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A

PG-EE-July, 2024

SET-Z

10429

SUBJECT: Chemistry

		Sr. No
Time: 1¼ Hours Roll No. (in figures)	Max. Marks : 100 (in words)	Total Questions : 100
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SEAL

(1) 3, 2, -2, -1/2

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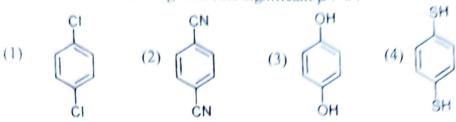
P. T. O.

	(3) 4, 0, 0, $+1/2$		(4) 4, 1, -1, +1/2		
2.	The number of orbit	tals in $n = 3$ are:			
	(1) 1	(2) 4	(3) 9	(4) 16	
3.	Electronegativity of	the following eleme	ents increases in the o	order :	
	(1) O, N, S, P	(2) P, S, N, O	(3) P, N, S, O	(4) S, P, N, O	
4.	Predict the correct of	order of repulsion am	ong the following:		
			ond pair > bond pair		
			ond pair > lone pair		
			bond pair > lone pair		
	(4) Ione pair – bone	d pair > bond pair -	bond pair > lone pair	– lone pair	
5.	Pick out the incorre	ct statement :			
	(1) sp^3d hybridisation involves $dx^2 - y^2$ orbital				
	(2) Hybridised orbital form sigma-bond when overlaps with other orbitals.				
	(3) SF_2 molecule is	s more polar than CS	2		
	(4) o-nitrophenol is	more volatile than p	o-nitrophenol.		
6.	. Which of the following order is <i>not</i> correct?				
	(1) $SF_2 > SF_4 > SF_6$ (ionic character)				
	$(2) AlF_3 < Al_2O_3 <$	AIN (covalent chara	icter)		
	(3) CaCl2 < SnCl2 <	CdCl ₂ (covalent ch	aracter)		
	(4) ZnCl2 < CdCl2 <	< HgCl ₂ (ionic chara	cter)		
7.	Which one of the fo	llowing molecules is	s expected to exhibit	diamagnetic behaviour?	
	(1) C ₂	(2) N_2^-	(3) O ₂	(4) S ₂	

(2) 3, 2, 0, 1/2

1. The quantum number of 20th electron of Fe (Z = 26) would be:

8. For which of the following molecule significant $\mu \neq 0$:



- (1) Only (3)
- (2) (3) and (4)
- (3) Only (1)
- (4) (1) and (2)
- The geometry with respect to the central atom of the following molecules are N(SiH₃)₃, Me₃N, (SiH₃)₃P:
 - (1) planar, pyramidal, planar
 - (2) planar, pyramidal, pyramidal
 - (3) pyramidal, pyramidal
 - (4) pyramidal, planar, pyramidal
- **10.** The IUPAC name of $[Co(NH_3)_5ONO]^{2-}$ ion is:
 - (1) Pentaamminenitritocobalt (IV) ion
 - (2) Pentaamminenitrocobalt (IV) ion
 - (3) Pentaamminenitrocobalt (III) ion
 - (4) Pentaamminenitritocobalt (III) ion
- 11. The chemical composition of brown ring produced in the test of NO_2 is:
 - (1) [FeNO]SO₄
- (2) [FeNO]Cl₂
- (3) $[FeSO_4]NO_2$
- (4) [FeCl₂[NO
- **12.** Under physiological condition, oxygen is binding to deoxy-hemoglobin and deoxy-rnyoglobin, the binding curve and its pH dependence respectively are :
 - (1) sigmoidal & pH dependent; hyperbolic and pH independent.
 - (2) hyperbolic and pH independent; sigmoidal & pH dependent.
 - (3) sigmoidal & pH independent; hyperbolic and pH dependent.
 - (4) hyperbolic and pH independent; sigmoidal & pH dependent.

