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Ph.D./URS-EE-Jan-2022

SUBJECT : Chemistry

10045

SET-Y

		51. NO
Time: 11/4 Hours Roll No. (in figures)	Max. Marks : 100 (in words)	Total Questions : 100
Name	Father's Name	
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1. In ion-exchange resin method, the order of elution of lanthanides is:

(1)
$$Lu^{+3} > Yb^{+3} > Ce^{+3} > La^{+3}$$

(2)
$$Sm^{+3} > Eu^{+3} > Tm^{+3} > Yb^{+3}$$

(3)
$$La^{+3} > Ce^{+3} > Yb^{+3} > Lu^{+3}$$

(4)
$$Yb^{+3} > Tm^{+3} > Sm^{+3} > Eu^{+3}$$

- 2. Which of the following statements is false?
 - (1) Lanthanides have poor tendency to form complexes
 - (2) Lanthanides closely resemble each other
 - (3) M^+ and M^{+2} are less stable than M^{+3} ion in lanthanides
 - (4) Basic strength of lanthanide oxides increases with increasing atomic number
- 3. Biological function of Haemocyanin and metal involved in it:
 - (1) Oxygen transport and Fe
- (2) Oxygen transport and Cu
- (3) Electron transport and Fe
- (4) Electron transport and Cu
- 4. If an enzyme fixes Nitrogen in plants by evolving H₂, the number of electrons and protons associated respectively are:
 - (1) 6 and 6
- (2) 8 and 8
- (3) 6 and 8
- (4) 8 and 6
- 5. The half-life of Cobalt-60 is 5.26 years. What will be the remaining percentage activity after 4 years?
 - (1) 76%
- (2) 32%
- (3) 59%
- (4) 18%

- 6. Radioisotopes of lodine are used in:
 - (1) Tagging leukocytes and labelling of blood platelets
 - (2) Diagnosis and treatment of the diseases of thyroid glands
 - (3) Diagnosis and treatment of the heart diseases
 - (4) Diagnosis and treatment of brain tumours

7 .	The rate of disintegration of radioactive follows the kinetics of order.		abstances depends only on the and		
	(1) Nature of radioactive substance and first				
	(2) Amount of radioactive substance an	nd see	econd		
	(3) Temperature and zero				
	(4) Half-life of the radioactive substance	ce an	nd first		
8.	Which of the complex is an active cataly (1) $[HRh(CO)(PPh_3)_3]$	-	and a 16 e^- species ? 2) $[HCo(CO)_3]$		
	$(3) [Rh(CO)_2I_4]^-$, ,	$\{Pd(PPh_3)_4\}$		
9.	The catalyst used for polymerization of	olefi	fins is :		
	(1) Wilkinson's catalyst	(2)	2) Zeise's salt complex		
	(3) Ziegler-Natta catalyst	(4)	F) Tetraethyl lead		
10.	In the hydrogenation of alkenes usin $RhCl(PPh_3)_2$. The first step in its catal	ig W lytic (Wilkinson's catalyst, the active catalyst is cycle is:		
	(1) Alkene co-ordination	(2)	2) Oxidative addition of H ₂		
	(3) Loss of PPh_3	(4)	Loss of Cl		
11.	John-Teller effect is in the field of:				
	(1) Nuclear physics	(2)	2) Vibronic interactions		
	(3) Thermodynamics	(4)) Kinetic theory of gases		
12.	Which of the following is a soft acid?				
	(1) Ag^+ (2) Pt^{2+}	(3)	3) Au^+ (4) All		
13.	Which of the following will combine wi	ith <i>B</i>			
	(1) CO (2) Pt^{2+}		3) OH^- (4) Methane		
14.	The electronic ground state term for the	chro	omium ion in 10-10-1		
	(1) 3 F (2) 3 H	(3)	$(4)^{3}$ G $(4)^{3}$ D		

3

15. The hapticity of cycloheptatriene (C_7H_8) in $Mo(C_7H_8)(CO)_3$ is:

(1) 6

(2) 5

(3) 4

(4) 9

16. If Δ_0 is octahedral splitting energy and *P* is electron pairing energy then the crystal field stabilization energy (CFSE) of $[Co(NH_3)_6]^{+2}$ is:

(1) $-0.8 \Delta_0 + 2 P$

(2) $-0.8 \Delta_0 + 1 P$

(3) $-0.8 \Delta_0$

(4) $-1.8\Delta_0 + 3P$

17. The shapes of XeF_5^+ and XeF_5^- respectively, are:

- (1) Pentagonal planar and square pyramidal
- (2) Pentagonal planar and trigonal bipyramidal
- (3) Square pyramidal and pentagonal bipyramidal
- (4) Square pyramidal and pentagonal planar

18. The number of terminal carbonyl groups present in $Fe_2(CO)_9$ are :

(1) 2

(2) 5

- (3) 6
- (4) 3

19. The order of polarity of NH_3 , NF_3 and BF_3 is:

- (1) $NH_3 < NF_3 < BF_3$
- (2) $BF_3 < NF_3 < NH_3$
- (3) $BF_3 < NH_3 < NF_3$
- (4) $NF_3 < BF_3 < NH_3$

20. Correct statement for Coulometry is:

- (1) It is based on Faraday's law of electrolysis.
- (2) It is a type of voltammetry.
- (3) It is based on Ohm's law.
- (4) It uses ion selective electrode.

	· · · · · · · · · · · · · · · · · · ·
21.	The calibration curve in spectrofluorimetric analysis becomes non-linear when:
	(1) Molecular weight of analyte is high
	(2) Intensity of light source is high
	(3) Concentration of analyte is high
	(4) Molar absorptivity of analyte is high
22.	Mossbauer spectrum of a metal complex gives information about:
	(a) Oxidation state and spin state of metal
	(b) Types of ligands co-ordinated of metal
	(c) Nuclear spin state of metal
	(d) Geometry of metal
	Correct answer is:
	(1) (a) and (c) (2) (b) and (c) (3) (a), (b) and (d) (4) (b) and (d)
23.	Intense band generally observed for a carbonyl group in the IR spectrum is due to
	(1) The force constant of CO bond is large
	(2) The force constant of CO bond is small
	(3) There is no change in dipole moment for CO bond stretching
	(4) The dipole moment change due to CO bond stretching is large
24	· ·
	$(2) NF_0 \qquad (2) NF_0$
25.	$(4) N(C \pi_3)_3$
	(3) Hypo structure (4) Nide at the structure
	(4) Nido structure

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26.	When an electron i	is added to a gaseous	aton	n :		
	(1) Its size decreas	ses	(2)	Energy is relea	sed	
	(3) It changes to p	ositive ion	(4)	Its tendency to	acce	ept electron increases
27.	Aufbau principle is	s not violated in:				
	(1) d-block elemen	nts	(2)	s and p-block e	eleme	ents
	(3) Lanthanides		(4)	Actinides		
28.	The highest value of	of n for the elements	prese	ent in periodic ta	ble i	s :
	(1) 6	(2) 7	(3)	10	(4)	9
29.	During the change	of NO^+ to NO , the e	electro	on is added in a	:	
	(1) σ-orbital	(2) π -orbital	(3)	σ*-orbital	(4)	π^* -orbital
30.	Alkali metals disso colour is due to:	olve in liquid ammo	nia t	o form blue col	oure	ed solutions. The blue
	(1) Alkali metals		(2)	Alkali metal io	ns	
	(3) Ammoniated el	ectrons	(4)	Ammoniated al	kali 1	metal ions
31.	Which of the specie	es has a permanent di	pole	moment?		
	$(1) SF_4$	(2) SiF_4	(3)	BF_3	(4)	XeF_4
32 .	Which of the ion ha	s maximum hydratio	n ene	ergy?		
	(1) Sr^{2+}	(2) Ca^{2+}	(3)	Mg^{2+}	(4)	Be^{2+}
33.	Oxymyoglobin Mb((O_2) and oxyhaemog	globir	$1 \text{ Hb}(O_2)_4 \text{ response}$	ectiv	ely, are:
	(1) Paramagnetic an	nd paramagnetic				
	(2) Diamagnetic an	d diamagnetic				
	(3) Paramagnetic ar	nd diamagnetic				
	(4) Diamagnetic an	d paramagnetic				

				•
34.	one dimensional in state of the system i	finite potential well is:	of length a. The cr	and mass m are moving in nergy of the lowest energy
	$(1) \frac{\pi^2 \hbar^2}{ma^2}$	$(2) \frac{2\pi^2\hbar^2}{3ma^2}$	$(3) \frac{3\pi^2\hbar^2}{ma^2}$	$(4) \frac{5\pi^2\hbar^2}{2ma^2}$
35.	The difference in a hydrogen atom is:			wo adjacent orbitals of the
	(1) $h/2\pi$	(2) h/π	(3) $(n+1)h/2\pi$	(4) $(n-1)h/2\pi$
36.	Apply molecular or	bital theory to predic	et which species has t	the strongest bond?
	(1) N_2	(2) N_2^-	(3) N_2^+	(4) All are equivalent
37.	The charge density	at each carbon atom	in butadiene is:	
	(1) 2	(2) 0	(3) 4	(4) 1
38.	<u>-</u>		etween the field necentary mound is which of t	essary for resonance in the he following?
	(1) Field shift		(2) Chemical shift	
	(3) Matrix shift		(4) Resonance shift	t
39.		on of the first excite		ale is v. The temperature at that of the ground state is
	(1) $(h v ln2)/k$	(2) $\ln 2 / (\ln v k)$	(3) h v /(k ln2)	(4) h v lnk
40.	What are the point	groups of tetrahedral	and octahedral mole	cules ?
	(1) D_{3h} and D_{4h} r	respectively		

- (2) T_d and O_h , respectively
- (3) C_{3h} and C_{4h} respectively
- (4) C_{4h} and D_{4h} respectively

41. The rotational constant B for the HCl molecule is 10.6 cm⁻¹. The frequency for the pure rotation transition $J = 0 \rightarrow J = 1$ is equal to:

 $(1) 10.6 \text{ cm}^{-1}$

 $(2) 5.3 \text{ cm}^{-1}$

 $(3) 21.2 \text{ cm}^{-1}$

(4) No absorption

42. If the reduced mass of a diatomic molecule is doubled without changing its force constant, the vibrational frequency of the molecule with respect to the original frequency will be:

(1) Unchanged

(2) $\sqrt{2}$ times

(3) 2 times

(4) $\frac{1}{\sqrt{2}}$ times

43. Identify which of the following pairs of molecules exhibit both a pure rotational spectrum and a rotational Raman spectrum?

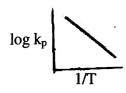
(1) O_2 and H_2O

(2) CO_2 and N_2O

(3) CO and CH_4

(4) NO and DCCH

44. The variation of $\log K_p$ with temperature 1/T for the equilibrium; $NH_4HS(s) \Rightarrow NH_3(g) + H_2S(g)$; is as shown in the plot. The equilibrium is displaced in the forward direction on:



(1) Increasing the temperature and decreasing the pressure

(2) Increasing the temperature and pressure both

(3) Decreasing the temperature and pressure both

(4) Decreasing the temperature and increasing the pressure

The upper critical solution temperature is defined as: 45.

(1) The maximum temperature at which two components will remain immiscible as two distinct liquids

(2) The minimum temperature at which two components will remain immiscible as two distinct liquids

(3) The maximum temperature at which two components remain miscible

(4) The minimum temperature at which two components remain miscible

Which of the following is true regarding non-ideal solutions with negative deviation?

