrelevant to plant conservation.
10. Which branch of biology is primarily concerned with the study of inflorescence?
    a. Zoology
    b. Botany
    c. Microbiology
    d. Geology

Answers:

1. b. The arrangement of flowers on a plant stem
2. d. By type (racemose or cymose)
3. a. Racemose
4. b. Modified leaves associated with flowers
5. a. Actinomorphic
6. c. They attract specific types of pollinators.
7. d. It helps improve crop yields and quality.
8. c. Inflorescence architecture development
9. c. They help identify and protect rare and endangered species.
10. b. Botany

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
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Ref. No.: ICS/

Date :

Notice

Date- 03/02/2020

All F.Y.B.Sc. Students are here by informed that class test will be conducted as on **06/02/2020** on **Topic Name-** 'Angiosperm' as part of teaching learning beyond curriculum.

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Khed, Dist Ratnagiri

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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- II** **Date:**

Class:F.Y.B.Sc **Total Marks : 10**

Name of the student: --Ambre Ashish Ajay--------------------------------

Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What does the term "inflorescence" refer to in botany?
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   - [✓ b. The arrangement of flowers on a plant stem]
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   - a. Actinomorphic
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   - c. Bilateral

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6. How do inflorescence characteristics influence a plant's choice of pollinators?
   a. They have no effect on pollinators.
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    a. Zoology
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    c. Microbiology
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09/10

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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- II** **Date:**
Class:F.Y.B.Sc **Total Marks : 10**
Name of the student: Bade Darisha Iqbal.
Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What does the term "inflorescence" refer to in botany?
   a. The arrangement of leaves on a stem
   [✓ b. The arrangement of flowers on a plant stem]
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10/10

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Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- II** **Date:**
Class:F.Y.B.Sc **Total Marks : 10**
Name of the student: Bhosale Jayesh Lavesh.
Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What does the term "inflorescence" refer to in botany?
   a. The arrangement of leaves on a stem
   [✓ b. The arrangement of flowers on a plant stem]
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08/10

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Khed, Ratnagiri.

RESULT OF TEST 2019-20

SR.NO.	STUDENT NAME	MARKS/10
1.	AMBRE ASHISH AJAY	09
2.	BADE DANISA IQBAL	10
3.	BHOSALE JAYESH LAVESH	08
4.	BHOSALE RUTUJA NANAJI	09
5.	BHOSALE SAKSHEE ANIL	06
6.	BHUVAD SANI SUBHASH	05
7.	BOTHARE SUNAYANA SHRIRAM	09
8.	CHALKE VAISHNAVI SAMBHAJI	08
9.	CHAVAN RAKHI SANJAY	07
10.	CHOUGULE SHANUF ABDUL WAHAB	10
11.	DALVI POOJA JANARDAN	06
12.	DAWRE MISBAH A RAZZAK	07
13.	DHADVE ANIKET GAJANAN	08
14.	DHEBE GANESH VITTHAL	10
15.	DHEBE PANKAJ DIPAK	09
16.	GAIKWAD AVANTIKA GANGARAM	08
17.	GAMARE POOJA PRATAP	07
18.	GAMARE PRANAY MOHAN	09
19.	GAVADE TRUPTI RAJENDRA	08
20.	GHAG ABHISHEK AMARDIP	07
21.	GHEVADEKAR RUTUJAS SUDHAKAR	09
22.	GHOSALKAR DURGESH DIPAK	08
23.	GHOSALKAR MITAL MADHUKAR	07
24.	GHOSALKAR SAHIL PRAMOD	09
25.	GHOSALKAR SAHIL SANTOSH	06
26.	GHOSALKAR SNEHAL SANJAY	10
27.	GUHAGARKAR RUTIK DIPAK	07
28.	GUJAR SNEHAL SUBHASH	09
29.	GURAV SNEHAL SANDIP	08
30.	JADHAV POOJA MUKESH	07
31.	JADHAV REVATI RAMESH	10
32.	JADHAV SHUBHAM SATISH	08
33.	JAGADALE PRATIKSHA GANESH	09

34.	JANGAM SHUBHANGI PRAMOD	07
35.	JUWALE RUTIK LAVU	10
36.	KADAM PRIYANKA SANJAY	08
37.	KADIRI ALFIYA LIYAQAT	09
38.	KAJARE AMRUTA ANANT	07
39.	KHAPARE RUSHIKESH SURESH	06
40.	KHARAT SURAJ JAYRAM	09
41.	KHEDEKAR AISHWARYA ASHOK	08
42.	KHEDEKAR AYESHA ABDUL GAFFAR	07
43.	KHERADE DIVYA VIJAY	09
44.	KHERADE RANJIT RATNAKAR	08
45.	KHERADE SHUBHAM SANJAY	07
46.	KHOPADE PRATHAMESH SANDESH	10
47.	KHOPAKAR RAMDAS VITHOBA	07
48.	KOTAWDEKAR SAAFIA NAZIM	08
49.	KOTERE SURAJ SANTOSH	09
50.	KUDALE SONALI SITARAM	08
51.	KUMBHAR OMKAR ARVIND	07
52.	MAHADIK ABHISHEK DILIP	09
53.	MAHADIK AQSA AFZAL	10
54.	MAHADIK RATNESH RAJU	09
55.	MAHAKAL PRAPTI RATNAKAR	08
56.	MAKHJANKAR AQSA SIKANDAR	07
57.	MANDAVKAR YOGITA HARISHCHANDRA	10
58.	MANE AKSHAY BARKU	06
59.	MANE SAYALI PRAVIN	07
60.	MANE TEJASWINI MANGESH	08
61.	MANKAR VIPUL VILAS	10
62.	MANVAL MANSI CHANDRAKANT	09
63.	MANVAL RUTUJA RAMESH	08
64.	MARWA A RAB	07
65.	MOHITE ANKITA SACHIN	09
66.	MORE PAYAL PRAVIN	08
67.	MORE TEJAVI BHAGOJI	07
68.	MORE VISHAL SANJAY	09
69.	MUKADAM YUSRA HIDAYAT	08
70.	MULLAJI IQRA JAVEED	07
71.	NACHARE SONAL KRUSHNA	09
72.	PADWAL SHUBHAM SUBHASH	06
73.	PANDAM AKSHAY CHANDRAKANT	10
74.	PANDHERE PRANALI PRAKASH	07
75.	PARKAR AHLAM ANIS	09
76.	PARKAR MEHRIN NAZIR	08

77.	PARKAR SAIMA FAYYAZ	07
78.	PARKAR SHAKILA FAIYYAZ	10
79.	PARTE AKSHATA SHANKAR	08
80.	PARTE AKSHATA SHANKAR	09
81.	PATOLE ANURADHA DAGADU	07
82.	PAWAR KASHMIRI SUBHASH	10
83.	SAKPAL RAJ VINOD	08
84.	SAKPAL YASH ANIL	09
85.	SALVI ROSHANI BALARAM	07
86.	SHIGVAN DIVYA DIPAK	06
87.	SHIGVAN PRATIK SANJAY	09
88.	SHIGWAN ANISHA ANIL	08
89.	SHINDE PARESH UDAY	07
90.	SONDE SAFA JALIL	09
91.	SURVE SANOBAR MOHAMMED RAFIQUE	08
92.	SUTAR PRATIKSHA BHARAT	07
93.	TAMBE SADAF ZAKIR	10
94.	TAMBITKAR SHUBHAM SUBHASH	07
95.	UDEK SHUBHAM SURESH	08
96.	UPALE AJAY BAJI	09
97.	VICHARE MAYUR MANOJ	09
98.	ZORE SHUBHAM HARIRAM	08
99.	ZORE VIJAY PANDURANG	07
100.	ZORE VIJAY RAVINDRA	10

S. Guhagarkar

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Khed-Ratnagiri, Maharashtra, India.

TEACHING LEARNING BEYOND CURRICULUM FILE

- **NAME OF THE TEACHER –**

  DR. AMOL VISHNUDAS PATIL
- **QUALIFICATION –**

  M.SC. PH.D. (PHYSICS)
- **SUBJECT –**

  PHYSICS

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Shriman Chandulal Sheth College of Commerce, ShrimatiShobhanatai Chandulal Sheth College of Science,

Khed-Ratnagiri, Maharashtra, India.

Evidences of teacher taught beyond curriculum

- ➢ **Extended updated curriculum with the support of internet, curriculum related extended contents online prints sample copies of few teachers are attached.**
- ➢ **Evidence of test examination on the basis of extended / updated curriculum conducted**

Academic Year 2018-19
To 2022-23

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Shriman Chandulal Sheth College of Commerce &
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Khed, Dist. Ratnagiri (M.S.) - 415 709.

