

Test Booklet No. _____

This booklet consists of 150 questions and 18 printed pages.

RGUPET/2024/___/___

RGUPET 2024
Common Entrance Test, 2024
DOCTOR OF PHILOSOPHY IN CHEMISTRY

Full Marks: 150
Hours

Time: 3

Roll No.

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Day and Date of Examination: _____

Signature of Invigilator(s) _____

Signature of Candidate _____

General Instructions:

PLEASE READ ALL THE INSTRUCTIONS CAREFULLY BEFORE MAKING ANY ENTRY.

1. DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO.
2. Candidate must write his/her Roll Number on the space provided.
3. This Test Booklet contains 150 Multiple Choice Questions (MCQs) from the concerned subject. Each question carries 1 mark.
4. Please check the Test Booklet to verify that the total pages and total number of questions contained in the test booklet are the same as those printed on the top of the first page. Also check whether the questions are in sequential order or not.
5. Candidates are not permitted to enter into the examination hall after the commencement of the entrance test or leave the examination hall within two hour.
6. Making any identification mark in the OMR Answer Sheet or writing Roll Number anywhere other than the specified places will lead to disqualification of the candidate.
7. Candidates shall maintain silence inside and outside the examination hall. If candidates are found violating the instructions mentioned herein or announced in the examination hall, they will be summarily disqualified from the entrance test.
8. In case of any dispute, the decision of the Entrance Test Committee shall be final and binding.
9. The OMR Answer Sheet consists of two copies, the Original copy and the Student's copy.

1	Which of the following changes in auxiliary cannot be seen while changing direct to indirect speech?				b
	a) 'Will' of future tense is changed to 'would'	b) 'Can' of the present tense is changed to 'could'	c) 'Shall' of future tense is changed to 'should'	d) 'Will' of future tense is changed to 'should'	'Can' of the present tense is changed to 'could'
2	Match the synonym pairs:				c
	A. Prosperous		i Covert		
	B. Surreptitious		ii Affluent		
	C. Sanguine		iii Disrespectful		
	D. Insolent		iv Optimistic		
	a)A-i; B-ii; C-iii; D-iv.	b) A-iv; B-iii; C-ii; D-i.	c) A-ii; B-i; C-iv; D-iii.	d)A-i; B-iii; C-ii; D-iv.	A-ii; B-i; C-iv; D-iii
3	He is so sick that he cannot speak. (Make it simple):				b
	A. He is sick, so he cannot speak. B. As he is sick, so he cannot speak. C. He is sick, and he cannot speak. D. He is too sick to speak.				
	a) C	b) D	c) B	d) A	D. He is too sick to speak
4	During peak hours, it _____ take more than two hours.				c
	a) will	b) shall	c) can	d) should	can
5	Identify the article in this sentence: "An apple a day keeps the doctor away."				c
	a) the	b) a	c) an	d) apple	an
6	A: Assertion: Pure water is neither acidic nor basic. B: Justification: The pH of a solution is inversely proportional to the concentration of hydrogen ions in it.				b
	a) Both A and B are true, and B is the correct explanation of A.	b) Both A and B are true, but B is not the correct explanation of A.	c) A is true but B is false.	d) A is false but B is true.	Both A and B are true, but B is not the correct explanation of A.
7	Who is the father of cellular phone?				c
	a) Linus Torvalds	b) Fred Morrison	c) Martin Cooper	d) Percy Lebaron Spencer	Martin Cooper
8	There is 10 % loss if an article is sold at Rs. 270. Then the cost price of the article is:				d
	a) Rs. 250	b) Rs. 320	c) Rs. 270	d) Rs. 300	Rs. 300

9	In a group of friends, Alice is taller than Bob, but shorter than Claire. David is taller than Bob, but shorter than Alice. Who is the tallest in the group?				c
	a) Alice	b) Bob	c) Claire	d) David	Claire
10	Which of the following statement regarding the properties of a parallelogram is true? A. Opposite angles are supplementary. B. Diagonals are not necessarily equal in length. C. All sides are necessarily equal in length. D. The sum of interior angles is 360 degrees.				a
	a) A	b) B	c) C	d) D	Opposite angles are supplementary
11	A clock is set right at 5 am the clock loses 16 min in 24 hours. What will be the right time when the clock indicates on 3 pm the 8th day?				c
	a) 7 pm	b) 6 pm	c) 5 pm	d) 4 pm	5 pm
12	Which letter would NOT look the same when viewed in a mirror?				a
	a) S	b) O	c) X	d) H	S
13	'Unnat Bharat Abhiyan' is associated with which Union Ministry?				d
	a) Ministry of Textiles	b) Ministry of Rural Development	c) Ministry of Culture	d) Ministry of Education	Ministry of Education
14	Match the environmental issue with the corresponding impact:				b
	A. Plastic pollution		i. Skin cancer		
	B. Deforestation		ii. Destruction of marine ecosystems		
	C. Depletion of ozone layer		iii. Rising CO ₂ levels		
	D. Acid rain		iv. Loss of soil nutrients		
	a) A-i, B-iii, C-ii, D-iv	b) A-ii, B-iii, C-i, D-iv	c) A-iii, B-i, C-ii, D-iv	d) A-iii, B-iv, C-i, D-ii	A-ii, B-iii, C-i, D-iv
15	A: Assertion: Increasing the temperature of a gas increases its pressure. B: Justification: According to the ideal gas law, pressure is directly proportional to temperature when the volume and the amount of gas remain constant.				a
	a) Both A and B are true, and B is the correct explanation of A.	b) Both A and B are true, but B is not the correct explanation of A.	c) A is true but B is false.	d) A is false but B is true.	Both A and B are true, and B is the correct explanation of A
16	Which one of the following is the context in which the term "qubit" is mentioned?				a
	a) Quantum Computing	b) Visible Light Communication	c) Cloud Services	d) Wireless Communication Technologies	Quantum Computing