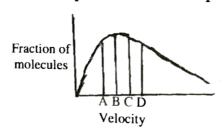
(1) The interactions between the components are lesser than in the pure components

(2) $\Delta V_{\text{mixing}} = +ve$

(3) $\Delta H_{\text{mixing}} = +ve$

(4) They form maximum boiling azeotropes

47. Which out of A, B, C and D corresponds to the most probable speed?



(1) A

(2) B

(3) C

(4) D

48. 8 distinguishable particles are distributed in two equal sized compartments. The probability of the macro state (4, 4) is equal to:

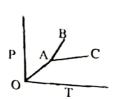
(1) 35/128

(2) 7/128

(3) 7/16

(4) 35/256

49. The slopes of the lines OA, AC and AB are $\tan \pi/4$, $\tan \pi/6$ and $\tan \pi/3$ respectively, If the melting point and ΔH melting are 27°C and 3 kJ mol⁻¹ respectively, the change in



(1) $10 \tan \pi/4$

(2) $10 \cot \pi/3$

(3) $10 \tan \pi/3$

(4) $10 \cot \pi/4$

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orandard entitle of vapourisation Arryan for water at 100 C 13 40.00 kg mor Assuming water vapour to behave like an ideal gas, the internal energy of vapourisation of water at 100°C (in kJ mol⁻¹) will be equal to: (1) +37.56(2) -40.66(3) +43.76(4) -43.7610 mL aliquots of a mixture of HCI and HNO₃ are titrated conductometrically using 51. a 0.1M NaOH and a 0.1M $AgNO_3$ separately. The titer volumes are V_1 and V_2 respectively. The concentration of HNO3 in the mixture is obtained from the combination: (1) $V_1 - V_2$ (2) $V_2 - V_1$ (3) $2V_1 - V_2$ (4) $2V_2 - V_1$ The electrode potential of which electrode depends upon the H^+ ion concentration? **52**. (1) Hydrogen electrode (2) Quinhydrone electrode (3) Glass electrode (4) All of the above One mole of an ideal gas is allowed to expand isothermally and reversibly from **53**. $0.02 \,\mathrm{m}^3$ to $0.20 \,\mathrm{m}^3$ at 300 K. The entropy change for the system will be in (JK⁻¹): (3) 19.14 (4) -19.14(1) 4.61 (2) 57.42 What is the half-life of N_2O_5 if it decomposes with a rate constant of $5.7 \times 10^{-4} \, s^{-1}$? 54. (2) 10 minutes (1) 20 minutes (4) Insufficient data (3) 0.05 minutes The activation energies of two reactions are E_1 and E_2 ($E_1 > E_2$) respectively. If the **55**. temperature of the system is increased from T_1 to T_2 , the rate constants of the reactions

change from k_1 to k_1' in the first reaction and k_2 to k_2' in the second reaction. Predict which of the following is correct?

$$(1) \ \frac{k_1'}{k_1} > \frac{k_2'}{k_2}$$

(2)
$$\frac{k_1'}{k_1} = \frac{k_2'}{k_2} = 1$$

(3)
$$\frac{k_1'}{k_1} < \frac{k_2'}{k_2}$$

(4) None of the above

- 56. Arrhenius equation to determine the activation energy is:
 - (1) $\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} \left(\frac{1}{T_2} \frac{1}{T_1}\right)$
- (2) $\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} \left(\frac{1}{T_2} + \frac{1}{T_1}\right)$
- (3) $\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = -\frac{E_a}{R} \left(\frac{1}{T_2} \frac{1}{T_1}\right)$
- (4) $\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} \left(T_1 T_2\right)$
- **57.** The following reaction takes place in a cell:

$$Fe^{2+}(aq) + Ag^{+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$$

Given that:
$$E_{Ag^+/Ag}^0 = xV$$
; $E_{Fe^{2+}/Fe}^0 = yV$; $E_{Fe^{3+}/Fe}^0 = zV$

The standard potential of the cell in volts (V) will be:

(1) x - z

(2) x - y

(3) x + 2y - 3z

- (4) x + y z
- **58.** What is the pH of HCl solution when the hydrogen gas electrode shows a potential of -0.22 V at standard temperature and pressure?
 - (1) 2.98
- (2) 2.17
- (3) 3.14
- (4) 3.73
- 59. The energy of the ground state of a particle in a box within first order perturbation theory of a system with the following potential energy will be:

$$V(x) = \begin{cases} V_0 & 0 \le x \le L \\ \infty & x < 0 \text{ and } x > L \end{cases}$$

 $(1) \frac{h^2}{8mL^2}$

(2) V_0

(3) $\frac{h^2}{8mL^2} + V_0$

 $(4) \ \frac{h^2}{4mL^2} + \frac{V_0}{2}$

	(4) None of the above
62.	Which of the following statements is not true?
	(1) Step-growth polymerization requires a bifunctional momoner
	(2) Nylon 6 is an example of step-growth polymerization
	(3) Chain growth polymerization includes both homo-polymerization and copolymerization
	(4) Chain growth polymerization involves homo-polymerization only
63.	Which of the following salts show maximum value of equivalent conductance in their fused state?
	(1) KCl (2) NaCl (3) CsCl (4) RbCl
64.	In terms of energy bands, insulators have:
	(1) Full conduction band
	(2) Very small energy gap
	(3) Full valence band
	(4) Moderate energy gap

method for crystal structure determination? (1) The d spacings become smaller (2) Bragg angles of reflections increase (3) The diffraction pattern expands (4) Some previously accessible reflections can no longer be measured A committee has 6 members having weights in (kg) as 45, 50, 65, 72, 63 and 65. Wha 66. will be the standard deviation? $(1) \sqrt{115}$ (2) $\sqrt{152}$ $(3) \sqrt{88}$ $(4) \sqrt{176}$ Most stable carbocation is: (1) Tropylium ion (2) Benzylcation (3) Allylcation (4) Vinylcation The given reaction is an example of: (1) Cope rearrangement (2) The claisen rearrangement (3) Diels-Alder reaction (4) Cheletropic reaction 69. Which of the following reagents react with phenol at 298K to form salt? (1) $NaHCO_3$ (2) *Cl*₂ (3) H_2SO_4 (4) *NaOH* PHD/URS-EE-2022/(Chemistry)(SET-Y)/(A)

take of the wavelength is doubled, which of the following is not

70. A single strong absorption near 1800 cm⁻¹ in IR spectroscopy indicates the presence of:

(1) Azo compound

(2) Acid halides

(3) Sulphoxide

(4) Thioketones

71. Which one of the following is strongest acid?

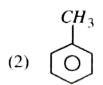
$$(4) \quad NO_2 \longrightarrow OH \\ NO_2 \\ NO_2$$

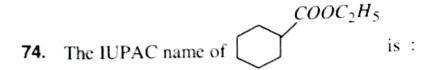
72. The ^{13}C NMR spectrum of ethyl benzene exhibits :

- (1) 8 signals
- (2) 6 signals
- (3) 5 signals
- (4) 4 signals

73. CH_2Cl + $Mg \xrightarrow{\text{dry ether}} A \text{ (product) is :}$

$$(1) \bigcirc CH_2MgCl$$





- (1) Cyclohexane carboxamide
- (2) Cyclohexane ethyl carboxylate
- (3) Ethyl cyclohexane carboxylate
- (4) Aminocyclo hexane carboxylate

75. Which one of the following statement is *correct*?

- (1) Allene and biphenyls show optical activity.
- (2) Allene and biphenyls do'nt show optical activity.
- (3) Only allene show optical activity not biphenyls.
- (4) Only biphenyls show optical activity not allene.

76. Chlorination of furan is carried out by :

(1) Cl_2 at $-40^{\circ}C$

(2) Cl_2 , $at - 30^{\circ}C$

(3) *Cl*₂

(4) FeCl₃

77. Which one of the following is aldoses?

(1) Fructose

(2) Galactose

(3) Ribulose

(4) Sorbose

78. Match the list-I and list-II and select the *correct* answer using codes given below the list:

List - I

List - II

(i) Citral

A. p-cymene

(ii) Linalool

- B. Carvoxime
- (iii) α-terpineol
- C. Tert. alcohol

(iv) Limonene

D. Lemon grass

Correct answer is:

- (1) i-B, ii-A, iii-D, iv-C
- (2) i-D, ii-C, iii-A, iv-B
- (3) i-C, ii-D, iii-B, iv-A
- (4) i-A, ii-B, iii-C, iv-D
- 79. (CH) (CH) (Red hot tube) (CH) (Red hot tube) (CH) (CH) (CH) (Red hot tube) (CH) (









- 80. Nicotine alkaloid belong to:
 - (1) Phenyl ethylamine group
 - (2) Pyrrolidine pyridine group
 - (3) Isoquinoline group
 - (4) Indol group

81.	. Which one of the following is mainly responsible for edd opined on .			
	(1) Nitrate	(2) Phosphate		
	(3) Carbamate	(4) Sulphate		
82.	Which one of the following is used as t	tranquilizer?		
	(1) Omepyrazole			
	(2) 2-acetoxy benzoic acid	toxy benzoic acid		
	(3) Chloromycetin			
	(4) Barbituric acid			
83.	In IR spectrum, primary amines show to	wo bands around the region:		
	(1) 3350 cm ⁻¹	(2) 2950 cm ⁻¹		
	(3) 1630 cm ⁻¹	(4) 2100 cm ⁻¹		
84.	Green chemistry protects the environment	nt by reducing :		
	(1) Forest	(2) Temperature		
	(3) Pollution	(4) Weeds		

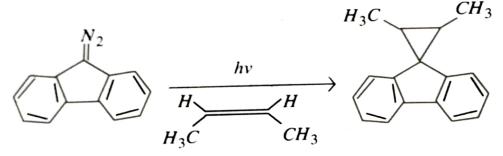
86.	The reaction $CH_3CCH_2CH_3 \xrightarrow{Zn-Hg} CH_3CH_2CH_2CH_3$ is known as:
	(1) Parkin reaction

- (1) Perkin reaction
- (2) Aldol condensation
- (3) Clemmensen reduction
- (4) Pechmann condansation
- Which of the following carbonyl give a haloform test? 87.
 - (1) Hexan-2-one

(2) Propanal

(3) Pentan-3-one

- (4) 2-Methyl butanal
- The intermediate involved in the following reaction is: 88.



(1) Carbocation

(2) Carbene

(3) Nitrene

- (4) Free radical
- Spiro compounds are optically active due to: 89.
 - (1) Chiral axis

(2) Chiral plane

(3) Chiral carbon

- (4) Helicity
- Which one of the following reagent gives syn addition with alkene? 90.
 - (1) Br_2

(2) Cl_2

(3) Dil $KMnO_4/OH^-$

- (4) DDQ
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list:

List-I

List-II

(i) Lipoprotein

A. Sugars

(ii) Glycoprotein

B. Tendons

(iii) Collagen

C. Lipids

(iv) Chromoprotein

D. Pigment

Correct answer is:

(1) i-B, ii-C, iii-A, iv-D

(2) i-C, ii-B, iii-D, iv-A

(3) i-A, ii-B, iii-C, iv-D

(4) i-C, ii-A, iii-B, iv-D

92. $H_3C \equiv C CH_3 \xrightarrow{(i) X} CH_3COCOCH_3$

In the above reaction X is:

(1) K_2Cr_2O7

(2) O_2

(3) O_3

(4) H_2SO_4

93. The reaction, $C_6H_5Br + 2Na + C_2H_5Br \rightarrow C_6H_5 - C_2H_5 + 2NaBr$ is known as:

(1) Cannizzaro reaction

(2) Wurtz reaction

(3) Oppenaur oxidation

(4) Wurtz-Fittig reaction

94. What is the condensation product of ethylacetate?

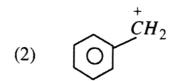
(1) Aceto acetic ester

(2) Ethyl cyanide

(3) Ethyl aceto acetate

(4) Ethyl propanoate

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(3)
$$\dot{C}H_3$$

$$(4) \qquad \bigcirc CH_2 - \overset{+}{C}H_2$$

96.

$$C \equiv C - CH_3 \xrightarrow{Hg^{2+}/H^+} A, A \text{ is :}$$

- 97. Which of the following undergoes a Diels-Alder reaction?
 - (1) Thiophene
- (2) Pyrrole
- (3) Pyridine
- (4) Furan

98. Reaction:

(1) Cheletropic reaction

- (2) Cycloaddition
- (3) Sigmatropic rearrangement
- (4) The enereaction

- Then complied is heated with KOII, the major product comme (1) Isocampholic acid

 - (2) Camphene
 - (3) Campholic acid
 - (4) Camphoric acid
- 100.
 - Which of the flowing reaction is favoured by polar aprotic solvent?
 - (1) S_{N2} reaction
 - (3) Addition reaction
- (2) S_{N_1}

 - (4) Both S_{N_1} & S_{N_2} reactions

Total No. of Printed Pages: 21

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В

Ph.D./URS-EE-Jan-2022

SUBJECT: Chemistry

SET-Y

10042

		Sr. No
Time: 1¼ Hours Roll No. (in figures)	Marks : 100 ords)	Total Questions 100
Name	Father's Name	
Mother's Name	Date of Examination_	
(Signature of the Candidate)	-	(Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

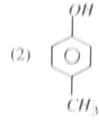
- 1. All questions are compulsory.
- 2. The candidates must return the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfairmeans / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
- 4. Question Booklet along with answer key of all the A, B, C & D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
- The candidate must not do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers must not be ticked in the question booklet.
- There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

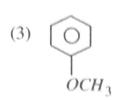
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SEAL

1. Which one of the following is strongest acid?







$$(4) NO_2 VH NO_2$$

$$NO_2$$

2. The ^{13}C NMR spectrum of ethyl benzene exhibits:

- (1) 8 signals
- (2) 6 signals
- (3) 5 signals
- (4) 4 signals

3.
$$CH_2Cl$$
 $+Mg \xrightarrow{\text{dry ether}} A \text{ (product) is :}$

$$(1) \bigcirc CH_2MgCl$$

4. The IUPAC name of $COOC_2H_5$ is :

- (1) Cyclohexane carboxamide
- (2) Cyclohexane ethyl carboxylate
- (3) Ethyl cyclohexane carboxylate
- (4) Aminocyclo hexane carboxylate
- **5.** Which one of the following statement is *correct*?
 - (1) Allene and biphenyls show optical activity.
 - (2) Allene and biphenyls do'nt show optical activity.
 - (3) Only allene show optical activity not biphenyls.
 - (4) Only biphenyls show optical activity not allene.
- **6.** Chlorination of furan is carried out by :
 - (1) Cl_2 at $-40^{\circ}C$
 - (2) Cl_2 , $at 30^{\circ}C$
 - (3) *Cl*₂
 - (4) FeCl₃
- 7. Which one of the following is aldoses?
 - (1) Fructose