S.Y. B.Sc
Quantum mechanics
Sem. IV
Topic: Basic Quantum mechanics

Science & Tech

quantum mechanics

physics

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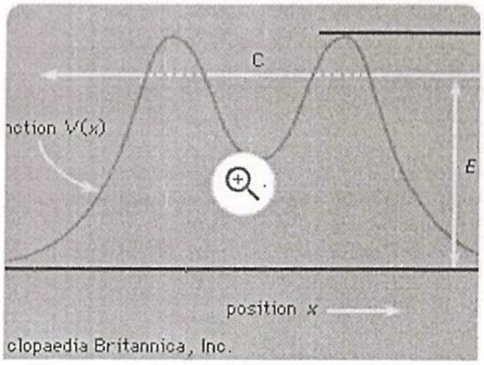
Written by Gordon Leslie Squires
Fact-checked by The Editors of Encyclopaedia Britannica
Last Updated: Oct 17, 2023 • Article History

Table of Contents

Quantum mechanics, science dealing with the behaviour of matter and light on the atomic and subatomic scale. It attempts to describe and account for the properties of molecules and atoms and their constituents—electrons, protons, neutrons, and other more esoteric particles such as quarks and gluons. These properties include the interactions of the particles with one another and with electromagnetic radiation (i.e., light, X-rays, and gamma rays).



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Key People: Werner Heisenberg • John von Neumann • P.A.M. Dirac • Richard Feynman • Pascual Jordan

Related Topics: quantum field theory • quantum • S-matrix • energy level • wave mechanics

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IV

The behaviour of matter and radiation on the atomic scale often seems peculiar, and the consequences of quantum theory are accordingly difficult to understand and to believe. Its concepts frequently conflict with common-sense notions derived from observations of the everyday world. There is no reason, however, why the behaviour of the atomic world should conform to that of the familiar, large-scale world. It is important to realize that quantum mechanics is a branch of physics and that the business of physics is to describe and account for the way the world—on both the large and the small scale—actually is and not how one imagines it or would like it to be.

The study of quantum mechanics is rewarding for several reasons. First, it illustrates the essential methodology of physics. Second, it has been enormously successful in giving correct results in practically every situation to which it has been applied. There is, however, an intriguing paradox. In spite of the overwhelming practical success of quantum mechanics, the foundations of the subject contain unresolved problems—in particular, problems concerning the nature of measurement. An essential feature of quantum mechanics is that it is generally impossible, even in principle, to measure a system without disturbing it; the detailed nature of this disturbance and the exact point at which it occurs are obscure and controversial. Thus, quantum mechanics attracted some of the ablest scientists of the 20th century, and they erected what is perhaps the finest intellectual edifice of the period.

Historical basis of quantum theory

Basic considerations

At a fundamental level, both radiation and matter have characteristics of particles and waves. The gradual recognition by scientists that radiation has particle-like properties and that matter has wavelike properties provided the impetus for the development of quantum mechanics. Influenced by Newton, most physicists of the 18th century believed that light consisted of particles, which they called corpuscles. From about 1800, evidence began to accumulate for a wave theory of light. At about this time Thomas Young showed that, if monochromatic light passes through a pair of slits, the two emerging beams interfere, so that a fringe pattern of alternately bright and dark bands appears on a screen. The bands are readily explained by a wave theory of light. According to the theory, a bright band is produced when the crests (and troughs) of the waves from the two slits arrive together at the screen; a dark band is produced when the crest of one wave arrives at the same time as the trough of the other, and the effects of the two light beams cancel. Beginning in 1815, a series of experiments by Augustin-Jean Fresnel of France and others showed that, when a parallel beam of light passes through a single slit, the emerging beam is no longer parallel but starts to diverge; this phenomenon is known as diffraction. Given the wavelength of the light and the geometry of the apparatus (i.e., the separation and widths of the slits and the distance from the slits to the screen), one can use the wave theory to calculate the expected pattern in each case; the theory agrees precisely with the experimental data.

Early developments

Planck's radiation law

By the end of the 19th century, physicists almost universally accepted the wave theory of light. However, though the ideas of classical physics explain interference and diffraction phenomena relating to the propagation of light, they do not account for the absorption and emission of light. All bodies radiate electromagnetic energy as heat; in fact, a body emits radiation at all wavelengths. The energy radiated at different wavelengths is a maximum at a wavelength that depends on the temperature of the body; the hotter the body, the shorter the wavelength for maximum radiation. Attempts to calculate the energy distribution for the radiation from a blackbody using classical ideas were unsuccessful. (A blackbody is a hypothetical ideal body or surface that absorbs and reemits all radiant energy falling on it.) One formula, proposed by Wilhelm Wien of Germany, did not agree with observations at long wavelengths, and another, proposed by Lord Rayleigh (John William Strutt) of England, disagreed with those at short wavelengths.

In 1900 the German theoretical physicist Max Planck made a bold suggestion. He assumed that the radiation energy is emitted, not continuously, but rather in discrete packets called quanta. The energy E of the quantum is related to the frequency ν by $E = h\nu$. The quantity h, now known as Planck's constant, is a universal constant with the approximate value of 6.62607×10^{-34} joule·second. Planck showed that the calculated energy spectrum then agreed with observation over the entire wavelength range.

Einstein and the photoelectric effect

In 1905 Einstein extended Planck's hypothesis to explain the photoelectric effect, which is the emission of electrons by a metal surface when it is irradiated by light or more-energetic photons. The kinetic energy of the emitted electrons depends on the frequency ν of the radiation, not on its intensity; for a given metal, there is a threshold frequency ν_0 below which no electrons are emitted. Furthermore, emission takes place as soon as the light shines on the surface; there is no detectable delay. Einstein showed that these results can be explained by two assumptions: (1) that light is composed of corpuscles or photons, the energy of which is given by Planck's relationship, and (2) that an atom in the metal can absorb either a whole photon or nothing. Part of the energy of the absorbed photon frees an electron, which requires a fixed energy W, known as the work function of the metal; the rest is converted into the kinetic energy $m_e u^2/2$ of the emitted electron (m_e is the mass of the electron and u is its velocity). Thus, the energy relation is

photoelectric effect: Einstein's Nobel Prize-winning discovery

Brian Greene discusses the key formula in the photoelectric effect, an insig...(more)

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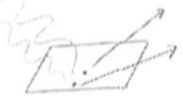

$$h\nu = W + \frac{m_e u^2}{2}. \tag{1}$$

If ν is less than ν_0, where $h\nu_0 = W$, no electrons are emitted. Not all the experimental results mentioned above were known in 1905, but all Einstein's predictions have been verified since.

Bohr's theory of the atom

A major contribution to the subject was made by Niels Bohr of Denmark, who applied the quantum hypothesis to atomic spectra in 1913. The spectra of light emitted by gaseous atoms had been studied extensively since the mid-19th century. It was found that radiation from gaseous atoms at low pressure consists of a set of discrete wavelengths. This is quite unlike the radiation from a solid, which is distributed over a continuous range of wavelengths. The set of discrete

19|02|2020

I.C.S. College of Arts, Commerce and Science, Khed

Unit Test-2019-2020

Subject: Physics
Paper No.-II
Time: 20 min.

Class: S.Y. B.Sc.
Semester - IV
Max. Marks: 10

Name of the paper: Quantum Mechanics

1) The application of the Schrodinger's equation enable us to compare the predications of

a) quantum mechanics

b) classical mechanics

c) none of these

d) **both a & b**

2) The state function ψ(x) has physical dimensions of

a) $(1/\sqrt{2})^2$

b) $1/\sqrt{2}$

c)1/2

d)1/2

3) The dynamic property of single particle motion is

a) one dimensional problems

b) two dimensional problems

c) three dimensional problems

d) none of these

4) Schrodinger equation is a

a) 1st order differential equation

b) 2nd order differential equation

c) both a & b

d) none of these

5) The state corresponding to this energy range are called

a) bound state

b) unbound state

c) discrete state

d) both a & c

6) The energy Spectra of bound state are

(a) Continuous

(b) Discrete

(c) Degenerate

(d) Non Degenerate

7) The value of probability density will be

a)$1/\sqrt{2}$

b) 1/2

c)1/3

d)$(1/2)^2$

8) The typical example of Bound State is

(a) Infinite square well potential

(b) Harmonic Oscillator

(c) Finite Square well Potential

(d) a & b

9) Schrodinger Equation admits only :_

A. Discrete Solutions

B . infinite solution

C. Continuous solution

D. Both a & c

10) Unbound states gives always:_

A. Intensity Graph

B. Discrete Spectrum

C. Continuous Spectrum

D. None of these

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date- 17/02/2020

All S.Y.B.Sc. students are here by informed that class test will be conducted as on **19/02/2020** on **Topic Name-** 'Quantum Mechanics' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

I.C.S. College of Arts, Commerce and Science, Khed
Unit Test-2019-2020

Subject: Physics **Class: S.Y. B.Sc.**
Paper No.-II **Semester - IV**
Time: 20 min. **Max. Marks: 10**

Name of the paper: Quantum Mechanics

Name of the student: Chavan Pratik Pramod.