- 13. The total number of isomers of [Co(en),Cl₂], (en = ethylenediamine) is ;
 - (1) 4

(2) 3

- (3) 6
- (4) 5
- 14. Arrange the following in decreasing order of axial C-O bond length and increasing order of axial UMC:

(1) ii > iv > iii > i

(2) iv > ii > iii > i

(3) ii > iv > i > iii

- (4) i > ii > iii > iv
- 15. Identify the correct statement for the two reactions given below:

$$Xe + PtF_6 \xrightarrow{SF_6} |Xe|^4 [PtF_6]$$

 $XeF_4 + Me_4NF \longrightarrow [Me_4N]^{\dagger}[XeF_5]$

- (1) Xe and XeF₄ both act as acids
 - (2) Xe and XeF₄ both act as bases
 - (3) Xe acts as an acid and XeF4 act as base
 - (4) Xe acts as a base and XeF4 act as an acid
- 16. The separation of lanthanides in the ion-exchange method is based on:
 - (1) Basicity of hydroxides
- (2) Size of the hydrated ions
- (3) Size of the unhydrated ion
- (4) The solubility of their nitrates
- 17. Which one of the following conductometric titration will show a linear increase of the conductance with volume of titrant added upto the break point and almost constant conductance afterwards?
 - (1) A strong acid with a strong base
- (2) A strong acid with a weak base
- (3) A weak acid with a strong base
- (4) A weak acid with a weak base

18.	The electronic configuration of chromium is $4s^{1}3d^{5}$. The element tungsten (W) to the same group and has atomic number = 74. The configuration of its valencis:				
	$(1) 5s^{1}4d^{1}$	$(2) 6s^{1}5d^{5}$	$(3) 6s^25d^4$	(4) $6s^{0}5d^{6}$	
19.	The nephelauxetic parameter (β) is highest for :				
	(1) Br	(2) Cl	(3) CN ⁻	(4) F	
20.	20. Among the following series of transition metal ions, the one where all metal ion $3d^2$ electronic configuration is:				
	(1) Ti^{2+} , V^{3+} , Cr^{2}	$^{4+}, Mn^{5+}$	(2) Ti^{2+} , V^{2+} , Cr	$^{3+}$, Mn^{4+}	
	(3) Ti^+ , V^{4+} , Cr^{6+}	$^{+}$, Mn^{7+}	(4) Ti^{4+} , V^{3+} , Cr^{3+}	$^{2+}$, Mn^{3+}	
21.	Coordination numb	er and geometry of [$Ce(NO_3)_6]^{2-}$:		
	(1) 6, octahedral	(2) 12, octahedral	(3) 8, octahedral	(4) 12, icosaheral	
22.	If an element has atomic siz	seven electrons in it te among all the elem	ts outermost shell the	nen it is likely to have the	
	(1) largest	(2) smallest	(3) same	(4) both (1) and (2)	
23.	The tripositive lan spectra:	thanoid ion which	does not show share	rp peak in the absorption	
	(1) Gd^{3+}	(2) Pm^{3+}	(3) Ce^{3+}	(4) Pr^{3+}	
24.	C ₆₀ has:				
	(1) 14 pentagons as	nd 18 hexagons			
	(2) 10 pentagons as	nd 20 hexagons			
	(3) 12 pentagons as				
	(4) 12 pentagons a				

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

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

(2) $-0.8 \Delta_0$

(3) $-1.8 \Delta_0 + 3P$ (4) $-0.8 \Delta_0 + P$

26.	Consider the following complex ions, P, Q and R, $P = [FeF_6]^{3-}$, $Q = [V(H_2O)_6]^{2+}$ and
	$R = [Fe(H_2O)_6]^{2+}$; The correct order of the complex ions, according to their spin-only
	magnetic moment values (in B.M.) is:

- (1) Q < P < R (2) R < Q < P (3) R < P < Q (4) Q < R < P

27. Glycerol is more viscous than glycol, the reason is :

- (1) Higher molecular wt.
- (2) More covalent
- (3) More extent of hydrogen bonding
- (4) Complex structure
- 28. In BF₃, the B-F bond length is 1.30 Å, when BF₃ is allowed to be treated with Me₃N, it forms an adduct, $[Me_3N \rightarrow BF_3]$ The bond length of B-F in the adduct is :
 - (1) Greater than 1.30Å

(2) Smaller than 1.30Å

(3) Equal to 1.30Å

- (4) None of these
- 29. Name the type of the structure of silicate in which one oxygen atom of $[SiO_4]^{4-}$ is shared?
 - (1) Linear chain silicate

(2) Sheet silicate

(3) Pyrosilicate

- (4) Three dimensional
- 30. Which of the following represents a set of hard acid and soft base respectively?