(2) Galactose

(3) Ribulose

(4) Sorbose

8. Match the **list-I** and **list-II** and select the *correct* answer using codes given below the list:

List - I

List - II

(i) Citral

A. p-cymene

(ii) Linalool

- B. Carvoxime
- (iii) α-terpineol
- C. Tert. alcohol
- (iv) Limonene
- D. Lemon grass

iv-C

Correct answer is:

- (1) i-B, ii-A, iii-D,
- (2) i-D, ii-C, iii-A, iv-B
- (3) i-C, ii-D, iii-B, iv-A
- (4) i-A, ii-B, iii-C, iv-D
- 9. $CH \longrightarrow CH \longrightarrow A$, A is $CH \longrightarrow CH \longrightarrow CH$







(4) N

- 10. Nicotine alkaloid belong to:
 - (1) Phenyl ethylamine group
 - (2) Pyrrolidine pyridine group
 - (3) Isoquinoline group
 - (4) Indol group

11. 10 mL aliquots of a mixture of HCI and HNO_3 are titrated conductometrically using a 0.1M NaOH and a 0.1M $AgNO_3$ separately. The titer volumes are V_1 and V_2 respectively. The concentration of HNO_3 in the mixture is obtained from the combination:

(1) $V_1 - V_2$

(2) $V_2 - V_1$

(3) $2V_1 - V_2$

(4) $2V_2 - V_1$

12. The electrode potential of which electrode depends upon the H^+ ion concentration?

- (1) Hydrogen electrode
- (2) Quinhydrone electrode
- (3) Glass electrode
- (4) All of the above

13. One mole of an ideal gas is allowed to expand isothermally and reversibly from $0.02\,\mathrm{m}^3$ to $0.20\,\mathrm{m}^3$ at 300 K. The entropy change for the system will be in (JK⁻¹):

- (1) 4.61
- (2) 57.42
- (3) 19.14
- (4) -19.14

14. What is the half-life of N_2O_5 if it decomposes with a rate constant of $5.7 \times 10^{-4} \, \text{s}^{-1}$?

(1) 20 minutes

(2) 10 minutes

(3) 0.05 minutes

(4) Insufficient data

15. The activation energies of two reactions are E_1 and E_2 ($E_1 > E_2$) respectively. If the temperature of the system is increased from T_1 to T_2 , the rate constants of the reactions change from k_1 to k_1 in the first reaction and k_2 to k_2 in the second reaction. Predict which of the following is **correct**?

$$(1) \ \frac{k_1'}{k_1} > \frac{k_2'}{k_2}$$

(2)
$$\frac{k_1'}{k_1} = \frac{k_2'}{k_2} = 1$$

(3)
$$\frac{k_1'}{k_1} < \frac{k_2'}{k_2}$$

(4) None of the above

16. Arrhenius equation to determine the activation energy is:

(1)
$$\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} \left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

(2)
$$\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} \left(\frac{1}{T_2} + \frac{1}{T_1}\right)$$

(3)
$$\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = -\frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

(4)
$$\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} \left(T_1 T_2\right)$$

17. The following reaction takes place in a cell:

$$Fe^{2+}(aq) + Ag^{+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$$

Given that:
$$E_{Ag^+/Ag}^0 = xV$$
; $E_{Fe^{2+}/Fe}^0 = yV$; $E_{Fe^{3+}/Fe}^0 = zV$

The standard potential of the cell in volts (V) will be:

(1)
$$x - z$$

(2)
$$x - y$$

(3)
$$x + 2y - 3z$$

(4)
$$x + y - z$$

18. What is the pH of HCl solution when the hydrogen gas electrode shows a potential of -0.22 V at standard temperature and pressure?

- (1) 2.98
- (2) 2.17
- (3) 3.14
- (4) 3.73

19. The energy of the ground state of a particle in a box within first order perturbation theory of a system with the following potential energy will be:

$$V(x) = \begin{cases} V_0 & 0 \le x \le L \\ \infty & x < 0 \text{ and } x > L \end{cases}$$

$$(1) \ \frac{h^2}{8mL^2}$$

(2)
$$V_0$$

(3)
$$\frac{h^2}{8mL^2} + V_0$$

(4)
$$\frac{h^2}{4mI^2} + \frac{V_0}{2}$$

			В	В
6	Which of the following dispersions de	oes not have liquid continue	ous phase?	28.
20.	(1) Foam	(2) Nanosuspension		
	(3) Microemulsion	(4) Gel		
21.	Which of the species has a permaner (1) SF_4 (2) SiF_4	ant dipole moment? (3) BF_3	1) XeF ₄	29.
22.	Which of the ion has maximum hydron (1) Sr^{2+} (2) Ca^{2+}	$(3) Mg^{2+}$	4) Be^{2+}	
23.	Oxymyoglobin $Mb(O_2)$ and oxyhae	emoglobin $Hb(O_2)_4$ respec	tively, are:	30.
	(1) Paramagnetic and paramagnetic			
	(2) Diamagnetic and diamagnetic			
	(3) Paramagnetic and diamagnetic			
24	one dimensional infinite potential state of the system is: (1) $\frac{\pi^2 \hbar^2}{ma^2}$ (3) $\frac{3\pi^2 \hbar^2}{ma^2}$	extrictles each of spin 1/2 are well of length a . The end (2) $\frac{2\pi^2\hbar^2}{3ma^2}$ (4) $\frac{5\pi^2\hbar^2}{2ma^2}$		31.
25	The difference in angular momen hydrogen atom is:	ntum of the electron in ty	wo adjacent orbitals of the	32.
	(1) $h/2\pi$ (2) h/π	(3) $(n+1)h/2\pi$	(4) $(n-1)h/2\pi$	
26	Apply molecular orbital theory to	predict which species has	the strongest bond?	33.
	(1) N_2 (2) N_2^-	(3) N_2^+	(4) All are equivalent	34.
2	. The charge density at each carbon	n atom in butadiene is:		
	(1) 2 (2) 0	(3) 4	(4) 1	Pivv-
PHI	//URS-EE-2022/(Chemistry)(SET-Y)/	(B) (2) (2) (2) (3)		PHD/U

2	_	~ ~	erence between the field osen compound is which	-	nce in the
	(1) Field shi	ft	(2) Chemical sl	nift	
	(3) Matrix sl	hift	(4) Resonance	shift	
2	which the po		nomonuclear diatomic mo st excited state will be h int):		
	(1) $(h v ln2)/(1 v ln2)$	⁄k	(2) $\ln 2 / (\ln v k)$		
	(3) h v /(k ln	2)	(4) h v lnk		
30). What are the	point groups of tetr	ahedral and octahedral m	olecules ?	
	(1) D_{3h} and	D_{4h} respectively			
	(2) T_d and O	O_h , respectively			
	(3) C_{3h} and (C_{4h} respectively			
	(4) C_{4h} and I	O _{4h} respectively			
31.	John-Teller ef	fect is in the field o	of:		
	(1) Nuclear pl	nysics			
	(2) Vibronic in	nteractions			
	(3) Thermody	namics			
	(4) Kinetic the	cory of gases			
32.	Which of the fo	ollowing is a soft a	cid ?		
	(1) Ag^+	(2) Pt^{2+}	$(3) Au^+$	(4) All	
33.	Which of the fo	ollowing will comb	ine with BH_3 to form a si	table complex?	
	(1) <i>CO</i>	(2) Pt^{2+}	(3) <i>OH</i> ⁻	(4) Methane	
34.	The electronic g	ground state term for	or the chromium ion in [$Cr(CN)_6 1^{-4}$ is:	
	$(1)^{3}F$	$(2)^{3}H$	(3) 3 G	5	

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	$M_{\alpha}(C_{\alpha}H_{\alpha})(CO)_{3}$ is:
35.	The hapticity of cycloheptatriene (C_7H_8) in $Mo(C_7H_8)(CO)_3$ is: (4) 9
	(1) 6 (2) 5 (3) 4
36.	(1) 6 (2) 5 (3) 4 If Δ_0 is octahedral splitting energy and P is electron pairing energy then the crystal field stabilization energy (CFSE) of $[Co(NH_3)_6]^{+2}$ is:
	(1) $0.8 \text{ A} + 2.\text{ D}$ (2) $-0.8 \Delta_0 + 1.1$
	(1) $-0.8 \Delta_0 + 2 P$ (3) $-0.8 \Delta_0$ (4) $-1.8 \Delta_0 + 3P$
37.	The shapes of XeF_5^+ and XeF_5^- respectively, are :
	(1) Pentagonal planar and square pyramidal
	(2) Pentagonal planar and trigonal bipyramidal
	(3) Square pyramidal and pentagonal bipyramidal
	(4) Square pyramidal and pentagonal planar
38.	The number of terminal carbonyl groups present in $Fe_2(CO)_9$ are:
	(1) 2 (2) 5 (3) 6 (4) 3
39.	The order of polarity of NH_3 , NF_3 and BF_3 is:
	$(1) NH_3 < NF_3 < BF_3$
	$(2) BF_3 < NF_3 < NH_3$
	$(3) BF_3 < NH_3 < NF_3$
	$(4) NF_3 < BF_3 < NH_3$

- **40.** *Correct* statement for Coulometry is :
 - (1) It is based on Faraday's law of electrolysis.
 - (2) It is a type of voltammetry.
 - (3) It is based on Ohm's law.
 - (4) It uses ion selective electrode.

41. Match the List-I and List-II and select the *correct* answer using codes given below the list:

List-I

- (i) Lipoprotein
- (ii) Glycoprotein
- (iii) Collagen
- (iv) Chromoprotein

List-II

- A. Sugars
- B. Tendons
- C. Lipids
- D. Pigment

Correct answer is:

- (1) i-B, ii-C, iii-A, iv-D
- (2) i-C, ii-B, iii-D, iv-A
- (3) i-A, ii-B, iii-C, iv-D
- (4) i-C, ii-A, iii-B, iv-D

42.
$$H_3C \equiv C \ CH_3 \xrightarrow{(i) \ X} CH_3COCOCH_3$$

In the above reaction X is:

(1) K_2Cr_2O7

(2) O_2

(3) O_3

- (4) H_2SO_4
- **43.** The reaction, $C_6H_5Br + 2Na + C_2H_5Br \rightarrow C_6H_5 C_2H_5 + 2NaBr$ is known as :
 - (1) Cannizzaro reaction

(2) Wurtz reaction

(3) Oppenaur oxidation

- (4) Wurtz-Fittig reaction
- 44. What is the condensation product of ethylacetate?
 - (1) Aceto acetic ester

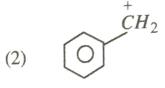
(2) Ethyl cyanide

(3) Ethyl aceto acetate

(4) Ethyl propanoate

45. Which of the following synthon is most stable?





$$(4) \qquad \bigcirc CH_2 - \overset{+}{C}H_2$$

46. $C \equiv C - CH_3 \xrightarrow{Hg^{2+}/H^+} A$, A is:

$$(1) \bigcirc OH$$

$$CH_3$$

47. Which of the following undergoes a Diels-Alder reaction?

- (1) Thiophene
- (2) Pyrrole
- (3) Pyridine
- (4) Furan

48. Reaction:

$$+SO_2 \rightarrow \bigcirc SO_2$$

(1) Cheletropic reaction

- (2) Cycloaddition
- (3) Sigmatropic rearrangement
- (4) The enereaction

4	9. When comphor is heated with KOH, the major product obtained is:				
	(1) Isocampholic acid	(2) Camphene			
	(3) Campholic acid	(4) Camphoric acid			
50	Which of the flowing reaction is favoured by polar aprotic solvent?				
	(1) S_{N2} reaction				
	(2) S_{N_1}				
	(3) Addition reaction				
	(4) Both S_{N_1} & S_{N_2} reactions				
51	I. Freundlich adsorption isotherm car	be used to model:			
	(1) Monolayer adsorption				
	(2) Multilayer adsorption				
	(3) Both monolayer and multilayer adsorption				
	(4) None of the above				
52.	Which of the following statements	s <i>not</i> true ?			
	(1) Step-growth polymerization rec	uires a bifunctional momoner			
	(2) Nylon 6 is an example of step-growth polymerization				
	(3) Chain growth polymerization	on includes both homo-	polymerization	and	
	(4) Chain growth polymerization in	volves homo-polymerization of	only		
53.	Which of the following salts show maximum value of equivalent conduction their fused state?			e in	
	(1) KCl (2) NaCl	(3) CsCl (4)	RbCl		