Roll no.

Instruction:

- ✓ Tick correct option

1) The application of the Schrodinger's equation enable us to compare the predications of

a) quantum mechanics

b) classical mechanics

c) none of these

[✓ d) both a & b]

2) The state function ψ(x) has physical dim

a) $(1/\sqrt{2})^2$

[✓ b) $1/\sqrt{2}$]

c)1/2

d)1/2

3) The dynamic property of single particle motion is

[✓ a) one dimensional problem]

b) two dimensional problems

c) three dimensional problems

d) none of these

4) Schrodinger equation is a

a) 1st order differential equation

b) 2nd order differential equation

[✓ c) both a & b]

d) none of these

5) The state corresponding to this energy range are called

a) bound state

[✓ b) unbound state]

c) discrete state

d) both a & c

6) The energy Spectra of bound state are

(a) Continuous

[✓ (b) Discrete]

(c) Degenerate

(d) Non Degenerate

7) The value of probability density will be

a)1/√2

[✓ b) 1/2]

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d) $(1/2)^2$

8) The typical example of Bound State is

(a) Infinite square well potential

(b) Harmonic Oscillator

(c) Finite Square well Potential

[✓ (d) a & b]

9) Schrodinger Equation admits only: _

a. Discrete Solutions

b. infinite solution

c. Continuous solution

[✓ d. Both a & c]

10) Unbound states give always: _

a. Intensity Graph

b. Discrete Spectrum

[✓ c. Continuous Spectrum]

d. None of these

$\frac{10}{10}$

I.C.S. College of Arts, Commerce and Science, Khed
Unit Test-2019-2020

Subject: Physics **Class: S.Y. B.Sc.**
Paper No.-II **Semester - IV**
Time: 20 min. **Max. Marks: 10**

Name of the paper: Quantum Mechanics

Name of the student: --Bhuvad Sushma Sitaram------------------------

Roll no.

Instruction:

- ✓ Tick correct option

1) The application of the Schrodinger's equation enable us to compare the predications of

a) quantum mechanics

b) classical mechanics

c) none of these

[✓ d) both a & b]

2) The state function ψ(x) has physical dim

a) $(1/\sqrt{2})^2$

[✓ b) $1/\sqrt{2}$]

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3) The dynamic property of single particle motion is

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b) 2nd order differential equation

[✓ c) both a & b]

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(a) Continuous

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(d) Non Degenerate

7) The value of probability density will be

a)1/√2

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d) $(1/2)^2$

8) The typical example of Bound State is

(a) Infinite square well potential

(b) Harmonic Oscillator

(c) Finite Square well Potential

[✓ (d) a & b]

9) Schrodinger Equation admits only: _

a. Discrete Solutions

b. infinite solution

c. Continuous solution

[✓ d. Both a & c]

10) Unbound states give always: _

a. Intensity Graph

b. Discrete Spectrum

[✓ c. Continuous Spectrum]

d. None of these

$\frac{10}{10}$

Result

Sr. No.	Roll No.	Name of the students	Obtained Marks
1	3	AMBRE SIDDHARAJ SUBHASH	10
2	5	BHUVAD SUSHMA SITARAM	10
3	9	CHAVAN PRATIK PRAMOD	10
4	10	CHIKHALKAR SACHIN SANTOSH	9
5	15	GARATE SWARUP KAMALAKAR	8
6	20	HATKAR ROMESH ANIL	10
7	27	JAWALE SANYOG SANJAY	10
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17	77	AKHADE SURESH KASHIRAM	6
18	78	AMBRE MANDAR DILIP	7
19	79	AMBRE YASH SUDHIR	9
20	80	GAMARE MANTHAN MILIND	10
21	81	GAMARE TUSHAR MOHAN	10
22	84	NAYNAK VAIBHAV KERU	10
23	85	PATIL PRAFUL BALU	10

A.palit

S.Y.B.Sc
Optics
Sem. IV

Dispersion

Dispersion is defined to be the spreading of white light into its full spectrum of wavelengths.

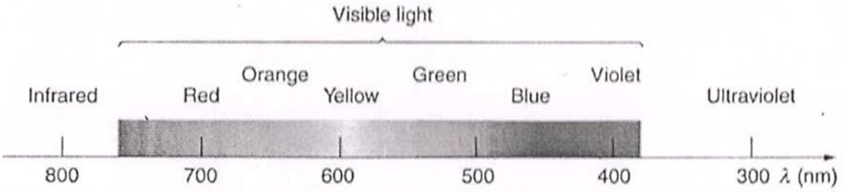

Figure 25.22 Even though rainbows are associated with seven colors, the rainbow is a continuous distribution of colors according to wavelengths.

Refraction is responsible for dispersion in rainbows and many other situations. The angle of refraction depends on the index of refraction, as we saw in The Law of Refraction. We know that the index of refraction n depends on the medium. But for a given medium, n also depends on wavelength. (See Table 25.2. Note that, for a given medium, n increases as wavelength decreases and is greatest for violet light. Thus violet light is bent more than red light, as shown for a prism in Figure 25.23(b), and the light is dispersed into the same sequence of wavelengths as seen in Figure 25.21 and Figure 25.22.

Making Connections: Dispersion

Any type of wave can exhibit dispersion. Sound waves, all types of electromagnetic waves, and water waves can be dispersed according to wavelength. Dispersion occurs whenever the speed of propagation depends on wavelength, thus separating and spreading out various wavelengths. Dispersion may require special circumstances and can result in spectacular displays such as in the production of a rainbow. This is also true for sound, since all frequencies ordinarily travel at the same speed. If you listen to sound through a long tube, such as a vacuum cleaner hose, you can easily hear it is dispersed by interaction with the tube. Dispersion, in fact, can reveal a great deal about what the wave has encountered that disperses its wavelengths. The dispersion of electromagnetic radiation from outer space, for example, has revealed much about what exists between the stars—the so-called empty space.

Table 25.2 Index of Refraction n in Selected Media at Various Wavelengths

Medium	Red (660 nm)	Orange (610 nm)	Yellow (580 nm)	Green (550 nm)	Blue (470 nm)	Violet (410 nm)
Water	1.331	1.332	1.333	1.335	1.338	1.342
Diamond	2.410	2.415	2.417	2.426	2.444	2.458
Glass, crown	1.512	1.514	1.518	1.519	1.524	1.530
Glass, flint	1.662	1.665	1.667	1.674	1.684	1.698
Polystyrene	1.488	1.490	1.492	1.493	1.499	1.506
Quartz, fused	1.455	1.456	1.458	1.459	1.462	1.468

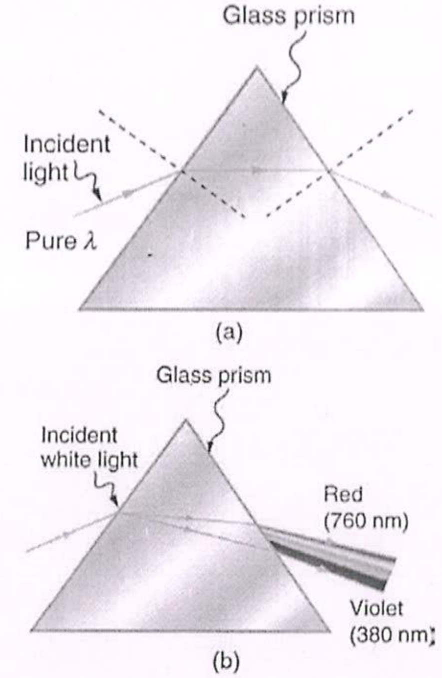

Figure 25.23 (a) A pure wavelength of light falls onto a prism and is refracted at both surfaces. (b) White light is dispersed by the prism (shown exaggerated). Since the index of refraction varies with wavelength, the angles of refraction vary with wavelength. A sequence of red to violet is produced, because the index of refraction increases steadily with decreasing wavelength.

Rainbows are produced by a combination of refraction and reflection. You may have noticed that you see a rainbow only when you look away from the sun. Light enters a drop of water and is reflected from the back of the drop, as shown in Figure 25.24. The light is refracted both as it enters and as it leaves the drop. Since the index of refraction of water varies with wavelength, the light is dispersed, and a rainbow is observed, as shown in Figure 25.25 (a). (There is no dispersion caused by reflection at the back surface, since the law of reflection does not depend on wavelength.) The actual rainbow of colors seen by an observer depends on the myriad of rays being refracted and reflected toward the observer's eyes from numerous drops of water. The effect is most spectacular when the background is dark, as in stormy weather, but can also be observed in waterfalls and lawn sprinklers. The arc of a rainbow comes from the need to be looking at a specific angle relative to the direction of the sun, as illustrated in Figure 25.25 (b). (If there are two reflections of light within the water drop, another "secondary" rainbow is produced. This rare event produces an arc that lies above the primary rainbow arc—see Figure 25.25 (c).)