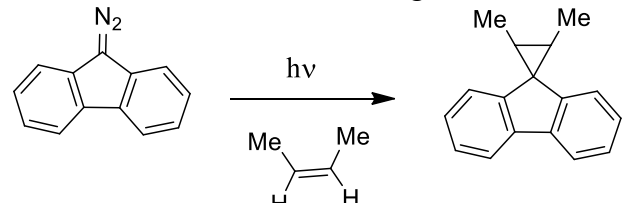
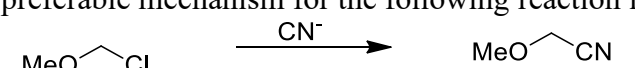
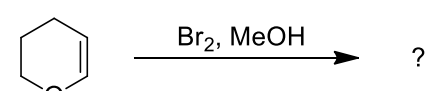
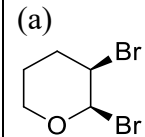
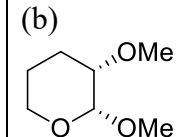
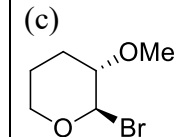
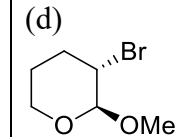
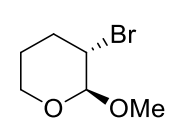
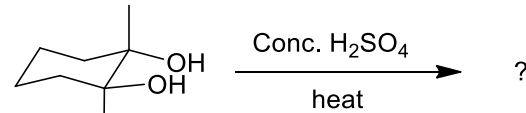
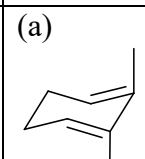
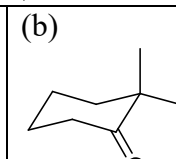
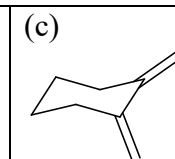
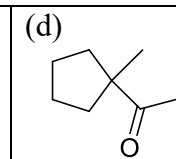
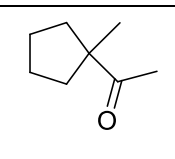
		on Technologies			
17	What kind of cell is the mobile phone battery when it is being charged?				c
	a) Solar cell	b) Fuel cell	c) Electrolytic cell	d) Galvanic cell	Electrolytic cell
18	Which of the following is blended with petrol in India?				b
	a) methanol	b) ethanol	c) kerosene	d) acetone	ethanol
19	Malinithan is located in-				c
	a) Assam	b) Tripura	c) Arunachal Pradesh	d) Manipur	Arunachal Pradesh
20	The Fame India scheme of Govt. of India encourages the adoption of-				c
	a) solar power	b) biodiesel	c) electric and hybrid vehicles	d) organic foods	electric and hybrid vehicles
21	Experimental research involves-				b
	a) invention of novel products	b) testing of variables in laboratory	c) systematic study of past events	d) none of these	testing of variables in laboratory
22	A good synopsis is considered as-				b
	a) a complete research	b) a half-way research	c) a partial research	d) a beginning of research	a half-way research
23	Identify the true statement(s) amongst the following: A. Action research is a research carried out to solve immediate problems. B. Action research is a research related to sports. C. Action research is an applied research. D. Action research is not a scientific research.				a
	a) A	b) A, C	c) B	d) B, D	Action research is a research carried out to solve immediate problems.
24	Hypothesis is				d
	a) a thoughtful statement	b) a forwarding statement	c) a temporary solution	d) all of these	all of these
25	A research reporting should be carried out-				b
	a) in an imaginary way	b) in a scientific way	c) copying from previous reports	d) improvising available reports	in a scientific way
26	A research design depends on				d
	a) nature of research problem	b) purposes of research	c) objectives of research	d) all of these	all of these

27	The false statement regarding hypothesis is: A. It allows to identify the research objectives. B. It allows to identify the key abstract concepts involved in the research. C. It can be tested, verifiable or falsifiable. D. It predicts the outcomes and consequences of the research.				d
	a) B	b) A, D	c) B, C	d) D	It predicts the outcomes and consequences of the research
28	The value that has higher frequency in a given set of values is called				b
	a) mean	b) mode	c) median	d) average	mode
29	Which of the following is not a measure of the dispersion of statistical data?				d
	a) mean deviation	b) range	c) standard deviation	d) none of these	none of these
30	'ANOVA' stands for-				b
	a) Analysis and variance	b) Analysis of variance	c) Analysis and verification	d) Analytical validation	Analysis of variance
31	The ethics of research is not related to				c
	a) scientific method	b) reliability	c) self interest	d) humanity	self-interest
32	In general, the quality of a research journal is assessed by its				a
	a) impact factor	b) price	c) editorial board	d) number of issues per year	impact factor
33	Which of the following may be considered as plagiarism?				d
	a) complete copying of someone else's work	b) copying of ideas	c) patch writing	d) all of these	all of these
34	Identify the true statement(s) in terms of research ethics. A. Plagiarism should be strictly avoided. B. Self-plagiarism should be encouraged. C. There is no technological means to check plagiarism. D. Similarity in bibliography/reference is not considered as plagiarism.				a
	a) A, D	b) A, C	c) B, D	d) C, D	A, D
35	Existing literature on a particular topic can be searched in				d
	a) books	b) journals	c) conference papers	d) all of these	all of these
36	A comprehensive full report of the research process is called				a
	a) Thesis	b) Synopsis	c) Abstract	d) Article	Thesis
37	Generally, research papers are presented/published in				d
	a) Journals	b) Seminars	c) Symposiums	d) all of these	all of these
38	Which of the following is not an abstract and citation database?				c
	a) Scopus	b) Web of Science	c) Google	d) Google Scholar	Google