- **54.** In terms of energy bands, insulators have:
 - (1) Full conduction band
 - (2) Very small energy gap
 - (3) Full valence band
 - (4) Moderate energy gap
- 55. If the value of the wavelength is doubled, which of the following is *not* true in Bragg's method for crystal structure determination?
 - (1) The d spacings become smaller
 - (2) Bragg angles of reflections increase
 - (3) The diffraction pattern expands
 - (4) Some previously accessible reflections can no longer be measured
- **56.** A committee has 6 members having weights in (kg) as 45, 50, 65, 72, 63 and 65. What will be the standard deviation?
 - $(1) \sqrt{115}$
- $(2) \sqrt{152}$
- (3) √88 (4) √176
- **57.** Most stable carbocation is:
 - (1) Tropylium ion

(2) Benzylcation

(3) Allylcation

- (4) Vinylcation
- The given reaction is an example of: 58.

$$\stackrel{CH_3}{\longrightarrow} \stackrel{CH_3}{\longrightarrow}$$

- (1) Cope rearrangement
- (2) The claisen rearrangement
- (3) Diels-Alder reaction
- (4) Cheletropic reaction

59.	Which of the following reagents react with phenol at 298K to form salt?		
	(1) <i>NaHCO</i> ₃	(2) <i>Cl</i> ₂	
	(3) H_2SO_4	(4) NaOH	
60.	A single strong absorption near 1800 cm ⁻¹ in IR spectroscopy indicates the presence of:		
	(1) Azo compound	(2) Acid halides	
	(3) Sulphoxide	(4) Thioketones	
61.	Which one of the following is mainly responsible for eutrophication?		
	(1) Nitrate	(2) Phosphate	
	(3) Carbamate	(4) Sulphate	
62.	Which one of the following is used as tranquilizer?		
	(1) Omepyrazole	(2) 2-acetoxy benzoic acid	
	(3) Chloromycetin	(4) Barbituric acid	
63.	In IR spectrum, primary amines show two bands around the region:		
	(1) 3350 cm ⁻¹	(2) 2950 cm ⁻¹	
	(3) 1630 cm ⁻¹	(4) 2100 cm ⁻¹	
64.	Green chemistry protects the environment by reducing:		
	(1) Forest	(2) Temperature	
	(3) Pollution	(4) Weeds	

65. Which of the following has the highest bond dissociation energy?

- (1) Hydrogen bond
- (2) Covalent bond
- (3) Dipole-Dipole interaction
- (4) Vander Waals forces

66. The reaction $CH_3CCH_2CH_3 \xrightarrow{Zn-Hg} CH_3CH_2CH_2CH_3$ is known as:

- (1) Perkin reaction
- (2) Aldol condensation
- (3) Clemmensen reduction
- (4) Pechmann condansation

67. Which of the following carbonyl give a haloform test?

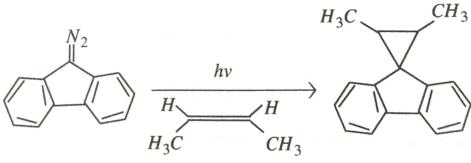
(1) Hexan-2-one

(2) Propanal

(3) Pentan-3-one

(4) 2-Methyl butanal

68. The intermediate involved in the following reaction is:



(1) Carbocation

(2) Carbene

(3) Nitrene

(4) Free radical

- Spiro compounds are optically active due to:
 - (1) Chiral axis

(2) Chiral plane

(3) Chiral carbon

- (4) Helicity
- Which one of the following reagent gives syn addition with alkene?
 - (1) Br_2

(2) Cl_2

(3) Dil $KMnO_A/OH^-$

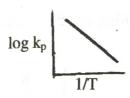
- (4) DDO
- 71. The rotational constant B for the HCl molecule is 10.6 cm⁻¹. The frequency for the pure rotation transition $J = 0 \rightarrow J = 1$ is equal to :
 - (1) 10.6 cm^{-1}
- (2) 5.3 cm^{-1}
- (3) 21.2 cm^{-1} (4) No absorption
- 72. If the reduced mass of a diatomic molecule is doubled without changing its force constant, the vibrational frequency of the molecule with respect to the original frequency will be:

- (1) Unchanged (2) $\sqrt{2}$ times (3) 2 times (4) $\frac{1}{\sqrt{2}}$ times
- Identify which of the following pairs of molecules exhibit both a pure rotational spectrum and a rotational Raman spectrum?
 - (1) O_2 and H_2O

(2) CO_2 and N_2O

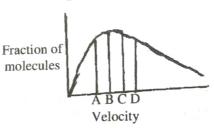
(3) CO and CH_4

- (4) NO and DCCH
- The variation of log K_p with temperature 1/T for the equilibrium; $NH_AHS(s) \Leftrightarrow$ 74. $NH_3(g) + H_2S(g)$; is as shown in the plot. The equilibrium is displaced in the forward direction on:

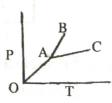


- (1) Increasing the temperature and decreasing the pressure
- (2) Increasing the temperature and pressure both
- (3) Decreasing the temperature and pressure both
- (4) Decreasing the temperature and increasing the pressure

- The upper critical solution temperature is defined as:
 - (1) The maximum temperature at which two components will remain immiscible as
 - (2) The minimum temperature at which two components will remain immiscible as two distinct liquids
 - (3) The maximum temperature at which two components remain miscible
 - (4) The minimum temperature at which two components remain miscible
- **76.** Which of the following is *true* regarding non-ideal solutions with negative deviation?
 - (1) The interactions between the components are lesser than in the pure components
 - (2) $\Delta V_{\text{mixing}} = +ve$
 - (3) $\Delta H_{\text{mixing}} = +ve$
 - (4) They form maximum boiling azeotropes
- Which out of A, B, C and D corresponds to the most probable speed?



- (1) A
- (2) B
- (3) C
- (4) D
- 8 distinguishable particles are distributed in two equal sized compartments. The 78. probability of the macro state (4, 4) is equal to:
 - (1) 35/128
- (2) 7/128
- (3) 7/16
- (4) 35/256
- The slopes of the lines OA, AC and AB are $\tan \pi/4$, $\tan \pi/6$ and $\tan \pi/3$ respectively, If the melting point and ΔH melting are 27°C and 3 kJ mol⁻¹ respectively, the change in volume upon melting is:



- (1) 10 $\tan \pi/4$
- (2) $10 \cot \pi/3$
- (3) 10 $\tan \pi/3$
- (4) $10 \cot \pi/4$

00	
80.	Standard enthalpy of vanourisation Auro
	Standard enthalpy of vapourisation ΔH_{vap}^{0} for water at 100°C is 40.66 kJ mol ⁻¹ .
	Assuming water vapour to behave like an ideal gas, the internal energy of
	Vanourisation of water and a second of the second of water and second of the second of
	vapourisation of water at 100°C (in kJ mol ⁻¹) will be equal to:
	(1) +37.56
	(1) (2) (3) (4) (6)

- (1) +37.56
- (2) -40.66
- (3) +43.76
- (4) -43.76

81. The calibration curve in spectrofluorimetric analysis becomes non-linear when:

- (1) Molecular weight of analyte is high
- (2) Intensity of light source is high
- (3) Concentration of analyte is high
- (4) Molar absorptivity of analyte is high

82. Mossbauer spectrum of a metal complex gives information about :

- (a) Oxidation state and spin state of metal
- (b) Types of ligands co-ordinated of metal
- (c) Nuclear spin state of metal
- (d) Geometry of metal

Correct answer is:

(1) (a) and (c)

(2) (b) and (c)

(3) (a), (b) and (d)

(4) (b) and (d)

83. Intense band generally observed for a carbonyl group in the IR spectrum is due to :

- (1) The force constant of CO bond is large
- (2) The force constant of CO bond is small
- (3) There is no change in dipole moment for CO bond stretching
- (4) The dipole moment change due to CO bond stretching is large

3	nhas	se proton affinity among the following: (4) $N(CH_3)_3$ (3) NH_3 12- adopts:
84.	The species having the strongest gas plant (1) N^{3-} (2) NF_3	(3) NH_3 $H_{13}^{2-} \text{adopts}:$
85.	(1) N^{3-} (2) NF_3 According to Wade's theory, the anion [1]	(2) Arachno structure (4) Nido structure
86.	(3) Hypo structureWhen an electron is added to a gaseous a(1) Its size decreases	(2) Energy is released (4) Its tendency to accept electron increases
	(3) It changes to positive ion	(4) Its tendency to do 1
87.	Aufbau principle is <i>not</i> violated in: (1) d-block elements	(2) s and p-block elements
	and a standard	(4) Actinides
88.	The highest value of n for the elements (1) 6 (2) 7	
89.	During the change of NO^+ to NO , the (2) π -orbital	(5) 0 -01011111
90.	Alkali metals dissolve in liquid amme	onia to form blue coloured solutions. The blue
	(1) Alkali metals	(2) Alkali metal ions
	(3) Ammoniated electrons	(4) Ammoniated alkali metal ions
91.		er of elution of lanthanides is:
	(1) $Lu^{+3} > Yb^{+3} > Ce^{+3} > La^{+3}$	
	(2) $Sm^{+3} > Eu^{+3} > Tm^{+3} > Yb^{+3}$	
	(3) $La^{+3} > Ce^{+3} > Yb^{+3} > Lu^{+3}$	
PHD	(4) $Yb^{+3} > Tm^{+3} > Sm^{+3} > Eu^{+3}$ /URS-EE-2022/(Chemistry)(SET-Y)/(B)	

92	Which of the fo	llowing statements is	false ?	
	(1) Lanthanides have poor tendency to form complexes			
	(2) Lanthanides closely resemble each other			
		⁺² are less stable than		nides
				creasing atomic number
93.		tion of Haemocyanin		
	(1) Oxygen tran		(2) Oxygen tra	
	(3) Electron tra	nsport and Fe	(4) Electron tra	
94.	If an enzyme fi	ixes Nitrogen in planed respectively are:		the number of electrons and
	(1) 6 and 6	(2) 8 and 8	(3) 6 and 8	(4) 8 and 6
95.	The half-life of after 4 years?	Cobalt-60 is 5.26 year	rs. What will be the	remaining percentage activity
	(1) 76%	(2) 32%	(3) 59%	(4) 18%
96.	Radioisotopes of	f lodine are used in:		
	(1) Tagging leuk	kocytes and labelling	of blood platelets	
	(2) Diagnosis and treatment of the diseases of thyroid glands			ands
	(3) Diagnosis ar	nd treatment of the hea	art diseases	
	(4) Diagnosis ar	nd treatment of brain t	umours	
97.		tegration of radioactics of orde		ends only on the and
	(1) Nature of rac	lioactive substance ar	nd first	
	(2) Amount of ra	adioactive substance	and second	
	(3) Temperature	and zero		
		he radioactive substar	nce and first	
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is

98.	Which of the complex is an active catalyst and a 16 e^- species?		
	(1) $[HRh(CO)(PPh_3)_3]$	$(2) [HCo(CO)_3]$	
	(3) $[Rh(CO)_2I_4]^-$	$(4) [Pd(PPh_3)_4]$	
99.	The catalyst used for polymerization of	olefins is :	
	(1) Wilkinson's catalyst	(2) Zeise's salt complex	
	(3) Ziegler-Natta catalyst	(4) Tetraethyl lead	
100.	In the hydrogenation of alkenes using $RhCl(PPh_3)_2$. The first step in its cataly	g Wilkinson's catalyst, the active catalyst ytic cycle is:	
	(1) Alkene co-ordination	(2) Oxidative addition of H ₂	
	(3) Loss of PPh_3	(4) Loss of Cl^-	

Total No. of Printed Pages: 21

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

C

Ph.D./URS-EE-Jan-2022

SUBJECT: Chemistry

SET-Y

10043

		Sr. No
Time: 1¼ Hours Roll No. (in figures)	Max. Marks : 100 (in words)	Total Questions: 100
Name	Father's Name	
Mother's Name	Date of Examination_	
(Signature of the Candidate)		(Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

- All questions are compulsory.
- 2. The candidates must return the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfairmeans / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
- 4. Question Booklet along with answer key of all the A, B, C & D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
- The candidate must not do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers must not be ticked in the question booklet.
- There will be no negative marking. Each correct answer will be awarded one full mark.
 Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated
 as incorrect answer.
- 7. Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

PHD/URS-EE-2022/(Chemistry)(SET-Y)/(C)

1. The rotational constant B for the HCl molecule is 10.6 cm⁻¹. The frequency for the pure rotation transition $J = 0 \rightarrow J = 1$ is equal to:

(1) 10.6 cm^{-1}

(2) 5.3 cm^{-1}

 $(3) 21.2 \text{ cm}^{-1}$

(4) No absorption

2. If the reduced mass of a diatomic molecule is doubled without changing its force constant, the vibrational frequency of the molecule with respect to the original frequency will be:

- (1) Unchanged
- rozzal o o zeneno (2) $\sqrt{2}$ times vood zaulio:
- (3) 2 times

(4) $\frac{1}{\sqrt{2}}$ times

3. Identify which of the following pairs of molecules exhibit both a pure rotational spectrum and a rotational Raman spectrum?