Rainbows

Rainbows are produced by a combination of refraction and reflection.

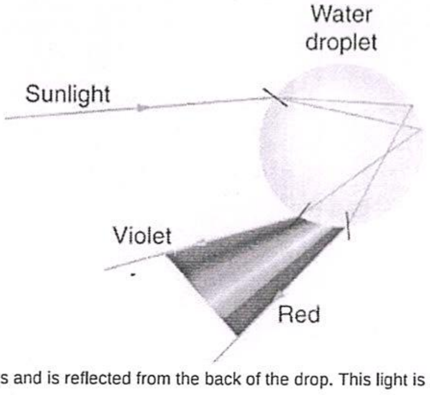

Figure 25.24 Part of the light falling on this water drop enters and is reflected from the back of the drop. This light is refracted and dispersed both as it enters and as it leaves the drop.

09|09|2019

I.C.S. College of Arts, Commerce and Science, Khed
Unit Test-2019-2020

Subject: Physics **Class: S.Y. B.Sc.**
Paper No.-II **Semester - III**
Time: 20 min. **Max. Marks: 10**

Name of the paper: Optics

---

1. Which of the following lights deviates the most when it passes through a prism?

   a. Red Light
   b. Violet Light
   c. Neither (a) nor (b)
   d. Both (a) and (b)

2. Which of the following phenomena of light results in a mirage?

   a. Refraction of light
   b. Reflection of light
   c. Total internal reflection
   d. Diffraction of light

3. For which of the following is the field of view maximum?

   a. Concave mirror
   b. Convex mirror
   c. Plane mirror
   d. Cylindrical mirror

4. What happens when the light is refracted into a medium?

   a. Both frequency and wavelength of the light increase
   b. The wavelength increases but the frequency remains unchanged
   c. Both wavelength and frequency decrease
   d. The wavelength decreases but the frequency remains constant

5. If a glass prism is dipped in water, what happens to its dispersive power?

   a. Increases
   b. Decreases
   c. Does not change
   d. No effect

6. What should be increased to increase the angular magnification of a simple microscope?

   a. The power of the lens
   b. The focal length of the lens
   c. Lens Aperture

d. Object Size

7. Which of the following phenomenon is used in optical fibre?

a. Refraction
b. Diffraction
c. Scattering
d. Total Internal Reflection

8. Which of the following statements is true for total internal reflection?

a. Light travels from rarer medium to denser medium
b. Light travels from denser medium to rarer medium
c. Light travels in water only
d. Light travels in the air only

9. A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then what is its focal length?

a. Focal Length will become zero
b. Focal Length will become infinite
c. Focal length will reduce, but not become zero
d. Remains unchanged

10. For a telescope, the larger the diameter of the objective lens

a. Greater the resolving power
b. Greater the magnifying power
c. Smaller the resolving power
d. Smaller the magnifying power

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SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/

Date :

Notice

Date- 07/09/2019

All S.Y.B.Sc. students are here by informed that class test will be conducted as on **09/09/2019** on **Topic Name-** 'Optics' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

I.C.S. College of Arts, Commerce and Science, Khed
Unit Test-2019-2020

Subject: Physics | **Class: S.Y. B.Sc.**
Paper No.-II | **Semester - III**
Time: 60 min. | **Max. Marks: 10**

Name of the paper: Optics

Name of the student: Ambre siddharaj Subhash

Roll no.

Instruction:

✓ Tick corrects option

1. Which of the following lights deviates the most when it passes through a prism?

   a. Red Light
   [✓ b. Violet Light]
   c. Neither (a) nor (b)
   d. Both (a) and (b)

2. Which of the following phenomena of light results in a mirage?

   a. Refraction of light
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   [✓ c. Total internal reflection]
   d. Diffraction of light

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   d. The wavelength decreases but the frequency remains constant

5. If a glass prism is dipped in water, what happens to its dispersive power?

   a. Increases
   [✓ b. Decreases]
   c. Does not change
   d. No effect

6. What should be increased to increase the angular magnification of a simple microscope?

   [✓ a. The power of the lens]
   b. The focal length of the lens
   c. Lens Aperture
   d. Object Size

7. Which of the following phenomenon is used in optical fibre?

   a. Refraction
   b. Diffraction
   c. Scattering
   [✓ d. Total Internal Reflection]

8. Which of the following statements is true for total internal reflection?

   a. Light travels from rarer medium to denser medium
   b. Light travels from denser medium to rarer medium
   [✓ c. Light travels in water only]
   d. Light travels in the air only

9. A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then what is its focal length?

   a. Focal Length will become zero
   [✓ b. Focal Length will become infinite]
   c. Focal length will reduce, but not become zero
   d. Remains unchanged

10. For a telescope, the larger the diameter of the objective lens

   [✓ a. Greater the resolving power]
   b. Greater the magnifying power
   c. Smaller the resolving power
   d. Smaller the magnifying power

$\frac{09}{10}$

Result

Sr. No.	Roll No.	Name of the students	Obtained Marks
1	3	AMBRE SIDDHARAJ SUBHASH	9
2	5	BHUVAD SUSHMA SITARAM	10
3	9	CHAVAN PRATIK PRAMOD	10
4	10	CHIKHALKAR SACHIN SANTOSH	9
5	15	GARATE SWARUP KAMALAKAR	8
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7	27	JAWALE SANYOG SANJAY	7
8	38	MAHADE NUTAN SANJAY	5
9	39	MANDAVKAR KALPESH SATISH	9
19	40	MANDAVKAR NARESH RAMCHANDRA	10
11	45	MENGADE YOGESH DIPAK	10
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13	56	PAWAR TEJAS VINAYAK	8
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17	77	AKHADE SURESH KASHIRAM	9
18	78	AMBRE MANDAR DILIP	10
19	79	AMBRE YASH SUDHIR	10
20	80	GAMARE MANTHAN MILIND	9
21	81	GAMARE TUSHAR MOHAN	8
22	84	NAYNAK VAIBHAV KERU	9
23	85	PATIL PRAFUL BALU	10

A. Patil

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,
Shriman Chandulal Sheth College of Commerce,
Shrimati Shobhanatai Chandulal Sheth College of Science,
Khed-Ratnagiri, Maharashtra, India.

TEACHING LEARNING BEYOND CURRICULUM FILE

- **NAME OF THE TEACHER –**

  MRS. RAKHI SURESH SHET

- **QUALIFICATION –**

  M.SC., (FISHERY)

- **SUBJECT –**

  ZOOLOGY

Sahajeevan Shikshan Sanstha's

Shrimati Indira Mahadev Beharay College of Arts,

Shriman Chandulal Sheth College of Commerce, ShrimatiShobhanatai Chandulal Sheth College of Science,

Khed-Ratnagiri, Maharashtra, India.

Evidences of teacher taught beyond curriculum

- **Extended updated curriculum with the support of internet, curriculum related extended contents online prints sample copies of few teachers are attached.**
- **Evidence of test examination on the basis of extended / updated curriculum conducted**

Academic Year 2018-19
To 2022-23

I/C PRINCIPAL,
Shrimati Indira Mahadev Beharay College of Arts
Shriman Chandulal Sheth College of Commerce &
Shrimati Shobhanatai Chandulal Sheth College of Scienc
Khed, Dist. Ratnagiri (M.S.)- 415 709.

Paper Name - Histology, Toxicology, Pathology &
Biostatistics.

Topic Name - General Pathology.

Class - T.Y.B.Sc.

Variability in endometrial carcinoma pathology practice: opportunities for improvement with molecular classification

We assessed the landscape of diagnostic pathology practice and how molecular classification could potentially impact management of patients with endometrial cancer by collecting patient samples, clinicopathologic data, and patient outcomes from EC patients diagnosed in 2016 at 10 Canadian tertiary cancer centers and 19 community hospitals. ProMisE molecular subtype (*POLE*mut, MMRd, p53abn, No Specific Molecular Profile (NSMP)) was assigned retrospectively. 1357 patients were fully evaluable including 85 *POLE*mut (6.3%), 380 MMRd (28.0%), 643 NSMP (47.4%), and 249 p53abn ECs (18.3%). Immunohistochemistry (IHC) for MMR proteins was undertaken at the time of primary diagnosis in 2016 in only 42% of the cohort (570/1357; range 3.5–95.4%/center). p53 IHC had only been performed in 21.1% of the cohort (286/1357; range 10.1–41.9%/center). Thus, based on the retrospective molecular subtype assignment, 54.7% (208/380) of MMRd EC had not been tested with MMR IHC (or MSI) and 48.2% (120/249) of p53abn ECs were not tested with p53 IHC in 2016. Molecular subtype diversity within histotypes was profound; most serous carcinomas were p53abn (91.4%), but only 129/249 (51.8%) p53abn EC were serous. Low-grade (Gr1-2) endometrioid carcinomas were mostly NSMP (589/954, 61.7%) but included all molecular subtypes,

including p53abn (19/954, 2.0%). Molecular subtype was significantly associated with clinical outcomes.($p < 0.001$) even in patients with stage I disease (OS $p = 0.006$, DSS $p < 0.001$, PFS $p < 0.001$). Assessment of national pathologic practice in 2016 shows highly variable use of MMR and p53 IHC and demonstrates significant opportunities to improve and standardize biomarker reporting. Inconsistent, non-reflexive IHC resulted in missed opportunities for Hereditary Cancer Program referral and Lynch Syndrome diagnosis, and missed potential therapeutic implications (e.g., chemotherapy in p53abn EC, immune blockade for MMRd EC). Routine integration of molecular subtyping into practice can improve the consistency of EC pathology assessment and classification.