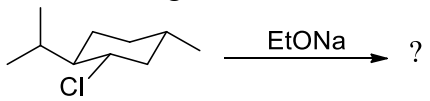
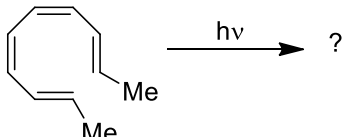
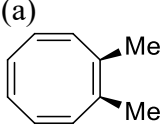
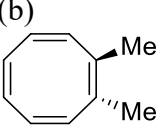
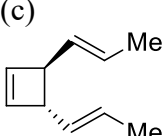
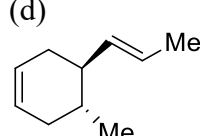
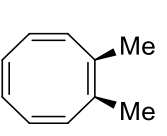
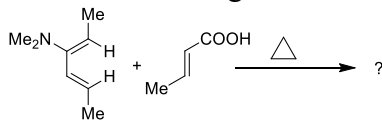
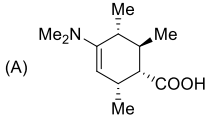
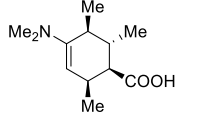
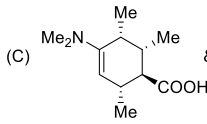
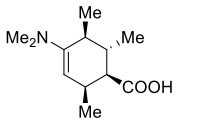
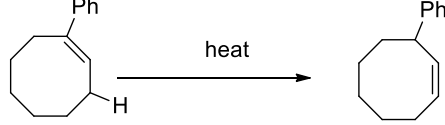
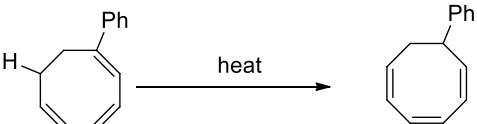
39	Research is a “Scientific undertaking” opined by				b
	a) Kerlinger	b) Young	c) Kothari	d) Emory	Young
40	“One of the methods of logical reasoning process” is called				d
	a) Research	b) Experiment	c) Deduction	d) Induction	Induction
41	The method by which a sample is chosen				s
	a) Design	b) Unit	c) Random	d) Census	Design
42	The author of “ The Grammar of Science” is				b
	a) Ostle	b) Pearson	c) Richard	d) Kerlinger	Pearson
43	The first step in formulating a problem is				c
	a) Gathering of Data	b) Measurement	c) Statement of the problem	d) Survey	Statement of the problem
44	Which of the following is a non-probability sampling method?				a
	a) Quota sampling	b) Simple random sampling	c) Systematic sampling	d) Cluster sampling	Quota sampling
45	Who put forward the statement, “Research is an honest effort carried out through insight”?				d
	a) Binet	b) Best	c) Cook	d) Watson	Watson
46	How does ScienceDirect differ from other databases like PubMed?				b
	a) ScienceDirect specializes in medical research.	b) ScienceDirect focuses on a broader range of scientific disciplines.	c) ScienceDirect does not provide access to full-text articles.	d) ScienceDirect is free to access.	ScienceDirect focuses on a broader range of scientific disciplines
47	In a standard normal distribution, what is the mean and standard deviation?				a
	a) Mean = 0, Standard deviation = 1	b) Mean = 1, Standard deviation = 0	c) Mean = 0, Standard deviation = 0	d) Mean = 1, Standard deviation = 1	Mean = 0, Standard deviation = 1
48	A normal distribution is characterized by:				b
	a) An asymmetric curve	b) A bell-shaped curve	c) A U-shaped curve	d) A straight line	A bell-shaped curve
49	Skewness in a distribution indicates:				a
	a) Asymmetry	b) Symmetry	c) Normality	d) Uniformity	Asymmetry
50	Which of the following is an author level metric?				c
	a) cite score	b) impact factor	c) <i>h</i> -index	d) SJR	<i>h</i> -index
51	The IUPAC name of the following compound is:				(d)
	(a) (R)-3-(prop-2-enyl) hex-5-ynoic acid	(b) (S)-3-(prop-2-enyl) hex-5-ynoic acid	(c) (R)-3-(prop-2-enyl) hex-5-enoic acid	(d) (S)-3-(prop-2-enyl) hex-5-enoic acid	(S)-3-(prop-2-enyl) hex-5-enoic acid

52	The absolute configuration for the two chiral centres in the following molecule are:					(b)
	(a) 5 <i>R</i> , 6 <i>R</i>	(b) 5 <i>R</i> , 6 <i>S</i>	(c) 5 <i>S</i> , 6 <i>R</i>	(d) 5 <i>S</i> , 6 <i>S</i>	5 <i>R</i> , 6 <i>S</i>	
53	Klyne-Prelog conformational terminology of the following molecule is:					(b)
	(a) \pm ap	(b) + sc	(c) - sc	(d) - ac	+ sc	
54	The IUPAC name of the compound:					(a)
	(a) 4-ethyl-1-fluoro-2-nitro benzene	(b) 5-ethyl-2-fluoro-1-nitro benzene	(c) 1-ethyl-5-fluoro-4-nitro benzene	(d) 4-ethyl-1-fluoro-6-nitro benzene	4-ethyl-1-fluoro-2-nitro benzene	
55	The correct relationship between the following two compounds is:					(c)
	(a) enantiomers	(b) diastereoisomers	(c) homomers	(d) constitutional isomers	homomers	
56	The correct statement about the following molecule is:					(a)
	(a) Molecule is chiral and possesses a chiral plane	(b) Molecule is chiral and possesses a chiral axis	(c) Molecule is achiral as it possesses a plane of symmetry	(d) Molecule is achiral as it possesses a center of symmetry	Molecule is chiral and possesses a chiral plane	
57	Which of the following options (a-d) is correct? I. All asymmetric molecules are dissymmetric II. Dissymmetry is a special kind asymmetry III. All chiral centres are stereogenic centres also IV. All chirotopic centres may not be chiral centres					(d)

	(a) All are correct	(b) All are wrong	(c) I, III & IV are correct while II is wrong	(d) I & III are correct while II & IV are wrong	I & III are correct while II & IV are wrong
58	In the following molecule, the asterisked C is:				(d)
	(a) chiral, stereogenic and chirotopic	(b) achiral, non-stereogenic and achirotopic	(c) achiral, stereogenic and achirotopic	(d) achiral, stereogenic and chirotopic	achiral, stereogenic and chirotopic
59	Among the carbocations given below				(a)
	(a) A is homoaromatic, B is antiaromatic and C is aromatic	(b) A is aromatic, B is antiaromatic and C is homoaromatic	(c) A is antiaromatic, B is aromatic and C is homoaromatic	(d) A is homoaromatic, B is aromatic and C is antiaromatic	A is homoaromatic, B is antiaromatic and C is aromatic
60	Which of the following is anti-aromatic?				(a)
	(a)	(b)	(c)	(d)	
61	cis-1,2-dimethylcyclohexane is:				(b)
	(a) chiral and exists as resolvable enantiomeric mixture	(b) chiral and exists as non-resolvable racemic mixture	(a) chiral and exists as resolvable enantiomeric mixture	(b) chiral and exists as non-resolvable racemic mixture	(a) chiral and exists as resolvable enantiomeric mixture
62	Correct statement for the compounds I & II is:				(b)
	(a) I is aromatic; II is non-aromatic	(b) I is anti-aromatic; II is non-aromatic	(c) I is anti-aromatic; II is anti-aromatic	(d) I is anti-aromatic; II is aromatic	I is anti-aromatic; II is non-aromatic
63	The intermediate formed in Beckmann rearrangement is also the intermediate in:				(d)