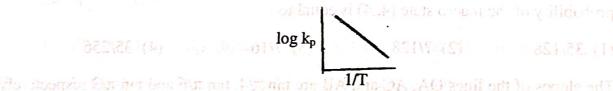
(1) O_2 and H_2O

(2) CO_2 and N_2O

(3) CO and CH_4

(4) NO and DCCH

4. The variation of $\log K_p$ with temperature 1/T for the equilibrium; $NH_4HS(s) \Leftrightarrow NH_3(g) + H_2S(g)$; is as shown in the plot. The equilibrium is displaced in the forward direction on:



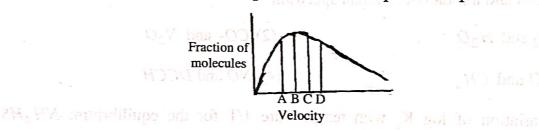
(1) Increasing the temperature and decreasing the pressure

(2) Increasing the temperature and pressure both

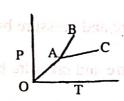
(3) Decreasing the temperature and pressure both

(4) Decreasing the temperature and increasing the pressure

- 5. The upper critical solution temperature is defined as:
 - (1) The maximum temperature at which two components will remain immiscible as two distinct liquids
 - (2) The minimum temperature at which two components will remain immiscible as two distinct liquids
 - (3) The maximum temperature at which two components remain miscible
 - (4) The minimum temperature at which two components remain miscible
- 6. Which of the following is true regarding non-ideal solutions with negative deviation?
 - (1) The interactions between the components are lesser than in the pure components
 - (2) $\Delta V_{\text{mixing}} = +ve$
 - (3) $\Delta H_{\text{mixing}} = +ve$
 - (4) They form maximum boiling azeotropes
- Which out of A, B, C and D corresponds to the most probable speed?



- (1) A side at transport (2) B side solg ont (3) C ode at 21 (2) (4) D side (4)
- 8. 8 distinguishable particles are distributed in two equal sized compartments. The probability of the macro state (4, 4) is equal to:
 - (1) 35/128
- (2) 7/128
- (3) 7/16
- (4) 35/256
- 9. The slopes of the lines OA, AC and AB are $\tan \pi/4$, $\tan \pi/6$ and $\tan \pi/3$ respectively, If the melting point and ΔH melting are 27°C and 3 kJ mol⁻¹ respectively, the change in volume upon melting is:



- (1) 10 $\tan \pi/4$
- (2) $10 \cot \pi/3$
- (3) 10 $\tan \pi/3$
- (4) $10 \cot \pi/4$

PREMIUS ES DESMICHMINET (SET-1861C)

	ta da a d
10.	Standard enthalpy of vapourisation ΔH_{vap}^0 for water at 100°C is 40.66 kJ mol ⁻¹ . Assuming water vapour to behave like an ideal gas, the internal energy of vapourisation of water at 100°C (in kJ mol ⁻¹) will be equal to:
	(1) +37.56 $(2) -40.66$ $(3) +43.76$ $(4) -43.76$
11.	The calibration curve in spectrofluorimetric analysis becomes non-linear when:
	(1) Molecular weight of analyte is high
	(2) Intensity of light source is high
	(3) Concentration of analyte is high
	(4) Molar absorptivity of analyte is high
12.	Mossbauer spectrum of a metal complex gives information about:
	(a) Oxidation state and spin state of metal
	(b) Types of ligands co-ordinated of metal
	(c) Nuclear spin state of metal
	(d) Geometry of metal
	Correct answer is:
	(1) (a) and (c) (2) (b) and (c) (3) (a), (b) and (d) (4) (b) and (d)
13.	Intense band generally observed for a carbonyl group in the IR spectrum is due to:
	(1) The force constant of CO bond is large
	(2) The force constant of CO bond is small
	(3) There is no change in dipole moment for CO bond stretching
	(4) The dipole moment change due to CO bond stretching is large

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22.	Which of the	e following statements is	sfalse?	
	(1) Lanthani	ides have poor tendency	to form complexes	
	(2) Lanthani	des closely resemble ea	ch other	
	(3) M^+ and	M^{+2} are less stable that	n M^{+3} ion in lantha	nnides
	(4) Basic str	ength of lanthanide oxid	les increases with in	ncreasing atomic number
23.	Biological fu	nction of Haemocyanin	and metal involved	in it:
	(1) Oxygen	transport and Fe	(2) Oxygen tra	ansport and Cu
	(3) Electron	transport and Fe	(4) Electron tr	ansport and Cu
24.		e fixes Nitrogen in placiated respectively are:	nts by evolving H ₂	, the number of electrons and
	(1) 6 and 6	(2) 8 and 8	(3) 6 and 8	(4) 8 and 6
25.	The half-life after 4 years		ars. What will be the	e remaining percentage activity
	(1) 76%	(2) 32%	(3) 59%	(4) 18%
26.	Radioisotope	s of lodine are used in:	enimi – leiku 17. mi	
	(1) Tagging I	leukocytes and labelling	g of blood platelets	
	(2) Diagnosis	s and treatment of the di	seases of thyroid gl	ands
	(3) Diagnosis	s and treatment of the he	eart diseases	
1	(4) Diagnosis	s and treatment of brain	tumours	
27.		isintegration of radioact	er.	ends only on the and
	(1) Nature of	radioactive substance a		
	(2) Amount of	of radioactive substance	and second	
	(3) Temperat	ure and zero		
	(4) Half-life of	of the radioactive substa	ance and first	and the second second
PHD/U	RS-EE-2022/(C	Chemistry)(SET-Y)/(C)	不到代表等等是	P.T. O

28.	Which of the complex is an active ca (1) $[HRh(CO)(PPh_3)_3]$	atalyst and a 16 e^- species ? (2) $[HCo(CO)_3]$
	(3) $[Rh(CO)_2I_4]^-$	$(4) [Pd(PPh_3)_4]$
29.	The catalyst used for polymerization	of olefins is:
	(1) Wilkinson's catalyst	(2) Zeise's salt complex
	(3) Ziegler-Natta catalyst	(4) Tetraethyl lead
30.	In the hydrogenation of alkenes $RhCl(PPh_3)_2$. The first step in its ca	using Wilkinson's catalyst, the active catalyst is atalytic cycle is:
	(1) Alkene co-ordination	(2) Oxidative addition of H ₂
	(3) Loss of <i>PPh</i> ₃	(4) Loss of Cl
31.	Which one of the following is mainly	y responsible for eutrophication?
	(1) Nitrate	(2) Phosphate
	(3) Carbamate	(4) Sulphate
32.	Which one of the following is used a	s tranquilizer?
	(1) Omepyrazole	
	(2) 2-acetoxy benzoic acid	randowns of Technology () and survey ()
	(5) Chioromyccum	the fact of and to almost about the state of
	(4) Barbituric acid	ranu spad ja 140
33.	In IR spectrum, primary amines show	v two bands around the region.
	(1) 3350 cm ⁻¹	The local control of the second control of t
	(1) 3330 CIII	(2) 2950 cm^{-1}
	(3) 1630 cm ⁻¹	(4) 2100 cm ⁻¹
PHD/U	RS-EE-2022/(Chemistry)(SET-Y)/(C)	The Med Edisposis

Green chemistry protects the environment by reducing:

(1) Forest

(2) Temperature

(3) Pollution

(4) Weeds

35. Which of the following has the highest bond dissociation energy?

- (1) Hydrogen bond
- (2) Covalent bond
- (3) Dipole-Dipole interaction
- (4) Vander Waals forces

The reaction $CH_3CCH_2CH_3 \xrightarrow{Zn-Hg} CH_3CH_2CH_2CH_3$ is known as: 36.

(1) Perkin reaction

- (2) Aldol condensation
- (3) Clemmensen reduction
- (4) Pechmann condansation

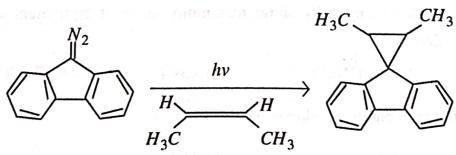
Which of the following carbonyl give a haloform test? 37.

- (1) Hexan-2-one (2) Propanal

(3) Pentan-3-one

(4) 2-Methyl butanal

The intermediate involved in the following reaction is:



(1) Carbocation

(2) Carbene

(3) Nitrene

(4) Free radical

39	Spiro compounds are optically active d(1) Chiral axis	ue to: (2) Chiral plane
	(3) Chiral carbon	(4) Helicity
40.	. Which one of the following reagent giv	es syn addition with alkene?
	$(1) Br_2 \qquad \qquad$	(0) (1)
	(3) Dil $KMnO_4/OH^-$	(4) DDQ
41.	Freundlich adsorption isotherm can be	used to model:
	(1) Monolayer adsorption	recourt un alogni viendi de
	(2) Multilayer adsorption	200 io 4 co 10 rot 42 co
	(3) Both monolayer and multilayer ads	- 1 ⁻⁷ 1 1 1
	(4) None of the above	LE LE CONTRACTOR (EL LA CONTRACTOR DE LA
42.	Which of the following statements is no	true?
	(1) Step-growth polymerization require	s a bifunctional momoner
	(2) Nylon 6 is an example of step-grow	th polymerization
	(3) Chain growth polymerization copolymerization	includes both homo-polymerization and
	(4) Chain growth polymerization invol-	ves homo-polymerization only
43.	THE REPORT OF THE PARTY OF THE	naximum value of equivalent conductance in
	(1) KCl (2) NaCl	(3) CsCl (4) RbCl
44.	In terms of energy bands, insulators have	e:
	(1) Full conduction band	(2) Very small energy gap
	(3) Full valence band	(4) Moderate energy gap
PHD/U	RS-EE-2022/(Chemistry)(SET-Y)/(C)	THE STATE OF THE PROPERTY OF THE PROPERTY OF THE PERSON OF

- **45.** If the value of the wavelength is doubled, which of the following is **not** true in Bragg's method for crystal structure determination?
 - (1) The d spacings become smaller
 - (2) Bragg angles of reflections increase harmonic to and appears of the death of
 - (3) The diffraction pattern expands
 - (4) Some previously accessible reflections can no longer be measured
 - 46. A committee has 6 members having weights in (kg) as 45, 50, 65, 72, 63 and 65. What will be the standard deviation?
 - (1) √115
- (2) √152
- (3) √88
- (4) √176

- 47. Most stable carbocation is:
 - (1) Tropylium ion

(2) Benzylcation

(3) Allylcation

- (4) Vinylcation
- 48. The given reaction is an example of:

$$\stackrel{CH_3}{\longrightarrow} \stackrel{CH_3}{\longrightarrow}$$

(1) Cope rearrangement

(2) The claisen rearrangement

(3) Diels-Alder reaction

- (4) Cheletropic reaction
- 49. Which of the following reagents react with phenol at 298K to form salt?
 - (1) $NaHCO_3$

(2) Cl₂

(3) H_2SO_4

(4) NaOH

10		
50.	A single strong absorption near 1800 of:	0 cm ⁻¹ in IR spectroscopy indicates the presence
	(1) Azo compound	(2) Acid halides
	(3) Sulphoxide	(4) Thioketones
51.	Which of the species has a permanent	dipole moment ? The relate trace (1)
	(1) SF_4 (2) SiF_4	$(3) BF_3 (4) XeF_4$
52.	Which of the ion has maximum hydra (1) Sr^{2+} (2) Ca^{2+}	tion energy? (3) Mg^{2+} (4) Be^{2+}
53.	Oxymyoglobin $Mb(O_2)$ and oxyhaen	noglobin $Hb(O_2)_4$ respectively, are:
	(1) Paramagnetic and paramagnetic	an approbabilitions on odd lliv
	(2) Diamagnetic and diamagnetic	
	(3) Paramagnetic and diamagnetic	
	(4) Diamagnetic and paramagnetic	47. Alest stable curbocution in a language of the contract of
54.	Three identical non interacting particle one dimensional infinite potential we state of the system is:	cles each of spin $1/2$ and mass m are moving in ell of length a . The energy of the lowest energy
	(1) $\frac{\pi^2 \hbar^2}{ma^2}$ (2) $\frac{2\pi^2 \hbar^2}{3ma^2}$	(3) $\frac{3\pi^2\hbar^2}{ma^2}$ (4) $\frac{5\pi^2\hbar^2}{2ma^2}$
55.	The difference in angular momentum hydrogen atom is:	n of the electron in two adjacent orbitals of the
	(1) $h/2\pi$ (2) h/π	(3) $(n+1)h/2\pi$ (4) $(n-1)h/2\pi$
56.		dict which species has the strongest bond?
	(1) N_2 (2) N_2^-	(3) N_2^+ (4) All are equivalent
57.	The charge density at each carbon ato	m in butadiene is:
	(1) 2	(3) 4 (4) 1
PHD/U	JRS-EE-2022/(Chemistry)(SET-Y)/(C)	PHONE BLEE-2022/Chealang)(SET-Y)(C)

- In NMR spectroscopy, the difference between the field necessary for resonance in the sample and in some arbitrary chosen compound is which of the following?
 - (1) Field shift

(2) Chemical shift

(3) Matrix shift

- (4) Resonance shift
- The vibrational frequency of a homonuclear diatomic molecule is v. The temperature at 59. which the population of the first excited state will be half that of the ground state is given by (k is Boltzmann constant):
 - (1) (h v ln 2)/k
- (2) $\ln 2 / (\ln v k)$
- (3) h v / (k ln 2)
- (4) h v lnk
- 60. What are the point groups of tetrahedral and octahedral molecules?
 - (1) D_{3h} and D_{4h} respectively
 - (2) T_d and O_h , respectively
 - (3) C_{3h} and C_{4h} respectively
 - (4) C_{4h} and D_{4h} respectively
- Which one of the following is strongest acid?

$$(4) \qquad \begin{array}{c} NO_2 \\ \\ NO_2 \\ \\ NO_2 \\ \\ NO_2 \\ \end{array}$$

- The ^{13}C NMR spectrum of ethyl benzene exhibits: 62.
 - (1) 8 signals
- (2) 6 signals
- (4) Only hiphenyle show equical activ (3) 5 signals
 - (4) 4 signals

63.
$$CH_2Cl$$
 $+Mg \xrightarrow{\text{dry ether}} A \text{ (product) is :}$

$$CH_2MgCl \qquad CH_3$$
(1) Var shabborn sinnowith may (2) a O_1

C

64. The IUPAC name of
$$COOC_2H_5$$
 is :

- (1) Cyclohexane carboxamide
- (2) Cyclohexane ethyl carboxylate
- (3) Ethyl cyclohexane carboxylate
- (4) Aminocyclo hexane carboxylate
- 65. Which one of the following statement is correct?
 - (1) Allene and biphenyls show optical activity.
 - (2) Allene and biphenyls do'nt show optical activity.
 - (3) Only allene show optical activity not biphenyls.
 - (4) Only biphenyls show optical activity not allene.