Sahajeevan shikshan santha's

SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS

SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE

SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

SEMESTER – V (2021-22) **Time: 1 hrs**

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Q.1 Choose the correct option. 10

Q. 1 Which of the following characteristics of developed countries may correlate with their higher incidence of endometrial cancer?

a. Use of oral contraceptives

b. Higher levels of air pollution

c. High-fat diets

d. Lack of condom use

Q.2 Which one of the following is usually one of the earliest symptoms of endometrial cancer?

a. Abnormal or excessive bleeding without pain
b. Excessive bleeding and pelvic pain
c. Abdominal pressure and watering discharge
d. Pain during intercourse

Q.3 Which treatment option (s) are best while the cancer is still localized to the uterus?
a. Surgery
b. Hormone therapy
c. Surgery and chemotherapy
d. Surgery and hormone therapy
e. Localized Radiation

Q.4 Where does endometrial cancer begin?

a. In the endometrium of the bladder
b. In the layer of cells that form the lining (endometrium) of the uterus
c. In the bladder
d. None of the above

Q.5 Endometrial cancer is often detected at------------because it frequently produces-------------.

a. Early stage, produces bile acid
b. Early stage, produces abnormal vaginal bleeding
c. Late stage, produces stones
d. Late stage, produces abnormal vaginal bleeding

Q.6 Symptoms for endometrial cancer include:

a. Vaginal bleeding after menopause
b. Bleeding between periods
c. Pelvic pain
d. All of the above

Q.7 Starting menstruation before which age may be a risk factor for future endometrial cancer?

a. Before age 18
b. Before age 16
c. Before age 14
d. Before age 12

Q. 8 Which of the below tests are done to diagnose endometrial cancer?

a. Chest X-ray
b. Computerized tomography
c. Position emission tomography
d. All of the above

Q.9 For treatment of endometrial cancer, where is the radiation is done?

a. From inside the body
b. From outside of the body
c. From both sides
d. Radiation is not an option for this cancer

Q. 10 Drug combinations used for endometrial cancer include:

a. Carboplatin-Taxol
b. Keytruda-Taxol
c. Lenvima-Taxol
d. Megestrol-Taxol

Answer key

1	c. High-fat diets
2	a. Abnormal or excessive bleeding without pain
3	a. Surgery
4	b. In the layer of cells that form the lining (endometrium) of the uterus
5	b. Early stage, produces abnormal vaginal bleeding
6	d. All of the above
7	d. Before age 12
8	d. All of the above
9	b. From outside of the body
10	a. Carboplatin-Taxol

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
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NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
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Ph No. 02356-260100
: 8888260100
E-mail : principalics@yahoo.co.in • principal@icskhed.edu.in • icscmit@gmail.com • cmit@icskhed.edu.in • Web : www.icskhed.edu.in • www.icskhed.org

Ref. No.: ICS/ **Date :**

Notice

Date- 28/09/2021

All T.Y.B.Sc. Students are here by informed that class test will be conducted as on **30/09/2021** on **Topic Name-** 'General Pathology' as part of teaching learning beyond curriculum.

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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

SEMESTER – V (2021-22) **Time: 1 hrs**

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Name of the student: Bade Danisha Iqbal.

Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10**

Q. 1 Which of the following characteristics of developed countries may correlate with their higher incidence of endometrial cancer?

a. Use of oral contraceptives

b. Higher levels of air pollution

[✓ c. High-fat diets]

d. Lack of condom use

Q.2 Which one of the following is usually one of the earliest symptoms of endometrial cancer?

[✓ a. Abnormal or excessive bleeding without pain]
b. Excessive bleeding and pelvic pain
c. Abdominal pressure and watering discharge
d. Pain during intercourse

Q.3 Which treatment option (s) are best while the cancer is still localized to the uterus?

[✓ a. Surgery]
b. Hormone therapy
c. Surgery and chemotherapy
d. Surgery and hormone therapy
e. Localized Radiation

Q.4 Where does endometrial cancer begin?
a. In the endometrium of the bladder
[✓ b. In the layer of cells that form the lining (endometrium) of the uterus]
c. In the bladder
d. None of the above

Q.5 Endometrial cancer is often detected at-------------because it frequently produces-------------.
a. Early stage, produces bile acid
[✓ b. Early stage, produces abnormal vaginal bleeding]
c. Late stage, produces stones
d. Late stage, produces abnormal vaginal bleeding

Q.6 Symptoms for endometrial cancer include:
a. Vaginal bleeding after menopause
b. Bleeding between periods
c. Pelvic pain
[✓ d. All of the above]

Q.7 Starting menstruation before which age may be a risk factor for future endometrial cancer?a. Before age 18
b. Before age 16
c. Before age 14
[✓ d. Before age 12]

Q. 8 Which of the below tests are done to diagnose endometrial cancer?

a. Chest X-ray
b. Computerized tomography
c. Position emission tomography
[✓ d. All of the above]

Q.9 For treatment of endometrial cancer, where is the radiation is done?
a. From inside the body
[✓ b. From outside of the body]
c. From both sides
d. Radiation is not an option for this cancer

Q. 10 Drug combinations used for endometrial cancer include:
[✓ a. Carboplatin-Taxol]
b. Keytruda-Taxol
c. Lenvima-Taxol
d. Megestrol-Taxol

Sahajeevan shikshan santha's

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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

SEMESTER – V (2021-22) **Time: 1 hrs**

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Name of the student: Khedekar Ayesha Abdul.

Roll no.

Instruction:

✓ Tick correct option

Q.1 Choose the correct option. **10**

Q. 1 Which of the following characteristics of developed countries may correlate with their higher incidence of endometrial cancer?

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c. Abdominal pressure and watering discharge
d. Pain during intercourse

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c. Surgery and chemotherapy
d. Surgery and hormone therapy
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Khed, Ratnagiri

SEMESTER – V (2021-22) Time: 1 hrs

CLASS: T.Y.B.Sc TOTAL MARKS: 10

Name of the student: Parkar Samiya Fayyaz.

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. 10

Q. 1 Which of the following characteristics of developed countries may correlate with their higher incidence of endometrial cancer?

a. Use of oral contraceptives

b. Higher levels of air pollution

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d. Lack of condom use

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d. Pain during intercourse

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c. Surgery and chemotherapy
d. Surgery and hormone therapy
e. Localized Radiation

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b. Keytruda-Taxol
c. Lenvima-Taxol
d. Megestrol-Taxol

Result-

Sr. No.	Name Of Student	Marks/10
1	BADE DANISA IQBAL	10
2	JANGAM ADITI SUDHIR	9
3	KADIRI SANA SAYED	9
4	KHEDEKAR AYESHA ABDUL	10
5	MAHADIK AQSA AFZAL	10
6	MARWA A RAB	9
7	MUKADAM YUSRA HIDAYAT	9
8	MULLAJI IQRA JAVEED	9
9	PARKAR AHLAM ANIS	8
10	PARKAR SAIMA FAYYAZ	10
11	PARKAR SHAKILA FAIYYAZ	10
12	PARTE AKSHATA SHANKAR	9
13	SAWANT YUGANDHAR MANAJI	9

Result-

Sr. No.	Name Of Student	Marks/10
1	BADE DANISA IQBAL	10
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5	MAHADIK AQSA AFZAL	10
6	MARWA A RAB	9
7	MUKADAM YUSRA HIDAYAT	9
8	MULLAJI IQRA JAVEED	9
9	PARKAR AHLAM ANIS	8
10	PARKAR SAIMA FAYYAZ	10
11	PARKAR SHAKILA FAIYYAZ	10
12	PARTE AKSHATA SHANKAR	9
13	SAWANT YUGANDHAR MANAJI	9

HEAD,
Dept of Zoology
J. C. S. College, Khed.
(Ratnagiri)

Paper Name - Histology, Toxicology, Pathology & Biostatistics.