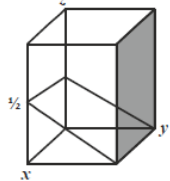
	(a) Perkin reaction	(b) Stobbe reaction	(c) Diels-Alder reaction	(d) Hoffmann reaction	Hoffmann reaction
64	An enolate ion is a reactive intermediate in:				(c)
	(a) Reimer-Tiemann reaction	(b) Grignard reaction	(c) Aldol condensation reaction	(d) Fries rearrangement	Aldol condensation reaction
65	Curtius rearrangement involves:				(d)
	(a) carbocation	(b) carbanion	(c) carbene	(d) nitrene	nitrene
66	The intermediate involved in the reaction given below is:				(a)
					
	(a) free radical	(b) carbocation	(c) carbanion	(d) carbene	free radical
67	The most preferable mechanism for the following reaction is:				(b)
					
	(a) S _N 2	(b) S _N 1	(c) S _N i	(d) Elimination	S _N 1
68	Retention of configuration at the reaction center can be expected in:				(d)
	(a) S _N 2 mechanism	(b) S _N 1 mechanism	(c) Addition-elimination mechanism	(d) S _N i mechanism	S _N i mechanism
69	The major product formed in the following reaction is:				(d)
					
	(a) 	(b) 	(c) 	(d) 	
70	Major product of the following reaction is:				(d)
					
	(a) 	(b) 	(c) 	(d) 	

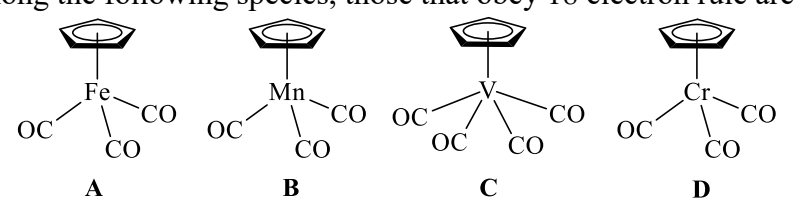
71	The intermediate A and the major products B in the following reaction are:				(d)
(a)	A is acyl cation; B is:	(b) A is acyl carbene; B is:	(c) A is acyl nitrene; B is:	(d) A is acyl nitrene; B is:	A is acyl nitrene; B is:
72	The major product formed in the following reaction is:				(d)
(a)	(b)	(c)	(d)		
73	Product of the following reaction is:				(b)
(a)	(b)	(c)	(d) None of the above		
74	1. The major product of the following reaction is:				(a)
(a)	(b)	(c)	(d) None of the above		
75	Substrates for Peterson olefination reactions are:				(b)
(a) carbonyl compounds and α -silyl carbanion	(b) carbonyl compounds and α -silyl carbanion	(c) aromatic acids and α -silyl carbanion	(d) none of the above	carbonyl compounds and α -silyl carbanion	
76	Which of the following reagent serves similar purpose as phosphorous ylides serve in Wittig reaction?				(c)
(a) Gilman's reagent	(b) Fetizon's reagent	(c) Tebbe reagent	(d) Baker's yeast	Tebbe reagent	

77	Sharpless asymmetric epoxidation is an example of :				(b)
	(a) reagent controlled reactions	(b) catalyst controlled reaction	(c) substrate controlled reaction	(d) none of the above	Catalyst controlled reaction
78	Cram's model can predict major products in:				(b)
	(a) some enantioselective syntheses	(b) some diastereoselective syntheses	(c) any chiral synthesis	(d) none of the above	some diastereoselective syntheses
79	The following reaction will result: 				(a)
	(a) a trans-cyclohexene as an exclusive product	(b) a cis-cyclohexene as an exclusive product	(c) a mixture of cis- and trans-cyclohexenes as product	(d) a substitution product	a trans-cyclohexene as an exclusive product
80	The product of the following reaction is: 				(a)
	(a) 	(b) 	(c) 	(d) 	
81	The major products of the following reaction are: 				(a)
	(A) 	(B) 	(C) 	(D) 	
	(a) (A)	(b) (B)	(c) (C)	(d) (D)	(A)
82	For the following reactions, which one of the statements is correct? Reaction 1: 				(b)
	Reaction 2: 				
	(a) Reaction 1 is faster than Reaction 2	(b) Reaction 1 is slower than Reaction 2	(c) Both the reactions will	(d) Can't be predicted for	Reaction 1 is slower than Reaction 2