66. Chlorination of furan is carried out by:

(1) Cl_2 at $-40^{\circ}C$

(2) Cl_2 , $at - 30^{\circ}C$

(3) Cl₂

(4) FeCl₃

67. Which one of the following is aldoses?

- (1) Fructose
- (2) Galactose
- (3) Ribulose
- (4) Sorbose

68. Match the **list-I** and **list-II** and select the *correct* answer using codes given below the list:

List - I

List - II

(i) Citral

A. p-cymene

(ii) Linalool

- B. Carvoxime
- (iii) α-terpineol
- C. Tert. alcohol

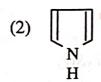
- (iv) Limonene
- D. Lemon grass

Correct answer is:

- (1) i-B, ii-A, iii-D, iv-C
- (2) i-D, ii-C, iii-A, iv-B
- (3) i-C, ii-D, iii-B, iv-A
- (4) i-A, ii-B, iii-C, iv-D

69. $CH \longrightarrow CH \longrightarrow A$, A is $CH \longrightarrow CH \longrightarrow A$









70. Nicotine alkaloid belong to:

- (1) Phenyl ethylamine group
- (2) Pyrrolidine pyridine group
- (3) Isoquinoline group
- (4) Indol group

71. Match the List-II and List-III and select the *correct* answer using codes given below the list:

List-I

(i) Lipoprotein

A. Sugars

(ii) Glycoprotein

B. Tendons

(iii) Collagen

C. Lipids

(iv) Chromoprotein

D. Pigment

Correct answer is:

72.
$$H_3C \equiv C CH_3 \xrightarrow{(i) X} CH_3COCOCH_3$$

In the above reaction X is:

(1)
$$K_2Cr_2O7$$

(2)
$$O_2$$

(3)
$$O_3$$

(4)
$$H_2SO_4$$

73. The reaction, $C_6H_5Br + 2Na + C_2H_5Br \rightarrow C_6H_5 - C_2H_5 + 2NaBr$ is known as:

(1) Cannizzaro reaction

(2) Wurtz reaction

(3) Oppenaur oxidation

(4) Wurtz-Fittig reaction

74. What is the condensation product of ethylacetate?

(1) Aceto acetic ester

(2) Ethyl cyanide

(3) Ethyl aceto acetate

(4) Ethyl propanoate

75. Which of the following synthon is most stable?

$$(2) \qquad \bigcirc \stackrel{\overset{+}{C}H_2}{}$$

(3)
$$\dot{C}H_3$$

$$(4) \qquad \bigcirc CH_2 - \overset{+}{C}H_2$$

76. $O = C - CH_3 \xrightarrow{Hg^{2+}/H^+} A, A \text{ is}$

77. Which of the following undergoes a Diels-Alder reaction?

- (1) Thiophene
- (2) Pyrrole
- (3) Pyridine
- (4) Furan (1)

(1) Cheletropic reaction

- (2) Cycloaddition
- (3) Sigmatropic rearrangement
- (4) The enereaction

79. When comphor is heated with KOH, the major product obtained is:

- (1) Isocampholic acid
- (2) Camphene
- (3) Campholic acid
- (4) Camphoric acid

Which of the flowing reaction is favoured by polar aprotic solvent?

(1) S_{N_2} reaction

(2) S_{N_1}

(3) Addition reaction

(4) Both $S_{N_1} & S_{N_2}$ reactions

John-Teller effect is in the field of:

(1) Nuclear physics

(2) Vibronic interactions

(3) Thermodynamics

(4) Kinetic theory of gases

Which of the following is a soft acid?

- (1) Ag^{+}
- (2) Pt^{2+}
- (3) Au^{+}

Which of the following will combine with BH_3 to form a stable complex?

- (2) Pt^{2+}
- (3) OH-
- (4) Methane

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•	·			<u> </u>
84.	The electronic ground state term for	the chromium ion in	$[Cr(CN)_6]^{-4}$ is:	
	$(1)^{3}F$ $(2)^{3}H$	(3) 3 G	(4) ⁵ D	
85.	The hapticity of cycloheptatriene (C	C_7H_8) in $Mo(C_7H_8)$	(CO) ₃ is:	
	(1) 6 (2) 5	(3) 4	(4) 9	
86.	If Δ_0 is octahedral splitting energy field stabilization energy (CFSE) of			crysta
	(1) $-0.8 \Delta_0 + 2 P$	(2) $-0.8 \Delta_0 + 1$	po odł chiedrogen P carterial	•
	(3) $-0.8 \Delta_0$	(4) $-1.8\Delta_0 + 3$	P .	
87.	The shapes of XeF_5^+ and XeF_5^- resp	pectively, are:	ary dopolessor in 17	
	(1) Pentagonal planar and square pyr	ramidal	broughwage unit of t	
	(2) Pentagonal planar and trigonal bi	ipyramidal	elation electrode	
	(3) Square pyramidal and pentagona	l bipyramidal	cuatine to lock out? In this part of the contract	
	(4) Square pyramidal and pentagona	l planar		
38.	The number of terminal carbonyl gro	oups present in $Fe_2(C)$	(O) ₉ are:	
9.	(1) 2 (2) 5 The order of polarity of NH_3 , NF_3 and NH_3	_	(4) 3	
	$(1) NH_3 < NF_3 < BF_3$	rzid Feddun i ma	The sequence energies of the section	
	$(2) BF_3 < NF_3 < NH_3$		grandon to the drinker	

(3) $BF_3 < NH_3 < NF_3$

(4) $NF_3 < BF_3 < NH_3$

90.	Correct statement for Coulometry is:
	(1) It is based on Faraday's law of electrolysis.
	(2) It is a type of voltammetry.
	(3) It is based on Ohm's law.
91.	(4) It uses ion selective electrode. 10 mL aliquots of a mixture of HCI and HNO_3 are titrated conductometrically using a 0.1M NaOH and a 0.1M $AgNO_3$ separately. The titer volumes are V_1 and V_2 respectively. The concentration of HNO_3 in the mixture is obtained from the combination:
	(1) $V_1 - V_2$ (2) $V_2 - V_1$ (3) $2V_1 - V_2$ (4) $2V_2 - V_1$
92.	The electrode potential of which electrode depends upon the H^+ ion concentration?

One mole of an ideal gas is allowed to expand isothermally and reversibly from $0.02 \,\mathrm{m}^3$ to $0.20 \,\mathrm{m}^3$ at 300 K. The entropy change for the system will be in (JK^{-1}) :

(1) 4.61

(2) 57.42

(3) 19.14

(4) -19.14

What is the half-life of N_2O_5 if it decomposes with a rate constant of $5.7 \times 10^{-4} s^{-1}$?

(1) 20 minutes

(1) Hydrogen electrode

(3) Glass electrode

(2) 10 minutes

(3) 0.05 minutes

(4) Insufficient data

(2) Quinhydrone electrode

(4) All of the above

The activation energies of two reactions are E_1 and E_2 ($E_1 > E_2$) respectively. If the temperature of the system is increased from T_1 to T_2 , the rate constants of the reactions change from k_1 to k_1' in the first reaction and k_2 to k_2' in the second reaction. Predict

 $(1) \ \frac{k_1'}{k_1} > \frac{k_2'}{k_2}$

(2) $\frac{k_1'}{k_1} = \frac{k_2'}{k_2} = 1$

(3) $\frac{k_1'}{k_1} < \frac{k_2'}{k_2}$

(4) None of the above

- Arrhenius equation to determine the activation energy is : mendial only or below 96.
 - (1) $\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R}\left(\frac{1}{T_2} \frac{1}{T_1}\right)$ (2) $\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R}\left(\frac{1}{T_2} + \frac{1}{T_1}\right)$
 - (3) $\ln\left(\frac{k_1}{k_2}\right) = -\frac{E_a}{R}\left(\frac{1}{T_2} \frac{1}{T_1}\right)$ (4) $\ln\left(\frac{k_1}{k_2}\right) = \frac{E_a}{R}(T_1 T_2)$
- The following reaction takes place in a cell: 97.

$$Fe^{2+}(aq) + Ag^{+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$$

Given that:
$$E_{Ag^+/Ag}^0 = xV$$
; $E_{Fe^{2+}/Fe}^0 = yV$; $E_{Fe^{3+}/Fe}^0 = zV$

- The standard potential of the cell in volts (V) will be:
- (1) x-z

(2) x - y

(3) x + 2y - 3z

- (4) x + y z
- What is the pH of HCl solution when the hydrogen gas electrode shows a potential of - 0.22 V at standard temperature and pressure?
 - (1) 2.98
- (2) 2.17
- (3) 3.14
- (4) 3.73
- The energy of the ground state of a particle in a box within first order perturbation 99. theory of a system with the following potential energy will be:

$$V(x) = \begin{cases} V_0 & 0 \le x \le L \\ \infty & x < 0 \text{ and } x > L \end{cases}$$

(1) $\frac{h^2}{8mI^2}$

(2) V_0

(3) $\frac{h^2}{2mL^2} + V_0$

(4) $\frac{h^2}{4mr^2} + \frac{V_0}{2}$

100. Which of the following dispersions does not have liquid continuous phase?

(1) Foam

(2) Nanosuspension

(3) Microemulsion

(4) Gel

What is in pill of HCl solution when the hydrogen gas elactrode shows a pear stad of - (1,22 v at standard temperature analytessure?

24 2 F. (H)

4-7 (5)

(3) 1.14 (4) 3.7°

of (Er

the energy of the ground state of a particle in a tox within tirst eater parachatens

1'c , (aq) + 'g (aq) - FE (aq) + Ag (s)

The standard potential of the coll in volta (VY will be a

 $V(s) = \begin{cases} V_0 & 0 \le x \le L \\ \vdots & x \le 0 \text{ and } x \ge L \end{cases}$

1. All questions are compulsory.

2. The candidates *must return* the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfairmeans / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.

STATING THE GOESTION PAPER.

- 3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
- 4. Question Booklet along with answer key of all the A, B, C & D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
- The candidate must not do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers must not be ticked in the question booklet.
- 6. There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

PHD/URS-EE-2022/(Chemistry)(SET-Y)/(D)

1.	1. John-Teller effect is in the field of:					
	(1) Nuclear physic		(2) Vibronic inte			
	(3) Thermodynamics					
2.	Which of the follow	wing is a soft acid?	(4) Kinetic theory of gases			
	$(1) Ag^+$	(2) Pt^{2+}	(3) Au^{+}	(4) All		
3.	Which of the following will combine with BH_3 to form a stable complex?					
4.	(1) <i>CO</i>	(2) Pt^{2+}	(3) <i>OH</i> ⁻	(4) Methane		
	The electronic ground state term for the chromium ion in $[Cr(CN)_6]^{-4}$ is:					
	$(1)^{3}$ F	$(2)^{3}H$	$(3)^{-3}G$	(4) ⁵ D		
5.	The hapticity of cycloheptatriene (C_7H_8) in $Mo(C_7H_8)(CO)_3$ is:					
6.	(1) 0	(2) 5	(3) 4	(4) 9		
U.	If Δ_0 is octahedral splitting energy and P is electron pairing energy then the crystal field stabilization energy (CFSE) of $[Co(NH_3)_6]^{+2}$ is:					
	(1) $-0.8 \Delta_0 + 2 P$					
	(3) $-0.8 \Delta_0$		(2) $-0.8 \Delta_0 + 1 P$			
7.	·	+ and VaE- manage	$(4) -1.8\Delta_0 + 3P$			
	The shapes of XeF_5^+ and XeF_5^- respectively, are:					
	(1) Pentagonal planar and square pyramidal					
	(2) Pentagonal planar and trigonal bipyramidal					
	(3) Square pyramidal and pentagonal bipyramidal					
•	(4) Square pyramidal and pentagonal planar					
8.	The number of terminal carbonyl groups present in $Fe_2(CO)_9$ are:					
	(1) 2	(2) 5	(3) 6	(4) 3		

9. The order of polarity of NH_3 , NF_3 and BF_3 is:

- $(1) NH_3 < NF_3 < BF_3$
- $(2) BF_3 < NF_3 < NH_3$
- (3) $BF_3 < NH_3 < NF_3$
- $(4) NF_3 < BF_3 < NH_3$

10. Correct statement for Coulometry is:

- (1) It is based on Faraday's law of electrolysis.
- (2) It is a type of voltammetry.
- (3) It is based on Ohm's law.
- (4) It uses ion selective electrode.