Topic Name - Toxicology.

Class - T.Y.B.Sc.

Toxicoepidemiology of poisoning exhibited in Indian population from 2010 to 2020: a systematic review and meta-analysis

Objective

To determine the prevalence of pesticide, corrosive, drugs, venom and miscellaneous poisoning in India.

Setting

Systematic literature search was done in PubMed Central, Cochrane and Google Scholar databases for studies that satisfied the inclusion criteria. Systematic review and meta-analyses of all observational studies published in the English language from January 2010 to May 2020 were included in this review.

Participants

Patients exposed to poisoning reported to hospitals were included.

Primary and secondary outcome measures

The prevalence of pesticide poisoning was analysed. The prevalence of poisoning due to corrosives, venom, drugs and miscellaneous agents, along with subgroup analysis based on age and region, was also determined. The percentage of persons with poisoning along with 95% CI was analysed.

Results

Pooled analysis of studies revealed that pesticides were the main cause of poisoning in adults, with an incidence of 63% (95% CI 63% to 64%), while miscellaneous agents were the main cause of poisoning in children, with an incidence of 45.0% (95% CI 43.1% to 46.9%), among those presenting to hospitals. Pesticide poisoning was the most prevalent in North India (79.1%, 95% CI 78.4% to 79.9%), followed by South (65.9%, 95% CI 65.3% to 66.6%), Central (59.2%, 95% CI 57.9% to 60.4%), West (53.1%, 95% CI 51.9% to 54.2%), North East (46.9%, 95% CI 41.5% to 52.4%) and East (38.5%, 95% CI 37.3% to 39.7%). The second most common cause of poisoning was miscellaneous agents (18%, 95% CI 18% to 19%), followed by drugs (10%, 95% CI 10% to 10%), venoms (6%, 95% CI 6% to 6%) and corrosives (2%, 95% CI 1% to 2%).

Conclusions

Pesticide poisoning is the most common type of poisoning in adults, while miscellaneous agents remain the main cause of poisoning in children.

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Khed, Ratnagiri

Time: 2 hrs **SEMESTER – V (2020-21)** **DATE:** 20/08/2020

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Q.1 Choose the correct option. **10**

Q. 1. A toxic substance produced by biological system is specially referred to as a ------

a) Toxicant

[✓ b) Toxin]

c) Xenobiotic

d) Poison

Q.2 Allergic contact dermatitis is

a) A non-immune response caused by a direct action of an agent on the skin

b) an immediate type I hypersensitivity reaction

[✓ c) A delayed type IV hypersensitivity reaction]

d) Characterized by the intensity of reaction being proportional to the elicitation dose

Q. 3 The LD50 is calculated from ------

[✓ a) a quantal dose-response curve]

b) a hormesis dose –response curve

c) a graded dose-response curve

d) a log-log dose-response curve

Q.**4** Regulatory toxicology aims at guarding the public from dangerous chemical exposures, and depends primarily on which form of study:

a. observational human studies.

[✓ b. controlled laboratory animal studies.]

c. controlled human studies.

d. environmental studies.

Q. 5 which of the following toxicity can occur due to single exposure?

[✓ a). Acute toxicity]

b). Sub-acute toxicity

c). Sub-chronic toxicity

d). Chronic toxicity

Q. 6 A newly formed hapten protein complex usually stimulates the formation of a significant amount of antibodies in ---------

a) 1 to 2 min

b) 1 -2 hrs

c) 1-2 days

[✓ d) 1 to 2 weeks]

Q. 7 The most common target organ of toxicity is the ----

a) Heart

b) Lung

[✓ c) CNS (brain and spinal cord)]

d) Skin

Q. 8 The organs least involved in systemic toxicity are ---

a) brain and peripheral nerves

[✓ b) Muscle and bone]

c) Liver and kidney

d) Hematopoietic system and lungs

Q.9 The use of antitoxin in the treatment of snakebite is an example of ------

a) Dispositional antagonism

[✓ b) Chemical antagonism]

c) Receptor antagonism

d) Functional antagonism

Q.10 which of the following are tools used in risk analysis?

a. toxicology

b. epidemiology

c. clinical trials

[✓ d. all of the above.]

10/10

Answer key –

1	b) Toxin
2	c) A delayed type IV hypersensitivity reaction
3	a) a quantal dose-response curve
4	b. controlled laboratory animal studies.
5	a). Acute toxicity
6	d) 1 to 2 weeks
7	c) CNS (brain and spinal cord)
8	b) Muscle and bone
9	b) Chemical antagonism
10	d. all of the above.

Estd.-1990

।। राष्ट्रोध्दारार्थ सेवामहे ।।
Sahajeevan Shikshan Sanstha's
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Ref. No.: ICS/ **Date :**

Notice

Date- 17/08/2020

All T.Y.B.Sc. Students are here by informed that class test will be conducted as on **20/08/2020** on **Topic Name-** 'Toxicology' as part of teaching learning beyond curriculum.

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Khed, Ratnagiri

Time: 1 hrs SEMESTER – V (2020-21) DATE:

CLASS: T.Y.B.Sc TOTAL MARKS: 10

Name of the student: Mariya [illegible] Aisha Ibrahim

Roll no.

Instruction:

- ✓ Tick correct option

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c. clinical trials

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10/10

Sahajeevan shikshan santha's

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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

Time: 1 hrs **SEMESTER – V (2020-21)** **DATE:**

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Name of the student: Pardaker Sara Wajuddin

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10**

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10/10

Result -

Sr No.	Name Of Student	Marks/10
1	MANIYAR AISHA IBRAHIM	10
2	MUKADAM SADAF MUSHTAK	9
3	MURUDKAR AYESHA A RAUF	10
4	PARKAR SARA WAJUDDIN	10
5	PATNE PARTH MANDAR	9
6	RATHOD AASHA GIRMAL	9
7	SURVE IRAM MD ISMAIL	10

HEAD,
Dept of Zoology
I. C. S. College, Khed,
(Ratnagiri)

Paper Name- Ethology, Parasitology, Economic zoology.
Topic Name - Dairy science - Dairy development in india.
Class - T.Y.B.Sc.

Dairy Sector to grow at over 6% in 2023 - govt

The dairy sector is expected to growth at more than 6% in 2023-24, said Union Animal Husbandry and Dairying minister Parshottam Rupala.

“Milk production is growing at the annual growth rate (CAGR) of 6.1% over the last eight years, and in the coming season, it is expected to grow at over 6%," the minister said while addressing reporters on nine-year achievements of Department of Animal Husbandry and Dairying.

Emphasising the domestic supply, Rupala said, “there is no supply constraint of milk in the country and there is ample quantity of milk powder."
This comes after a buzz around supply crunch pushing up retail milk prices steeply in 2022-23.
Dairy is the single largest agricultural commodity that contributes 5% to India’s national economy and employ more than 8 crore farmers directly. In 2023, the average retail price of milk in the country has shot up by 10% in June year-on-year to ₹57.61 per litre.

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Khed, Ratnagiri

SEMESTER –IV (2022-23) **Time: 1 hrs**

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Q. Choose the correct option. 10

Q.1 expected the dairy industry in India to exhibit a CAGR of ---- during 2023-2028.

a. 13. 2 %

b.14.2 %

c. 15.2 %

d. 16.2 %

Q. 2 Dairy trends includes cultured dairy for

a. immune health

b. dairy for weight management

c. premium cheese for wellness

d. all the above

Q.3 which state is the largest producer of milk producer of milk in india in 2023 ?

a. Rajstan

b. Uttar Pradesh

c. Maharashtra

d. goa

Q.4 The dairy industry in india was valued at INR ------ billionin 2022.

a. 1,899

b. 5.899

c. 10,899

d. 14,899

Q. 5 India has driven the dairy industry alone to grow by _____ % in 2021-22.

a. 8-9%

b. 9-11 %

c. 12 -14 %

d. 15-16 %

Q.6 india has the world's largest dairy herd with over _____ million bovines.

a.100

b. 200

c. 300

d. 400

Q.7 India producing over ---- tones f milk.

a. 177

b. 187

c. 197

d. 200

Q. 8 Rajstan produces _____ million metric tons.

a. 23.3

b. 33.3

c. 43.3

d. 53.3

Q.9 which is the second largest state in india for milk production.

a. goa

b. Maharashtra

c. uttar Pradesh

d. Madhya Pradesh

Q.10 India accounting for --- % of global milk production.

a. 20

b.24

c. 30

d. 34

Answer key

1	a. 13. 2 %
2	d. all the above
3	a. Rajstan
4	d. 14,899
5	b. 9-11 %
6	c. 300
7	b. 187
8	b. 33.3
9	c. uttar Pradesh
10	b.24 %

॥ राष्ट्रोध्दारार्थ सेवामहे ॥

Sahajeevan Shikshan Sanstha's

Estd.-1990

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Ph No. 02356-260100
: 8888260100

E-mail : principalics@yahoo.co.in • principal@icskhed.edu.in • icscmit@gmail.com • cmit@icskhed.edu.in • Web : www.icskhed.edu.in • www.icskhed.org

Ref. No.: ICS/

Notice

Date :

Date- 03/08/2022

All S.Y.B.Sc. students are here by informed that class test will be conducted as on **06/09/2018** on **Topic Name-** 'Dairy science- dairy development in india' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I C.S. College of Arts, Commerce & Sci
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Sahajeevan shikshan santha's

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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

SEMESTER – V (2022-23) **Time: 1 hrs**

CLASS: S.Y.B.Sc **TOTAL MARKS: 10**

Name of the student: Bate Fiza Husain Qadirabanu

Roll no.