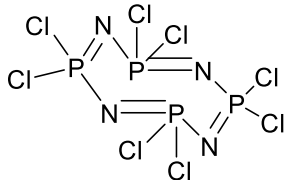
			have same reaction rate	the given reactions	
83	In the following transformation, what type of sigmatropic H-shift is being observed?				(a)
	(a) [1,5]	(b) [1,7]	(c) [3,5]	(d) [3,3]	[1,7]
84	Which of the following function is an eigen function with respect to the linear operator, d/dx				d
	a) $\cos(ax)$	b) $\sin(ax)$	c) x^2	d) e^{2x}	e^{2x}
85	The quantum numbers which are derived from the solution of Schrodinger wave equation for hydrogen atom is				a
	a) n, l, m_l	b) n, l, m_s	c) n, m_s, m_l	d) l, m_l, m_s	n, l, m_l
86	The normalized ψ_{1s} orbital of hydrogen-like atoms is				a
	a) $\psi_{1s} = \frac{1}{\sqrt{\pi a_0^3}} \exp(-\frac{r}{a_0})$	b) $\psi_{1s} = \frac{1}{\sqrt{\pi a_0^3}} \exp(-\frac{2r}{a_0})$	c) $\psi_{1s} = \frac{1}{\sqrt{\pi a_0}} \exp(-\frac{r}{a_0})$	d) $\psi_{1s} = \frac{1}{\sqrt{3\pi a_0}} \exp(-\frac{r}{a_0})$	$\psi_{1s} = \frac{1}{\sqrt{\pi a_0^3}} \exp(-\frac{r}{a_0})$
87	The quantum mechanical operator for the momentum of a particle moving in one dimension is given by				b
	a) $i \frac{h}{2\pi} \frac{d}{dx}$	b) $\frac{h}{2\pi i} \frac{d}{dx}$	c) $i \frac{h}{2\pi} \frac{d}{dt}$	d) $-\frac{h^2}{2m} \frac{d^2}{dx^2}$	$\frac{h}{2\pi i} \frac{d}{dx}$
88	In linear variation method using two orthogonal basis functions, the two roots obtained are ϵ_0 and ϵ_1 ($\epsilon_0 < \epsilon_1$). The correct relation of these with exact ground and first excited state energies, E_0 and E_1 , respectively, is				d
	a) $\epsilon_0 \geq E_0$ and $\epsilon_1 < E_1$	b) $\epsilon_0 < E_1$ and $\epsilon_1 \geq E_1$	c) $\epsilon_0 < E_0$ and $\epsilon_1 < E_1$	d) $\epsilon_0 \geq E_0$ and $\epsilon_1 \geq E_1$	$\epsilon_0 \geq E_0$ and $\epsilon_1 \geq E_1$
89	The zero-point energy of a diatomic vibrating molecule is				c
	a) 0	b) $h\nu$	c) $\frac{1}{2} h\nu$	d) $\frac{3}{2} h\nu$	$\frac{1}{2} h\nu$
90	Hydrogen bonding causes the $\pi \rightarrow \pi^*$ transition to shift to				b
	a) shorter wavelength	b) longer wavelength	c) no shifting at all	d) unpredictable	longer wavelength
91	The ground state of H_2 molecules is represented by				b
	a) $^1\Sigma_u^+$	b) $^1\Sigma_g^+$	c) $^1\Pi_u$	d) $^3\Sigma_u^+$	$^1\Sigma_g^+$
92	Which of the following transition is allowed				b
	a) $^1\Sigma_g^+ \rightarrow ^1\Sigma_g^+$	b) $^1\Sigma_g^+ \rightarrow ^1\Pi_u$	c) $^1\Sigma_g^+ \rightarrow ^1\Delta_g$	d) $^1\Sigma_g^+ \rightarrow ^3\Sigma_u^+$	$^1\Sigma_g^+ \rightarrow ^1\Pi_u$
93	Among the following species, the one having the highest bond strength is				b
	a) O_2	b) O_2^+	c) O_2^-	d) O_2^{2-}	O_2^+
94	Simple Hückel molecular orbital theory				c
	a) considers electron-electron repulsion explicitly	b) distinguishes cis-butadiene and trans-butadiene	c) distinguishes cyclobutadiene and cis-butadiene	d) has different coulomb integrals for non-equivalent carbons	distinguishes cyclobutadiene and cis-butadiene

95	BF ₃ has				a
	a) three C ₂ axis and one C ₃ axis	b) 6-fold C ₆ axis	c) one two-fold C ₂ axis	d) one three-fold C ₃ axis	three C ₂ axis and one C ₃ axis
96	In which of the following point group centre of inversion is absent				c
	a) D _{2h}	b) D _{4h}	c) T _d	d) D _{6h}	T _d
97	The vibrational degree of freedom of a non-linear polyatomic molecule containing <i>n</i> atoms is				c
	a) 3 <i>n</i> -4	b) 3 <i>n</i> -5	c) 3 <i>n</i> -6	d) 3 <i>n</i>	3 <i>n</i> -6
98	The rotational constant (in cm ⁻¹) is				c
	a) $J(J+1) \frac{h^2}{8\pi^2 I}$	b) $J(J+1) \frac{h}{2\pi}$	c) $\frac{h}{8\pi^2 I c}$	d) $\frac{h^2}{8\pi^2 I}$	$\frac{h}{8\pi^2 I c}$
99	Which part of the IR spectrum is called the "fingerprint region"?				d
	a) 3000-2000 cm ⁻¹	b) 3000-1000 cm ⁻¹	c) 2000-1000 cm ⁻¹	d) 1000-600 cm ⁻¹	1000-600 cm ⁻¹
100	The free energy change of mixing of ideal gases is given by $\Delta G_m = nRT \sum x_i \ln x_i$. Hence, mixing of two or more ideal gases is a				a
	a) spontaneous process	b) non-spontaneous process	c) reversible process	d) unpredictable	spontaneous process
101	1 mol of CO ₂ , 1 mol of N ₂ , and 2 mol of O ₂ are mixed at 300 K. The entropy of mixing is				a
	a) 6 <i>Rln</i> 2	b) 8 <i>Rln</i> 2	c) 8 <i>Rln</i> 2/300	d) 16 <i>Rln</i> 2	6 <i>Rln</i> 2
102	For which one of the following equilibrium reactions, K _p will equal K _c				c
	a) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$	b) $COCl_2 \rightleftharpoons CO + Cl_2$	c) $H_2 + I_2 \rightleftharpoons 2HI$	d) $3H_2 + N_2 \rightleftharpoons 2NH_3$	$H_2 + I_2 \rightleftharpoons 2HI$
103	At a triple point				a
	a) both the temperature and pressure are fixed	b) only the temperature is fixed	c) only the pressure is fixed	d) sometimes pressure and sometimes temperature is fixed	both the temperature and pressure are fixed
104	Acetaldehyde (CH ₃ CHO) decomposes by second order kinetics with a rate constant of 0.334 M ⁻¹ s ⁻¹ at 500 °C. The time it would take for 80% of the acetaldehyde to decompose in a sample that has an initial concentration of 0.00750 M is				a
	a) ~ 1600 s	b) ~ 1850 s	c) ~ 1000 s	d) ~ 5100 s	~ 1600 s
105	The expression for the rate constant according to the activated complex theory is				b
	a) $k_r = \left(\frac{h}{kT}\right) k^\ddagger$	b) $k_r = \left(\frac{kT}{h}\right) k^\ddagger$	c) $k_r = \left(\frac{kT}{h}\right) k^\ddagger \exp\left\{-\frac{E}{RT}\right\}$	d) $k_r = \left(\frac{kT}{h}\right) k^\ddagger \exp\left\{-\frac{E}{RT}\right\}$	$k_r = \left(\frac{kT}{h}\right) k^\ddagger$
106	For the reaction $2A \rightarrow B + C$, the rate of the reaction is $-\frac{d[A]}{dt} = k[A]^2$, the value of <i>t</i> _{1/2} is				b
	a) $\frac{1}{k}$	b) $\frac{1}{k[A]_0}$	c) $\frac{1}{k[A]_0^2}$	d) $\frac{1}{k[A]_0^3}$	$\frac{1}{k[A]_0}$