11. Match the List-I and List-II and select the *correct* answer using codes given below the list:

List-I

- (i) Lipoprotein
- (ii) Glycoprotein
- (iii) Collagen
- (iv) Chromoprotein

List-II

- A. Sugars
- B. Tendons
- C. Lipids
- D. Pigment

Correct answer is:

- (1) i-B, ii-C, iii-A, iv-D
- (2) i-C, ii-B, iii-D, iv-A
- (3) i-A, ii-B, iii-C, iv-D
- i-C, ii-A, iii-B, iv-D

12.
$$H_3C \equiv C CH_3 \xrightarrow{(ii)} X CH_3COCOCH_3$$

In the above reaction X is:

- (1) K_2Cr_2O7
- (2) O_2
- (3) O_3

 $(4) H_2SO_4$

13. The reaction, $C_6H_5Br + 2Na + C_2H_5Br \rightarrow C_6H_5 - C_2H_5 + 2NaBr$ is known as:

(1) Cannizzaro reaction

(2) Wurtz reaction

(3) Oppenaur oxidation

(4) Wurtz-Fittig reaction

14. What is the condensation product of ethylacetate?

(1) Aceto acetic ester

(2) Ethyl cyanide

(3) Ethyl aceto acetate

(4) Ethyl propanoate

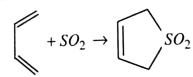
15. Which of the following synthon is most stable?

$$(4) \qquad \bigcirc CH_2 - \overset{+}{C}H_2$$

16. $C \equiv C - CH_3 \xrightarrow{Hg^{2+}/H^+} A$, A is:

- 17. Which of the following undergoes a Diels-Alder reaction?
 - (1) Thiophene
- (2) Pyrrole
- (3) Pyridine
- (4) Furan

18. Reaction:



(1) Cheletropic reaction

- (2) Cycloaddition
- (3) Sigmatropic rearrangement
- (4) The enereaction
- 19. When comphor is heated with KOH, the major product obtained is:
 - (1) Isocampholic acid

(2) Camphene

(3) Campholic acid

- (4) Camphoric acid
- 20. Which of the flowing reaction is favoured by polar aprotic solvent?
 - (1) S_{N_2} reaction

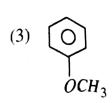
(2) S_{N_1}

(3) Addition reaction

- (4) Both $S_{N_1} & S_{N_2}$ reactions
- 21. Which one of the following is strongest acid?

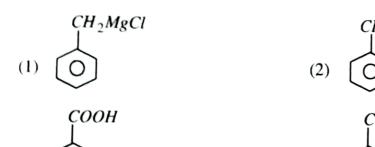


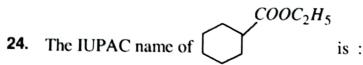
(2) OH CH 2



- $(4) \quad NO_2 \longrightarrow OH \\ NO_2 \longrightarrow NO_2$
- 22. The ^{13}C NMR spectrum of ethyl benzene exhibits :
 - (1) 8 signals
- (2) 6 signals
- (3) 5 signals
- (4) 4 signals

23.
$$CH_2Cl$$
 $+ Mg \xrightarrow{\text{dry ether}} A \text{ (product) is :}$





- (1) Cyclohexane carboxamide
- (2) Cyclohexane ethyl carboxylate
- (3) Ethyl cyclohexane carboxylate
- (4) Aminocyclo hexane carboxylate
- **25.** Which one of the following statement is *correct*?
 - (1) Allene and biphenyls show optical activity.
 - (2) Allene and biphenyls do'nt show optical activity.
 - (3) Only allene show optical activity not biphenyls.
 - (4) Only biphenyls show optical activity not allene.
- 26. Chlorination of furan is carried out by:
 - (1) Cl_2 at $-40^{\circ}C$

(2) Cl_2 , $at - 30^{\circ}C$

(3) Cl₂

- (4) $FeCl_3$
- **27.** Which one of the following is aldoses?
 - (1) Fructose
- (2) Galactose
- (3) Ribulose
- (4) Sorbose

Match the list-I and list-II and select the correct answer using codes given below the list:

List - I

List - II

(i) Citral

A. p-cymene

(ii) Linalool

- B. Carvoxime
- (iii) α-terpineol
- C. Tert. alcohol

(iv) Limonene

D. Lemon grass

Correct answer is:

- (1)i-B, ii-A, iii-D, iv-C
- (2) i-D. ii-C, iii-A, iv-B
- (3) i-C, ii-D, iii-B, iv-A
- (4) i-A. ii-B. iii-C. iv-D

29.
$$\begin{array}{c|c} CH & CH \\ \parallel + NH_3 & \parallel \\ CH & CH \end{array}$$
 Red hot tube A , A is :









- **30.** Nicotine alkaloid belong to:
 - (1) Phenyl ethylamine group
- (2) Pyrrolidine pyridine group

(3) Isoquinoline group

- (4) Indol group
- 10 mL aliquots of a mixture of HCI and HNO₃ are titrated conductometrically using a 0.1M NaOH and a 0.1M $AgNO_3$ separately. The titer volumes are V_1 and V_2 respectively. The concentration of HNO3 in the mixture is obtained from the combination:
- (1) $V_1 V_2$ (2) $V_2 V_1$ (3) $2V_1 V_2$ (4) $2V_2 V_1$
- The electrode potential of which electrode depends upon the H^+ ion concentration? 32.
 - (1) Hydrogen electrode

(2) Quinhydrone electrode

(3) Glass electrode

(4) All of the above

PHD/URS-EE-2022/(Chemistry)(SET-Y)/(D)

-	Out make of an ide	al gas is allowed to exp	and isothermally and reversibly from
	0.02 m ² to 0.20 m ³ a	300 K. The entropy chan	ge for the system will be in (JK^{-1}) :
	(3) 4 (2)	T. Trime	So les the system will be in (JK 1):

(1) 4.61

(2) 57.42

(3) 19.14

(4) - 19.14

What is the half-life of N_2O_5 if it decomposes with a rate constant of $5.7 \times 10^{-4} \, s^{-1}$? 34.

(1) 20 minutes

(2) 10 minutes

(3) 0.05 minutes

(4) Insufficient data

The activation energies of two reactions are E_1 and E_2 ($E_1 > E_2$) respectively. If the temperature of the system is increased from T_1 to T_2 , the rate constants of the reactions change from k_1 to k_1' in the first reaction and k_2 to k_2' in the second reaction. Predict which of the following is correct?

$$(1) \ \frac{k_{1}^{'}}{k_{1}} > \frac{k_{2}^{'}}{k_{2}}$$

(2)
$$\frac{k_1'}{k_1} = \frac{k_2'}{k_2} = 1$$

$$(3) \ \frac{k_{1}^{'}}{k_{1}} < \frac{k_{2}^{'}}{k_{2}}$$

(4) None of the above

Arrhenius equation to determine the activation energy is: 36.

$$(1) \quad \ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} \left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

(2)
$$\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} \left(\frac{1}{T_2} + \frac{1}{T_1}\right)$$

(3)
$$\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = -\frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

(4)
$$\ln\left(\frac{\mathbf{k}_1}{\mathbf{k}_2}\right) = \frac{E_a}{R} (T_1 T_2)$$

The following reaction takes place in a cell: 37.

$$Fe^{2+}(aq) + Ag^{+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$$

Given that:
$$E_{Ag^+/Ag}^0 = xV$$
; $E_{Fe^{2+}/Fe}^0 = yV$; $E_{Fe^{3+}/Fe}^0 = zV$

The standard potential of the cell in volts (V) will be:

$$(1) x-z$$

$$(2) x - y$$

(3)
$$x + 2y - 3z$$
 (4) $x + y - z$

What is the pH of HCl solution when the hydrogen gas electrode shows a potential of 38. - 0.22 V at standard temperature and pressure?

- (1) 2.98
- (2) 2.17
- (3) 3.14
- (4) 3.73

The energy of the ground state of a particle in a box within first order perturbation theory of a system with the following potential energy will be: 39.

$$V(x) = \begin{cases} V_0 & 0 \le x \le L \\ \infty & x < 0 \text{ and } x > L \end{cases}$$

 $(1) \frac{h^2}{9m^2}$

(2) V_0

(3) $\frac{h^2}{9m^2} + V_0$

(4) $\frac{h^2}{4mI^2} + \frac{V_0}{2}$

40. Which of the following dispersions does not have liquid continuous phase?

(1) Foam

(2) Nanosuspension

(3) Microemulsion

(4) Gel

41. Which of the species has a permanent dipole moment?

- (1) SF_4
- (2) SiF_A
- (3) BF_3
- (4) XeF_4

42. Which of the ion has maximum hydration energy?

- (1) Sr^{2+}
- (2) Ca^{2+} (3) Mg^{2+}
- (4) Be^{2+}

43. Oxymyoglobin $Mb(O_2)$ and oxyhaemoglobin $Hb(O_2)_4$ respectively, are:

- (1) Paramagnetic and paramagnetic
- (2) Diamagnetic and diamagnetic
- (3) Paramagnetic and diamagnetic
- (4) Diamagnetic and paramagnetic

Three identical non interacting particles each of spin 1/2 and mass m are moving in one dimensional infinite potential will also of spin 1/2 and mass m are moving in the energy one dimensional infinite potential well of length a. The energy of the lowest energy

$$(1) \ \frac{\pi^2 \hbar^2}{ma^2}$$

$$(2) \frac{2\pi^2\hbar^2}{3ma^2}$$

$$(3) \frac{3\pi^2\hbar^2}{ma^2}$$

(1)
$$\frac{\pi^2 \hbar^2}{ma^2}$$
 (2) $\frac{2\pi^2 \hbar^2}{3ma^2}$ (3) $\frac{3\pi^2 \hbar^2}{ma^2}$ (4) $\frac{5\pi^2 \hbar^2}{2ma^2}$

	45. The difference			
	hydrogen aton	e in angular momentu n is :	m of the electron in	two adjacent orbitals of the
	(1) $h/2\pi$	(2) h/π	· / (- / / / - /	(4) $(n-1)h/2\pi$
4	6. Apply molecul	ar orbital theory to pre	dict which species has	the strongest bond?
	(1) N_2	(2) N_2^-	(3) N_2^+	(4) All are equivalent
4	7. The charge den	sity at each carbon ato	m in butadiene is:	-
	(1) 2	(2) 0	(3) 4	(4) 1
48	3. In NMR spectre sample and in s	oscopy, the difference ome arbitrary chosen c	between the field nec	essary for resonance in the
	(1) Field shift		(2) Chemical shift	
	(3) Matrix shift		(4) Resonance shift	ît
49	which the popu	frequency of a homonolation of the first excioltzmann constant):	uclear diatomic molected state will be half	ale is v. The temperature at that of the ground state is
	(1) (by 152)/h	(2) $\ln 2 / (\ln v k)$	(3) $h v / (k ln 2)$	(4) h v lnk
	(1) $(h v ln2)/k$, ,	, ,	
50.	•	nt groups of tetrahedra		cules ?
50.	•	nt groups of tetrahedra		cules ?
50.	What are the poi	nt groups of tetrahedra		cules ?
50.	What are the point (1) D_{3h} and D_4	nt groups of tetrahedra h respectively respectively		cules ?
50.	What are the point (1) D_{3h} and D_4 (2) T_d and O_h ,	nt groups of tetrahedra h respectively respectively respectively		cules ?