Instruction:

- ✓ Tick correct option

Q. Choose the correct option. **10**

Q.1 expected the dairy industry in India to exhibit a CAGR of ---- during 2023-2028.

[✓ a. 13. 2 %]

b.14.2 %

c. 15.2 %

d. 16.2 %

Q. 2 Dairy trends includes cultured dairy for

a. immune health

b. dairy for weight management

c. premium cheese for wellness

[✓ d. all the above]

Q.3 which state is the largest producer of milk producer of milk in india in 2023 ?

[✓ a. Rajstan]

b. Uttar Pradesh

c. Maharashtra

d. goa

Q.4 The dairy industry in india was valued at INR ------ billionin 2022.

a. 1,899

b. 5.899

c. 10,899

[✓ d. 14,899]

Q. 5 India has driven the dairy industry alone to grow by _____ % in 2021-22.

a. 8-9%

[✓ b. 9-11 %]

c. 12 -14 %

d. 15-16 %

Q.6 india has the world's largest dairy herd with over _____ million bovines.

a.100

b. 200

[✓ c. 300]

d. 400

Q.7 India producing over ---- tones f milk.

a. 177

[✓ b. 187]

c. 197

d. 200

Q. 8 Rajstan produces _____ million metric tons.

a. 23.3

[✓ b. 33.3]

c. 43.3

d. 53.3

Q.9 which is the second largest state in india for milk production.

a. goa

b. Maharashtra

[✓ c. uttar Pradesh]

d. Madhya Pradesh

Q.10 India accounting for --- % of global milk production.

a. 20

[✓ b.24]

c. 30

d. 34

$\frac{10}{10}$

Sahajeevan shikshan santha's

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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

SEMESTER – V (2022-23) **Time: 1 hrs**

CLASS: S.Y.B.Sc **TOTAL MARKS: 10**

Name of the student: Duduke Bazila Asif

Roll no.

Instruction:

- ✓ Tick correct option

Q. Choose the correct option. **10**

Q.1 expected the dairy industry in India to exhibit a CAGR of ---- during 2023-2028.

[✓ a. 13. 2 %]

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d. Madhya Pradesh

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a. 20

[✓ b.24]

c. 30

d. 34

10/10

Result –

Sr No.	Name Of Student	Marks/10
1	BATE FIZA HUSAIN QADIRABANU	10
2	DUDUKE BAZILA ASIF	10
3	KAZI FIZA ASHRAF	10
4	PARKAR FATIMA ASLAM	10
5	RAWAL AYESHA ANWAR	10
6	SHAIKH SHIRIN MAHMED	9

HEAD,
Dept of Zoology
J. C. S. College, Khed,
(Ratnagiri)

Paper Name - Genetics and Bioinformatics.

Topic ~~Title~~ Name - Types of Mutation.

class - T.Y. B.Sc.

Bad from Good: Origin of Sickle Cell Anemia

In addition to helping unearth the origins of human species, genome sequencing has also been used to determine the origins of human diseases. Daniel Shriner and Charles N. Rotimi, from the Center for Research on Genomics and Global Health in the National Institutes of Health, studied how sickle cell, a genetic disease that is caused by the sickle cell mutation rs334, developed by comparing genetic sequences of many individuals with sickle cell disease.

Interestingly, a mutation causing sickle cell disease also conveys protection against malaria, another devastating and often deadly disease. Shriner and Rotimi compared the genomes from 2,932 individuals from the 1000 Genomes Project, the African Genome Variation Project, and Qatar. Contrary to the belief that various mutations occurred independently, they discovered that this disease came from a single mutation in one person, occurring about 7,300 years ago.

Sahajeevan shikshan santha's

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Khed, Ratnagiri

year

Time: 2 hrs. **SEMESTER – V (2018-19)** **DATE:**

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Q.1 Choose the correct option. **10**

1. A person who is heterozygous for sickle cell anemia has increased resistance for?

A. Malaria

B. Filariasis

C. Dengue haemorrhagic fever

D. Thalassemia

2. The point mutation leading to sickle cell anaemia occurs.

A. at sixth position in the beta chain of haemoglobin

B. at sixth position in the alpha chain of haemoglobin

C. at sixth position in the beta chain of myoglobin

D. at sixth position in the alpha chain of myoglobin

3. The point mutation in sickle cell anemia leads to change in codon identify the correct change

A. UGA to UAA

B. GUG to GAG

C. GAG to GUG

D. UAA to UGA

4. Sickle cell anaemia results from

A. A chromosomal aberration

B. non disjunction of autosome

C. A point mutation

D. Blood transfusion reaction.

5. symptoms of sickle cell anaemia

a. extreme tiredness

b. headache

c. dizziness

d all

6. A normal women, whose father had colour blindness, married a normal man. What is the chance of occurrence of colour blindness in the progeny?

A. 20 %

B. 50 %

C. 100 %

D. 74 %

7. Which of the genotype could cause sickle cell anemia?

A. $Hb^s + Hb^A$

B. $Hb^A + Hb^A$

C. $Hb^s + Hb^s$

D. Both A and B

8. in sickle cell anaemia blood cell show shape

a. round

b. sickle

c. square

d. none.

9. Which of the following disorder is an example of point mutation?

(a) Sickle cell anaemia

(b) Down's syndrome

(c) Night blindness

(d) Thalassemia

9. Which of the following is a type of autosomal recessive genetic disorder?

(a) Haemophilia

(b) Skeletal dysplasia

(c) Sickle cell anaemia

(d) None of the above

10. Sickle cell anemia is cause by?

A. Deficiency of folic acid

B. Abnormal level of hemoglobin

C. Deficiency of iron

D. Decreased production of red blood cells

Answer key

1	A. Malaria
2	A. at sixth position in the beta chain of haemoglobin
3	C. GAG to GUG
4	C. A point mutation
5	d all
6	B. 50 %
7	A. $Hb^s + Hb^A$
8	b. sickle
9	C. Sickle cell anaemia
10	B. Abnormal level of hemoglobin

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE
KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
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Ref. No.: ICS/ **Date :**

Notice

Date- 15/02/2019

All T.Y.B.Sc. students are here by informed that class test will be conducted as on **19/02/2019** on **Topic Name-** 'Types of Mutation' as part of teaching learning beyond curriculum.

I/C PRINCIPAL
I C.S. College of Arts, Commerce & Sci
Khed, Dist Ratnagiri

Sahajeevan shikshan santha's

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SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE

SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

Time: 1 hrs. **SEMESTER – V (2018-19)** **DATE:**

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Name of the student: ---

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10**

1. A person who is heterozygous for sickle cell anemia has increased resistance for?

[✓ A. Malaria]
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C. Dengue haemorrhagic fever
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A. UGA to UAA
B. GUG to GAG
[✓ C. GAG to GUG]
D. UAA to UGA

4. Sickle cell anaemia results from

A. A chromosomal aberration
B. non disjunction of autosome
[✓ C. A point mutation]
D. Blood transfusion reaction.

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b. headache
c. dizziness
[✓ d all]

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~~A. Hb~~^{s} + Hb^A

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C. Hb^s + Hb^s

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C. Deficiency of iron

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09/10

Sahajeevan shikshan santha's

SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS

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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

Time: 1 hrs. **SEMESTER – V (2018-19)** **DATE:**

CLASS: T.Y.B.Sc **TOTAL MARKS: 10**

Name of the student: ---

Roll no.