107	The effective rate constants for the gaseous unimolecular reaction: $A \rightarrow P$ following the Lindemann-Hinshelwood mechanism are $1.7 \times 10^{-3} \text{ s}^{-1}$ and $2.2 \times 10^{-4} \text{ s}^{-1}$ at $[A]=4.37 \times 10^{-4} \text{ mol dm}^{-3}$ and $1.0 \times 10^{-5} \text{ mol dm}^{-3}$, respectively. The rate constant for the activation step in the mechanism is approximately equal to (in $\text{dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$)				d
	a) 12.3	b) 49.4	c) 6.1	d) 24.7	24.7
108	One of the methods of purifying a colloidal solution is				c
	a) coagulation	b) protection	c) dialysis	d) electro-osmosis	dialysis
109	The aggregation of surfactant molecules is known as				a
	a) micelles	b) clusters	c) gels	d) colloid	micelles
110	The scattering of light by the dispersed phase is called				b
	a) Brownian movement	b) Tyndall effect	c) adsorption	d) electrophoresis	Tyndall effect
111	Adsorption of a gas is described by the Langmuir isotherm with $K = 0.75 \text{ kPa}^{-1}$ at 25°C . The pressure (in kPa) at which the fractional surface coverage becomes 0.25 is				b
	a) 0.158	b) 0.44	c) 0.265	d) 0.33	0.44
112	A plot of $\log x/m$ versus $\log p$ for the adsorption of a gas on a solid gives a straight line with slope equal to				b
	a) $n ; (n > 1)$	b) $1/n ; (n > 1)$	c) $\log k$	d) $-\log k$	$1/n ; (n > 1)$
113	Consider ammonia to be an ideal gas, with each molecule of ammonia occupying an effective area of 7.0 \AA^2 on BaF_2 surface. The adsorption follows the following isotherm- $\frac{p}{v(p_0-p)} = \frac{1}{v_m c} + \frac{c-1}{v_m c} \left(\frac{p}{p_0}\right)$ where all the terms have their usual meaning. The plot of $\frac{p}{v(p_0-p)}$ versus $\frac{p}{p_0}$ gives the intercept as $4.66 \times 10^{-4} \text{ cm}^{-3}$ and slope as 0.0761 cm^{-3} . the surface area of adsorption (in m^2) is close to				a
	a) 24.5	b) 2.5	c) 33.2	d) 1.9	24.5
114	Which miller index plane is shown below				c
					
	a) (0 2 1)	b) (0 4 1)	c) (0 1 2)	d) (0 0 0)	(0 1 2)
115	Which method is the most appropriate for determining number average molecular weight?				a
	a) osmometry method	b) viscometry method	c) light scattering method	d) sedimentation method	osmometry method
116	The weight average molecular mass of macromolecules is the number average molecular mass				a
	a) greater than	b) lesser than	c) equal to	d) none of these	greater than

11 7	In osmosis pressure method for determination of molecular weight of polymers, a plot of π/C versus C is a straight line at 300 K with intercept 0.249. The molecular weight of the polymer is approximately-					c																			
	a) 20000	b) 15000	c) 10000	d) 5000		10000																			
11 8	The character table of C_{3v} point group along with an additional reducible representation is given below					a																			
	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>E</th> <th>$2C_3$</th> <th>$3\sigma_v$</th> </tr> </thead> <tbody> <tr> <th>A_1</th> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <th>A_2</th> <td>1</td> <td>1</td> <td>-1</td> </tr> <tr> <th>E</th> <td>2</td> <td>-1</td> <td>0</td> </tr> <tr> <th>Γ</th> <td>6</td> <td>0</td> <td>2</td> </tr> </tbody> </table>						E	$2C_3$	$3\sigma_v$	A_1	1	1	1	A_2	1	1	-1	E	2	-1	0	Γ	6	0	2
	E	$2C_3$	$3\sigma_v$																						
A_1	1	1	1																						
A_2	1	1	-1																						
E	2	-1	0																						
Γ	6	0	2																						
	Γ is given by																								
	a) $2A_1 + 2E$	b) $2A_2 + 2E$	c) $2A_1 + A_2 + E$	d) $A_1 + 2A_2 + E$		$2A_1 + 2E$																			
11 9	Among the following species, those that obey 18 electron rule are:					c																			
																									
	a) D and C	b) A and B	c) B and C	d) B and D		B and C																			
12 0	According to Wade's theory, the anion $[B_7H_7]^{2-}$ adopts					b																			
	a) <i>arachno</i> -structure	b) <i>closo</i> -structure	c) <i>nido</i> -structure	d) <i>hypo</i> -structure		<i>closo</i> -structure																			
12 1	In the following reaction, $CH_3C(O)Mn(CO)_5$ is formed through.					d																			
	$CH_3Mn(CO)_5 + CO \longrightarrow CH_3C(O)Mn(CO)_5$																								
	a) Reductive elimination	b) Oxidative addition	c) Substitution reaction	d) Migratory insertion reaction		Migratory insertion reaction																			
12 2	The electronic absorption spectrum of $[Ti(H_2O)_6]^{3+}$ consists of one absorption band at $20,400\text{ cm}^{-1}$ of crystal field origin assigned to the transition:					a																			
	a) ${}^2T_{2g} \rightarrow {}^2E_g$	b) ${}^5T_{2g} \rightarrow {}^5E_g$	c) ${}^2E_g \rightarrow {}^2T_{2g}$	d) ${}^5E_g \rightarrow {}^5T_{2g}$		${}^2T_{2g} \rightarrow {}^2E_g$																			
12 3	$[Mn(H_2O)_6]^{2+}$ shows a faint pink colour. This is because the transition are.					c																			
	a) Laporte allowed but spin forbidden	b) Laporte forbidden but spin allowed	c) Both Laporte and spin forbidden	d) Both Laporte and spin allowed		Both Laporte and spin forbidden																			
12 4	The complex that is isolobal to CH_3 is:					b																			
	a) $Fe(CO)_5$	b) $Mn(CO)_5$	c) $Fe(CO)_4$	d) $Cr(CO)_5$		$Mn(CO)_5$																			
	The reaction of $[Pt(Cl)_4]^{2-}$ with two equivalent of NH_3 produces-					b																			