)	Mossbauer spectrum of a metal complex g	gives i	nformation abou	it:	
52 .	Mossbauer spectrum of a metal complex of				
	(a) Oxidation state and spin state of metal	l			
	(b) Types of ligands co-ordinated of meta	d			
	(c) Nuclear spin state of metal				
	(d) Geometry of metal				
	Correct answer is:				
	(1) (a) and (c) (2)		a), (b) and (d)		
53 .	Intense band generally observed for a car	bonyl	group in the IR	spec	etrum is due to:
	(1) The force constant of CO bond is large	ge			
	(2) The force constant of CO bond is sm	iall			
	(3) There is no change in dipole momen	t for C	CO bond stretch	ing	
	(4) The dipole moment change due to C	O bor	nd stretching is l	large	
54.	. The species having the strongest gas pha	ase pro	oton affinity am	ong	the following:
	(1) N^{3-} (2) NF_3	(3)	NH_3	(4)	$N(CH_3)_3$
55.	5. According to Wade's theory, the anion [$B_{12}H$	12] ²⁻ adopts:		
	(1) Closo structure	(2)	Arachno structi	ure	
	(3) Hypo structure	(4)	Nido structure		
56	6. When an electron is added to a gaseous	atom	:		
	(1) Its size decreases				
	(2) Energy is released				
	(3) It changes to positive ion				
	(4) Its tendency to accept electron incr	reases			
PH	HD/URS-EE-2022/(Chemistry)(SET-Y)/(D)	T AF			

D				
57	7. Aufbau principle	is not violated in:		
	(1) d-block eleme	ents	(2) s and p-block	elements
	(3) Lanthanides		(4) Actinides	
58	. The highest value	of n for the elements	s present in periodic ta	ble is:
	(1) 6	(2) 7	(3) 10	(4) 9
59.	During the change	of NO^+ to NO , the	electron is added in a	:
	(1) σ-orbital	(2) π-orbital	(3) σ*-orbital	(4) π*-orbital
60.	Alkali metals dissection colour is due to:	olve in liquid amme	onia to form blue co	loured solutions. The blue
	(1) Alkali metals			
	(2) Alkali metal io	ns		
	(3) Ammoniated el	lectrons		
	(4) Ammoniated al			
61.	The rotational cons	stant B for the HCl ion $J = 0 \rightarrow J = 1$ is	molecule is 10.6 cm equal to:	-1. The frequency for the
	(1) 10.6 cm ⁻¹		$(2) 5.3 \text{ cm}^{-1}$	
	(3) 21.2 cm ⁻¹		(4) No absorption	
62.				ithout changing its force respect to the original
	(1) Unchanged		(2) √2 times	
	(3) 2 times		(4) $\frac{1}{\sqrt{2}}$ times	

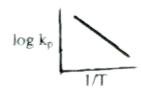
(1) O_2 and H_2O

(2) CO_2 and N_2O

(3) CO and CH₄

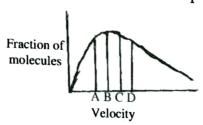
(4) NO and DCCH

64. The variation of log K_p with temperature 1/T for the equilibrium; $NH_4HS(s) \approx NH_3(g) + H_2S(g)$; is as shown in the plot. The equilibrium is displaced in the forward direction on :

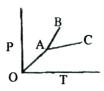


- (1) Increasing the temperature and decreasing the pressure
- (2) Increasing the temperature and pressure both
- (3) Decreasing the temperature and pressure both
- (4) Decreasing the temperature and increasing the pressure
- 65. The upper critical solution temperature is defined as:
 - (1) The maximum temperature at which two components will remain immuscible at two distinct liquids
 - (2) The minimum temperature at which two components will remain imminished at two distinct liquids
 - (3) The maximum temperature at which two components remain miscible
 - (4) The minimum temperature at which two components remain miscible

- **66.** Which of the following is *true* regarding non-ideal solutions with negative deviation?
 - (1) The interactions between the components are lesser than in the pure components
 - (2) $\Delta V_{\text{mixing}} = +ve$
 - (3) $\Delta H_{\text{mixing}} = +ve$
 - (4) They form maximum boiling azeotropes
- 67. Which out of A, B, C and D corresponds to the most probable speed?



- (1) A
- (2) B
- (3) C
- (4) D
- **68.** 8 distinguishable particles are distributed in two equal sized compartments. The probability of the macro state (4, 4) is equal to:
 - (1) 35/128
- (2) 7/128
- (3) 7/16
- (4) 35/256
- 69. The slopes of the lines OA, AC and AB are $\tan \pi/4$, $\tan \pi/6$ and $\tan \pi/3$ respectively, If the melting point and ΔH melting are 27°C and 3 kJ mol⁻¹ respectively, the change in volume upon melting is:



- (1) $10 \tan \pi/4$
- (2) $10 \cot \pi/3$
- (3) $10 \tan \pi/3$
- (4) $10 \cot \pi/4$
- **70.** Standard enthalpy of vapourisation ΔH_{vap}^0 for water at 100°C is 40.66 kJ mol⁻¹. Assuming water vapour to behave like an ideal gas, the internal energy of vapourisation of water at 100°C (in kJ mol⁻¹) will be equal to:
 - (1) +37.56
- (2) -40.66
- (3) +43.76
- (4) -43.76

71.	Freundlich adsorption isotherm can be used to model:
	(1) Monolayer adsorption
	(2) Multilayer adsorption
	(3) Both monolayer and multilayer adsorption
	(4) None of the above
72.	Which of the following statements is <i>not</i> true?
	(1) Step-growth polymerization requires a bifunctional momoner
	(2) Nylon 6 is an example of step-growth polymerization
	(3) Chain growth polymerization includes both homo-polymerization and copolymerization
	(4) Chain growth polymerization involves homo-polymerization only
73.	Which of the following salts show maximum value of equivalent conductance in their fused state?
	(1) KCl (2) NaCl (3) CsCl (4) RbCl
74.	In terms of energy bands, insulators have :
	(1) Full conduction band
	(2) Very small energy gap
	(3) Full valence band
	(4) Moderate energy gap
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- **75.** If the value of the wavelength is doubled, which of the following is **not** true in Bragg's method for crystal structure determination?
 - (1) The d spacings become smaller
 - (2) Bragg angles of reflections increase
 - (3) The diffraction pattern expands
 - (4) Some previously accessible reflections can no longer be measured
- **76.** A committee has 6 members having weights in (kg) as 45, 50, 65, 72, 63 and 65. What will be the standard deviation?
 - (1) √115
- (2) √152
- (3) √88
- (4) √176

- 77. Most stable carbocation is:
 - (1) Tropylium ion

(2) Benzylcation

(3) Allylcation

- (4) Vinylcation
- **78.** The given reaction is an example of:

$$\stackrel{CH_3}{\longrightarrow} \stackrel{CH_3}{\longrightarrow}$$

(1) Cope rearrangement

(2) The claisen rearrangement

(3) Diels-Alder reaction

- (4) Cheletropic reaction
- 79. Which of the following reagents react with phenol at 298K to form salt?
 - (1) $NaHCO_3$

(2) Cl₂

(3) H_2SO_4

(4) *NaOH*

- **80.** A single strong absorption near 1800 cm⁻¹ in IR spectroscopy indicates the presence of:
 - (1) Azo compound

(2) Acid halides

(3) Sulphoxide

- (4) Thioketones
- 81. In ion-exchange resin method, the order of elution of lanthanides is:

(1)
$$Lu^{+3} > Yb^{+3} > Ce^{+3} > La^{+3}$$

(2)
$$Sm^{+3} > Eu^{+3} > Tm^{+3} > Yb^{+3}$$

(3)
$$La^{+3} > Ce^{+3} > Yb^{+3} > Lu^{+3}$$

(4)
$$Yb^{+3} > Tm^{+3} > Sm^{+3} > Eu^{+3}$$

- **82.** Which of the following statements is *false*?
 - (1) Lanthanides have poor tendency to form complexes
 - (2) Lanthanides closely resemble each other
 - (3) M^+ and M^{+2} are less stable than M^{+3} ion in lanthanides
- (4) Basic strength of lanthanide oxides increases with increasing atomic number
- 83. Biological function of Haemocyanin and metal involved in it:
 - (1) Oxygen transport and Fe
 - (2) Oxygen transport and Cu
 - (3) Electron transport and Fe
 - (4) Electron transport and Cu

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8	4. If an enzyme fixes Nitrogen protons associated respectively	in plants by evolving H_2 , are:	the number of electrons and
	(1) 6 and 6 (2) 8 and	8 (3) 6 and 9	
88	5. The half-life of Cobalt-60 is 5.2 after 4 years?	26 years. What will be the	(4) 8 and 6 remaining percentage activity
	(1) 76% (2) 32%	(3) 59%	(4) 18%
86	. Radioisotopes of lodine are use	ed in :	(1) 10%
	(1) Tagging leukocytes and labor	elling of blood platelets	
	(2) Diagnosis and treatment of t	the diseases of thyroid gland	ds
	(3) Diagnosis and treatment of the		
	(4) Diagnosis and treatment of b	orain tumours	
87.	The rate of disintegration of radifollows the kinetics of	ioactive substances depend order.	s only on the and
	(1) Nature of radioactive substan	ce and first	
	(2) Amount of radioactive substa	nce and second	
	(3) Temperature and zero		
	(4) Half-life of the radioactive sub	ostance and first	
88.	Which of the complex is an active	catalyst and a 16 e^- specie	s ?
	$(1) [HRh(CO)(PPh_3)_3]$	$(2) [HCo(CO)_3]$	
	$(3) [Rh(CO)_2I_4]^{-}$	$(4) [Pd(PPh_3)_4]$	grave.
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89.	The catalyst used for polymerization of o	olefins is:
•	(1) Wilkinson's catalyst	(2) Zeise's salt complex
	(3) Ziegler-Natta catalyst	(4) Tetraethyl lead
90.	In the hydrogenation of alkenes using $RhCl(PPh_3)_2$. The first step in its cataly	Wilkinson's catalyst, the active catalyst is tic cycle is:
	(1) Alkene co-ordination	
	(2) Oxidative addition of H ₂	
	(3) Loss of PPh_3	
	(4) Loss of Cl ⁻	
91.	Which one of the following is mainly res	sponsible for eutrophication?
	(1) Nitrate	(2) Phosphate
	(3) Carbamate	(4) Sulphate
92.	Which one of the following is used as tra	anquilizer?
	(1) Omepyrazole	
	(2) 2-acetoxy benzoic acid	
	(3) Chloromycetin	
	(4) Barbituric acid	
93.	In IR spectrum, primary amines show tw	o bands around the region:
	(1) 3350 cm ⁻¹	(2) 2950 cm ⁻¹
	(3) 1630 cm ⁻¹	(4) 2100 cm ⁻¹

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Green chemistry protects the environment by reducing:

(1) Forest

(2) Temperature

(3) Pollution

(4) Weeds

Which of the following has the highest bond dissociation energy?

(1) Hydrogen bond

- (2) Covalent bond
- (3) Dipole-Dipole interaction
- (4) Vander Waals forces

The reaction $CH_3CCH_2CH_3 \xrightarrow{Zn-Hg} CH_3CH_2CH_2CH_3$ is known as: 96.

- (1) Perkin reaction
- (2) Aldol condensation
- (3) Clemmensen reduction
- (4) Pechmann condansation

97. Which of the following carbonyl give a haloform test?

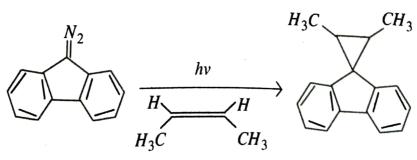
(1) Hexan-2-one

(2) Propanal

(3) Pentan-3-one

(4) 2-Methyl butanal

98. The intermediate involved in the following reaction is:



(1) Carbocation

(2) Carbene

(3) Nitrene

(4) Free radical

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99.	Spiro compounds	are optically	active due to:
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(1) Chiral axis

(2) Chiral plane

(3) Chiral carbon

(4) Helicity

100. Which one of the following reagent gives syn addition with alkene?

(1) Br_2

(2) *Cl*₂

(3) Dil $KMnO_4/OH^-$

(4) DDQ

Answer Key of Chemistry Ph.D/URS Entrance Exam 2021-22					
Q. No.	А	В	С	D	
1	1	4	3	2	
2	4	2	4	4	
3	2	1	4	1	
4	2	3	1	2	
5	3	1	1	1	
6	2	1	4	3	
7	1	2	2	4	
8	2	2	1	3	
9	3	2	2	2	
10	2	2	1	1	
11	2	1	3	4	
12	4	4	3	3	
13	1	3	4	4	
14	2	1	1	1	
15	1	1	1	2 ·	
16	3	1	2	2	
17	4	3	2	4	
18	3	4	2	1	
19	2	3	4	3	
20	1	4	3	1	
21	3	1	1	4	
22	3	4	4	2	
23	4	2	2	1	
24	1	3	2	3	
25	1	1	3	1	
26	2	1	2	1	
27	2	2	1	2	
28	2	2	2	2	
29	4	3	3	2	
30	3	2	2	2	
31	1	2	2	1	
32	4	4	4	4	
33	2	1	1	3	
34	3	2	3	1	
35	1	1	2	1	
36	1	3	3	1	
37	2	4	1	3	
38	2	3	2	4	
39	3	2	1	3	
40	2	1	3	4	
41	3	4	2	1	
42	4	3	4	4	
43	4	4	3	2	
44	1	1	3	3	
45	1	2	1	1	
46	4	2	3	1	
47	2	4	1	2	
48	1	1	1	2	
49	2	3	4	3	
50	1	1	2	2	

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