Instruction:

- ✓ Tick correct option

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[✓ C. GAG to GUG]
D. UAA to UGA

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08/10

Sahajeevan shikshan santha's

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SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE

SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri

Result of

Sr No.	Name Of Student	Marks/10
1	BALABHAI SHIFA A GAFOOR	8
2	CHAVAN PRIYA ANKUSH	9
3	CHAVAN SNEHA SANDEEP	9
4	CHAVAN SUPRIYA SACHIDANAND	9
5	CHIPLUNKAR SAIMA MOHAMMED	9
6	DANDEKAR ESHA AJIT	10
7	DHOTRE MEGHA MAHENDRA	10
8	DHUMAL PRATIKSHA BHARAT	10
9	FAKIR YUSUF HAMID	9
10	JANGAM PRASHANT PRAKASH	9
11	LASNEY SHAGUFTA RAFEEQUE	9
12	MODSHING SHRADDHA SANJAY	9
13	NADKAR BATUL SALIM MUNIRA	9
14	PARKAR TAHSEEN ABUBAKAR	9
15	/PATHAN FAEEZA IBRAHIMKHAN	10
16	PATIL BHAGYASHRI VINAYAK	10
17	ZUGAR VAISHNAVI KRUSHNAT	10

HEAD,
Dept of Zoology
I. C. S. College, Khed,
(Ratnagiri)

S.Y. B.Sc Paper Ist Sem - III
Unit - III - Modern techniques to study plant diversity

Unit III (paper 1st) : Modern techniques to study plant diversity

1. DNA Barcoding: DNA barcoding involves sequencing a specific region of a plant's DNA to identify and classify it accurately. This technique has revolutionized the identification of plant species, especially when traditional morphological features are insufficient or unreliable.
2. Metabarcoding: Metabarcoding is a high-throughput DNA sequencing technique that allows researchers to analyze multiple samples simultaneously. It is particularly useful for studying diverse plant communities and can provide insights into the composition of ecosystems and their dynamics.
3. Next-Generation Sequencing (NGS): NGS technologies, such as Illumina and PacBio sequencing, have made it more affordable and efficient to sequence entire plant genomes. This has significantly expanded our understanding of plant diversity, evolution, and adaptation.
4. Remote Sensing and GIS: Remote sensing technology, including satellite and drone imagery, is used to monitor and map plant diversity across large geographical areas. Geographic Information Systems (GIS) are essential for analyzing and visualizing spatial data, making it easier to study plant distributions and ecosystems.
5. Citizen Science: Citizen science initiatives, like iNaturalist and eBird, allow individuals to contribute data on plant species and locations. These platforms enhance data collection and improve our understanding of plant diversity.
6. Herbarium Digitization: Many herbaria are digitizing their collections, making plant specimens and their associated data available online. Researchers can access this digitized information, facilitating studies on plant diversity, distribution, and taxonomy.
7. High-Resolution Imaging: High-resolution imaging techniques, such as light microscopy and electron microscopy, enable researchers to examine plant structures in great detail. This aids in the identification of plant species and the study of their anatomy.
8. Bioinformatics and Computational Tools: The use of bioinformatics tools and databases, such as GenBank and NCBI, has become crucial in managing and analyzing plant genetic data. Computational methods help researchers process and interpret large datasets effectively.
9. Stable Isotope Analysis: Stable isotope analysis can provide insights into plant ecophysiology and interactions within ecosystems. Researchers can

study plant adaptation to environmental conditions and their role in food webs.

10. Environmental DNA (eDNA): eDNA analysis involves extracting and sequencing DNA from environmental samples, such as soil or water, to detect the presence of plant species. It's a non-invasive way to study plant diversity in different habitats.
11. Phylogenomics: Phylogenomics combines genomic data with evolutionary relationships to construct comprehensive phylogenetic trees, helping researchers understand the evolutionary history and relationships among plant species.
12. Functional Traits Analysis: Studying plant functional traits, such as leaf morphology, root structure, and photosynthetic capacity, can provide insights into how plants adapt to various environmental conditions and their roles in ecosystems.

Sahajeevan Shikshan Sanstha's

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SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time : 1 hrs **SEMESTER- III** **Date:**
Class:S.Y.B.Sc **Total Marks : 10**

Q.1 Choose the correct option. **10M**

1. What is DNA barcoding used for in the study of plant diversity?
   a) Assessing plant root structures
   b) Identifying and classifying plant species
   c) Analyzing plant functional traits
   d) Mapping plant distribution in GIS
2. Metabarcoding is a technique primarily employed for:
   a) Sequencing entire plant genomes
   b) Monitoring plant communities using satellite imagery
   c) High-throughput DNA sequencing of multiple samples
   d) Digitizing herbarium collections
3. Next-Generation Sequencing (NGS) has significantly expanded our knowledge of:
   a) Plant distribution in GIS
   b) Plant anatomy using high-resolution imaging
   c) Plant diversity, evolution, and adaptation
   d) Environmental DNA (eDNA) analysis
4. Which technology is best suited for mapping plant diversity across large geographical areas?
   a) Remote sensing and GIS
   b) Herbarium digitization
   c) Citizen science initiatives
   d) Stable isotope analysis
5. How can citizen science contribute to the study of plant diversity?
   a) By analyzing plant genomes
   b) By digitizing herbarium collections
   c) By providing data on plant species and locations

d) By using stable isotope analysis

6. What is the primary purpose of herbarium digitization in studying plant diversity?
   a) Analyzing plant functional traits
   b) Mapping plant distributions using GIS
   c) Making plant specimens and data available online
   d) Remote sensing and satellite imagery
7. High-resolution imaging techniques are useful for studying:
   a) Plant ecophysiology
   b) Plant evolutionary relationships
   c) Plant DNA barcodes
   d) Plant root structures
8. What role do bioinformatics tools and databases play in the study of plant diversity?
   a) Analyzing plant genomes
   b) Digitizing herbarium collections
   c) Managing and analyzing genetic data
   d) Collecting eDNA samples
9. Stable isotope analysis is used to study:
   a) Plant functional traits
   b) Plant DNA barcodes
   c) Plant ecophysiology and interactions within ecosystems
   d) Plant distribution in GIS
10. What is the primary purpose of phylogenomics in the study of plant diversity?
    a) Identifying plant species
    b) Analyzing plant functional traits
    c) Constructing comprehensive phylogenetic trees
    d) Sequencing entire plant genomes

Answers:

1. b) Identifying and classifying plant species
2. c) High-throughput DNA sequencing of multiple samples
3. c) Plant diversity, evolution, and adaptation
4. a) Remote sensing and GIS
5. c) By providing data on plant species and locations
6. c) Making plant specimens and data available online
7. a) Plant ecophysiology
8. c) Managing and analyzing genetic data
9. c) Plant ecophysiology and interactions within ecosystems
10. c) Constructing comprehensive phylogenetic trees

॥ राष्ट्रोध्दारार्थ सेवामहे ॥
Sahajeevan Shikshan Sanstha's
Estd.-1990
SHRIMATI INDIRA MAHADEV BEHARAY COLLEGE OF ARTS
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
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KHED, Dist. RATNAGIRI (M.S.) - 415 709.
(Permanently Affiliated to University of Mumbai)
NAAC Re- Accredited B^{++} Grade (CGPA-02.83)
(As Per Revised Accreditation Process July - 2017)
Mumbai University "BEST COLLEGE AWARD"(2017-18)
Ph No. 02356-260100
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Ref. No.: ICS/ **Date :**

Notice

Date- 16/08/2022

All S.Y.B.Sc. students are here by informed that class test will be conducted as on **19/08/2022** on **Topic Name-** 'Modern techniques to study plant diversity' as part of teaching learning beyond curriculum**.**

Anish A.J.

I/C PRINCIPAL
I.C.S. College of Arts, Commerce & Sc
Khed, Dist Ratnagiri

Sahajeevan Shikshan Sanstha's
SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS,
SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE &
SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.
Khed, Ratnagiri.

Time : 1 hrs	**SEMESTER- III**	**Date:**
Class:S.Y.B.Sc		**Total Marks : 10**

Name of the student: --

Roll no.

Instruction:

- ✓ Tick correct option

Q.1 Choose the correct option. **10M**

1. What is DNA barcoding used for in the study of plant diversity?
   a) Assessing plant root structures
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   d) Mapping plant distribution in GIS
2. Metabarcoding is a technique primarily employed for:
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   c) Citizen science initiatives
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b) By digitizing herbarium collections
[✓ c) By providing data on plant species and locations]
d) By using stable isotope analysis

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   [✓ c) Plant ecophysiology and interactions within ecosystems]
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    b) Analyzing plant functional traits
    [✓ c) Constructing comprehensive phylogenetic trees]
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10/10

Sahajeevan Shikshan Sanstha's

SHRIMATI INDIRA MAHADEV BEHARAYCOLLEGE OF ARTS, SHRIMAN CHANDULAL SHETH COLLEGE OF COMMERCE & SHRIMATI SHOBHANATAI CHANDULAL SHETH COLLEGE OF SCIENCE.

Khed, Ratnagiri.

RESULT OF TEST 2022-23

SR.NO.	NAME OF THE STUDENT	MARKS /10
1	GHOLAP PRATIKSHA JANARDAN	10
2	KADAM TANVI SURYAKANT	10
3	MUKADAM MAIMUNA HALIM	10