12 5	a) <i>cis</i> -Pt(NH ₃) ₂ Cl ₄]	b) <i>cis</i> -Pt(NH ₃) ₂ Cl ₂]	c) <i>trans</i> -[Pt(NH ₃) ₂ Cl ₂]	d) both <i>cis</i> - and <i>trans</i> -[Pt(NH ₃) ₂ Cl ₂]	<i>cis</i> -[Pt(NH ₃) ₂ Cl ₂]
12 6	The complex [Cr(bipyridyl) ₃] ³⁺ , shows red phosphorescence due to transition				d
	a) $^4A_{2g} \leftarrow ^2T_{2g}$	b) $^4T_{2g} \leftarrow ^2A_{1g}$	c) $^4T_{2g} \leftarrow ^2E_g$	d) $^4A_{2g} \leftarrow ^2E_g$	$^4A_{2g} \leftarrow ^2E_g$
12 7	In Al(BH ₄) ₃ , the number of 3c-2e bonds present is				c
	a) two	b) four	c) six	d) eight	six
12 8	Upon heating, the compound [(η ⁵ -C ₅ H ₅)Mo(CO) ₃] ₂ undergoes elimination of 2 equivalents of CO to form [(η ⁵ -C ₅ H ₅)Mo(CO) ₂] ₂ . The change in the Mo–Mo bond order in this reaction is				b
	a) 1 → 2	b) 1 → 3	c) 2 → 3	d) 3 → 4	1 → 3
12 9	The Brønsted acidity of boron hydrides follows the order				d
	a) B ₂ H ₆ = B ₄ H ₁₀ > B ₅ H ₉ > B ₁₀ H ₁₄	b) B ₂ H ₆ > B ₄ H ₁₀ > B ₅ H ₉ = B ₁₀ H ₁₄	c) B ₂ H ₆ < B ₄ H ₁₀ < B ₅ H ₉ < B ₁₀ H ₁₄	d) B ₂ H ₆ > B ₄ H ₁₀ > B ₅ H ₉ > B ₁₀ H ₁₄	B ₂ H ₆ < B ₄ H ₁₀ < B ₅ H ₉ < B ₁₀ H ₁₄
13 0	Consider the following metalloenzyme and heme proteins in column I and match with column II.				c
	Column I		Column II		
	i. Carboxypeptidase		a. Fe and transport of oxygen		
	ii. Carbonic anhydrase		b. Zn and hydrolyses peptide bonds		
	iii. Catalases		c. Fe and oxidation of compounds by H ₂ O ₂		
	iv. Peroxidases		d. Zn and dehydration of bicarbonate ion		
			e. Mg and hydrolyses peptide bonds		
			f. Fe and decomposition of H ₂ O ₂		
	a) i.-e.; ii.-d.; iii.-f.; iv.-a.	b) i.-d.; ii.-b.; iii.-f.; iv.-a.	c) i.-b.; ii.-d.; iii.-f.; iv.-c.	d) i.-b.; ii.-d.; iii.-a.; iv.-c.	i.-b.; ii.-d.; iii.-f.; iv.-c.
13 1	Match column I with column II.				c
	Column I		Column II		
	i. Transferrin		a. Cu and O ₂ transport		
	ii. Ferredoxin		b. Mg and electron carrier		
	iii. Hemerythrin		c. Binding and transport of Fe(III)		
	iv. Hemocyanin		d. Fe and O ₂ transport		
			e. Fe-S protein and electron transfer		
			f. Co and O ₂ transport		
	a) i.-a.; ii.-e.; iii.-d.; iv.-f	b) i.-c.; ii.-b.; iii.-d.; iv.-a	c) i.-c.; ii.-e.; iii.-d.; iv.-a	d) i.-c.; ii.-a.; iii.-d.; iv.-b	i.-c.; ii.-e.; iii.-d.; iv.-a
13 2	The oxide of nitrogen which does not have a N — N bond is.				d
	a) N ₂ O	b) N ₂ O ₃	c) N ₂ O ₄	d) N ₂ O ₅	N ₂ O ₅

13 3	Among the following oxoacids of phosphorus, the compound(s) which is/are reducing agent. H_3PO_4 H_3PO_3 $H_4P_2O_6$ $H_4P_2O_5$ $H_4P_2O_7$	b												
	a) H_3PO_4 and $H_4P_2O_5$ b) H_3PO_3 and $H_4P_2O_5$ c) H_3PO_3 and $H_4P_2O_6$ d) $H_4P_2O_6$ and $H_4P_2O_7$	H_3PO_3 and $H_4P_2O_5$												
13 4	The correct order of reactivity of the interhalogens is.	a												
	a) $BrF_5 > BrF_3 > BrF$ b) $BrF > BrF_3 > BrF_5$ c) $BrF_3 > BrF_5 > BrF$ d) $BrF > BrF_5 > BrF_3$	$BrF_5 > BrF_3 > BrF$												
13 5	Which among the following borate anion is/are a spiro anion. $[B_2O_6]^{3-}$ $[B_4O_5(OH)_4]^{2-}$ $[B_5O_6(OH)_4]^-$ $[B_3O_3(OH)_5]^{2-}$	b												
	a) $[B_2O_6]^{3-}$ b) $[B_5O_6(OH)_4]^-$ c) $[B_5O_6(OH)_4]^-$ and $[B_3O_3(OH)_5]^{2-}$ d) $[B_2O_6]^{3-}$ and $[B_4O_5(OH)_4]^{2-}$	$[B_5O_6(OH)_4]^-$												
13 6	The correct order of first ionization energy for alkaline earth elements is.	d												
	a) $Sr > Ca > Mg > Be$ b) $Mg > Ca > Sr > Be$ c) $Mg > Ca > Be > Sr$ d) $Be > Mg > Ca > Sr$	$Be > Mg > Ca > Sr$												
13 7	In the flame test, a characteristic-coloured flame is observed for metals. Match the metals in List I to their characteristic observed coloured flame observed in List II.	c												
	<table border="1"> <thead> <tr> <th>List I</th> <th>List II</th> </tr> </thead> <tbody> <tr> <td>i. Li</td> <td>a. Blue</td> </tr> <tr> <td>ii. Na</td> <td>b. Crimson</td> </tr> <tr> <td>iii. Cs</td> <td>c. Lilac</td> </tr> <tr> <td></td> <td>d. Yellow</td> </tr> <tr> <td></td> <td>e. Red-violet</td> </tr> </tbody> </table>	List I	List II	i. Li	a. Blue	ii. Na	b. Crimson	iii. Cs	c. Lilac		d. Yellow		e. Red-violet	
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	a) i.-b.; ii.-c.; iii.-a. b) i.-c.; ii.-d.; iii.-e. c) i.-b.; ii.-d.; iii.-a. d) i.-e.; ii.-a.; iii.-b.	i.-b.; ii.-d.; iii.-a.												
13 8	Consider the following cyclophosphazene:  <p>The statement which is/are correct about the above cyclophosphazene is/are.</p> <p>A. The oxidation state of P-atom is +V and N-atom is +III B. The oxidation state of P-atom is +III and N-atom is +III C. Synthesized by the reaction of PCl_5 with NH_4Cl D. Synthesized by the reaction of an azide with PCl_3</p>	a												
	a) A and C b) B and D c) C and D d) A, B and C	A and C												
13 9	The species ^{131}I and ^{13}N emit a β -particle and positron respectively. The species thus formed are respectively	c												
	a) ^{13}B and ^{131}Xe b) ^{13}B and ^{131}Te c) ^{13}C and ^{131}Xe d) ^{13}C and ^{131}Te	^{13}C and ^{131}Xe												
14 0	Calculate the number of α and β particles emitted in the conversion of $^{232}_{90}Th$ to $^{208}_{82}Pb$.	a												

	a) 6α and 4β particles	b) 6α and 2β particles	c) 3α and 4β particles	d) 3α and 2β particles	6α and 4β particles
14	The number of stereoisomers of the complex ion $[\text{RhCl}_2(\text{en})_2]^+$ ion is				b
1	a) 2	b) 3	c) 4	d) 5	3
14	The crystal field stabilization energy for a high spin d^6 system such as $[\text{CoF}_6]^{3-}$ is.				b
2	a) $2 Dq$	b) $4 Dq$	c) $6 Dq$	d) $12 Dq$	$4 Dq$
14	Among the following complexes, Jahn teller distortion is expected for. $\text{K}_4[\text{Cr}(\text{Cl})_6]$ $\text{K}_4[\text{Fe}(\text{CN})_6]$ $\text{K}_4[\text{Mn}(\text{CN})_6]$				a
3	a) $\text{K}_4[\text{Cr}(\text{Cl})_6]$ and $\text{K}_4[\text{Mn}(\text{CN})_6]$	$\text{K}_4[\text{Cr}(\text{Cl})_6]$ and $\text{K}_4[\text{Fe}(\text{CN})_6]$	$\text{K}_4[\text{Fe}(\text{CN})_6]$ and $\text{K}_4[\text{Mn}(\text{CN})_6]$	$\text{K}_4[\text{Cr}(\text{Cl})_6]$ only	$\text{K}_4[\text{Cr}(\text{Cl})_6]$ and $\text{K}_4[\text{Mn}(\text{CN})_6]$
14	In the reaction of $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\text{CH}_3)(\text{CO})_2]$ with PMe_3 , the intermediate involved is				c
4	a) $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\text{CH}_3)(\text{CO})(\text{PMe}_3)]$	b) $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\text{PMe}_3)(\text{CO})_2]$	c) $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\text{COCH}_3)(\text{CO})]$	d) $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\text{PMe}_3)_2(\text{CO})]$	$[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\text{COCH}_3)(\text{CO})]$
14	Among the following, the compounds which show fluxional behaviour are SF_5 $[\text{CoF}_6]^{3-}$ $[\text{NiCl}_4]^{3-}$ $\text{Fe}(\text{CO})_5$				d
5	a) $[\text{NiCl}_4]^{3-}$ and $\text{Fe}(\text{CO})_5$	b) $[\text{CoF}_6]^{3-}$ and $[\text{NiCl}_4]^{3-}$	c) SF_5 and $[\text{CoF}_6]^{3-}$	d) SF_5 and $\text{Fe}(\text{CO})_5$	SF_5 and $\text{Fe}(\text{CO})_5$
14	The separation of lanthanides can best be carried out using the method				a
6	a) Ion exchange chromatography	b) High performance liquid chromatography	c) Gas chromatography	d) Gel permeation chromatography	Ion exchange chromatography
14	Among the following hydroxides, the hydroxide having the lowest solubility is				d
7	a) $\text{La}(\text{OH})_3$	b) $\text{Ga}(\text{OH})_3$	c) $\text{Yb}(\text{OH})_3$	d) $\text{Lu}(\text{OH})_3$	$\text{Lu}(\text{OH})_3$
14	In the cluster $[\text{Co}_3(\text{CH})(\text{CO})_9]$, the number of bridging ligands and metal-metal bond(s) respectively, are (cluster obeys 18e rule)				a
8	a) 1 CH and 3	b) 1 CH and 2	c) 1 CO and 3	d) 3 CO and 2	1 CH and 3
14	In the cluster $[\text{Mo}_2(\text{S}_2)_6]^{2-}$, the coordination number of Mo and the number of bridging S_2^{2-} respectively are,				c
9	a) 4 and 1	b) 6 and 2	c) 8 and 2	d) 8 and 3	8 and 2
15	The predicted structures for the metal clusters $[\text{Os}_3(\text{CO})_{12}]$ and $[\text{Ru}_6(\text{C})(\text{CO})_{17}]$ respectively, are				b
0	a) arachno and nido	b) arachno and closo	c) nido and closo	d) closo and nido	arachno and closo