 - (1) Fe^{3+} and F (2) Fe^{3+} and F^{2-} (3) Ag^{+} and F^{2-} (4) Ag^{+} and F^{-}

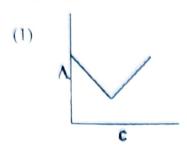
31. Copper has role in:

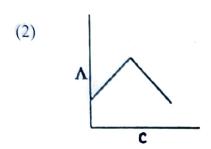
- (1) Hb formation
- (2) ATP production by reformation
- (3) Formation of fibres elastic
- (4) All of the above

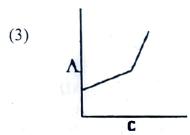
32.	Which among the following electronic configurations represent the elements with the maximum electron affinity?					
	(1) $1s^2 2s^2 2p^6$ (3) $1s^2 2s^2 2p^6 3s^6$		(2) $1s^2 2s^2 2p^6 3s^2$ (4) $1s^2 2s^2 2p^5$	3p ⁵		
33.	Which one of the f	ollowing is most eas	ily reduced?			
	(1) Ni(CO) ₄	(2) Cr(CO) ₆	(3) Fc(CO) ₅	(4) V(CO) ₆		
34.	The value of d ₁₁₁ in	n a cubic crystal is 3	25.6 pm. The value	of d ₃₃₃ is :		
		(2) 976.8 pm		(4) 625.6 pm		
35.	A metal crystallize the crystal is 1.33	es in FCC structure g/cc, the molar mass	with a unit cell sid of the metal is clos	e of 500 pm. If the density of se to:		
	(1) 23	(2) 24	(3) 25	(4) 26		
36.	6. The decomposition of gaseous acetaldehyde at T(K) follows second-order kinetics. The half-life of this reaction is 400 s when the initial pressure is 250 Torr. What will be the rate constant (in Torr ⁻¹ s ⁻¹) and half-life (in seconds) respectively, if the initial pressure of the acetaldehyde is 200 Torr at the same temperature?					
	(1) 10 ⁵ and 500 se	econds	$(2) 10^{-5}$ and 40	0 seconds		
	(3) 10^{-4} and 400	seconds	$(4) 10^{-5}$ and 50	0 seconds		
37.	min ⁻¹ g ⁻¹ Calcul	ate the age of the	old wood sample,	nd to be 14.2 disintegrations if for a fresh wood sample arbon-14 is 5730 years), is :		
	(1) 5,000 years	(2) 4,000 years	(3) 877 years	(4) 617 years		
38.	Kohlrausch's law	is applicable to a dil	ute solution of:			
	(1) Potassium chl	oride in hexane	(2) Acetic acid	in water		
	(3) Hydrochloric	acid in water	(4) Benzoic aci	id in benzene		
39.	The concentration M Na ₂ SO ₄ solution		on having the same	ionic strength as that of a 0.		

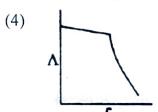
(1) 0.05 M (2) 0.067 M (3) 0.075 M (4) 0.133 M

40. The molar conductivity \(\simes \) versus concentration (c) plot of sodium dodecylsufate in water is expected to look like:









41. Indicate which one of the following relations is *not* correct:

$$(1) - \left(\frac{\partial T}{\partial V}\right)_{S} = \left(\frac{\partial P}{\partial S}\right)_{V}$$

(2)
$$-\left(\frac{\partial T}{\partial P}\right)_{S} = \left(\frac{\partial V}{\partial S}\right)_{P}$$

(3)
$$-\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$$

(4)
$$-\left(\frac{\partial S}{\partial P}\right)_T = \left(\frac{\partial V}{\partial T}\right)_P$$

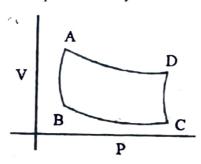
When two moles of liquid A are mixed with two moles of liquid B at 300K, the excess molar Gibbs energy of the solution is $-1.5 \text{ kJ} \text{ mol}^{-1}$. The corresponding value of Gibbs energy of mixing (in kJ) is closest to:

- (1) -12.9
- (2) 6.0
- (3) -1.5 (4) -0.9

The minimum work required by an engine to transfer 5 J of heat from a reservoir at 100 43. K to one at 300 K is:

- (1) 5 J
- (2) 10 J
- (3) 15 J
- (4) 20 J

The figure below describes how a reversible Carnot heat engine works. It starts from the adiabatic compression step denoted by:



- (1) AB
- (2) BC
- (3) DC
- (4) AD

A thermodynamic equation that relates the chemical potential to the composition of a mixture is known as:

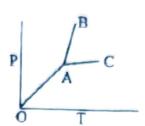
- (1) Gibb's-Helmholtz equation
- (2) Gibb's-Duhem equation
- (3) Joule-Thomson equation
- (4) Debye-Huckel equation

46. The heat capacity of a species is independent of temperature if it is:

- (1) Tetratomic
- (2) Triatomic
- (3) Diatomic
- (4) Monatomic

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47. The phase diagram of a compound is shown below:



The slopes of the lines OA, AC and AB are $\tan \frac{\pi}{4}$, $\tan \frac{\pi}{6}$ and $\tan \frac{\pi}{3}$ respectively. If melting point and ΔH of melting are 300K and 3 kJ mol-1 respectively, the change in the volume on melting is:

(1) $10 \tan \frac{\pi}{3}$ (2) $10 \tan \frac{\pi}{4}$ (3) $10 \cot \frac{\pi}{3}$ (4) $10 \cot \frac{\pi}{4}$

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48. The number of phases, components, and degrees of freedom, when Argon is added to an equilibrium mixture of NO, O_2 and NO_2 in the gas phase are, respectively:

- (1) 1, 3, 5
- (2) 1, 4, 5
- (3) 1, 3, 4 (4) 1, 4, 4

(1)
$$|dE/dV| = 0$$
; $|d^2E/d^2V| = 0$

(2)
$$|dE/dV| = 0$$
; $|d^2E/d^2V| > 0$

(3)
$$|dE/dV| > 0$$
; $|d^2E/d^2V| = 0$

(4)
$$|dE/dV| > 0$$
; $|d^2E/d^2V| > 0$

The Daniel cell is: 50.

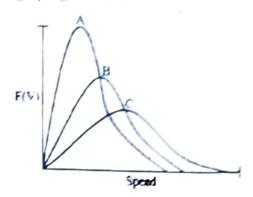
$$(1) \ Pt_l(s)|Zn(s)|Zn^{2^+}(aq)||Cu^{2^+}(aq)|Cu(s)|Pt_{l1}$$

(2)
$$Pt_1(s)|Zn(s)|Zn^{2+}(aq)||Ag^{2+}(aq)|Ag(s)|Pt_{11}$$

(3)
$$Pt_{I}(s)|Fe(s)|Fe^{2+}(aq)||Cu^{2+}(aq)|Cu(s)|Pt_{II}$$

(4)
$$Pt_1(s)|H_2(s)|H_2SO_4(aq)||Cu^{2+}(aq)|Cu(s)|Pt_{11}$$

- 51. Electrolysis of an aqueous solution of 1.0 M NaOH results in
 - (1) Na at the cathode and (), at the anode
 - (2) H₂ at the cathode and O₂ at the anode
 - (3) Na and II- at the cathode, and O₂ at the anode
 - (4) O2 at the cathode and H2 at the anode
- 52. Identify the speed distribution functions of Neon. Argon and Krypton gas in the three curves (Λ or B or C) in the graph given below:



(1) Ne-A, Ar-B, Kr-C

(2) Ne-B. Ar-C. Kr-A

(3) Ne-C, Λr-B, Kr-A

- (4) Ne-C. Ar-A, Kr-B
- 53. The root mean square speed of the molecules of a perfect gas is proportional to:
 - $(1) 1/T^{1/2}$
- (2) T
- (3) T^{1/2}
- (4) 1/1
- 54. At room temperature, which molecule has the maximum rotational entropy?
 - $(1) H_2$
- (2) O₂
- (3) D₂
- (4) No
- 55. The rotational constant ¹⁴N₂ is 2cm⁻¹. The wave number of incident radiation in a Raman spectrometer is 20487 cm⁻¹. What is the wave number of first scattered Stokes line (in cm⁻¹) of ¹⁴N₂?
 - (1) 20479
- (2) 20475
- (3) 20499
- (4) 20495
- **56.** For the vibrational Raman spectrum of a homonuclear diatomic molecule, the selection rule under harmonic approximation is :
 - (1) $\Delta v = 0$ only

(2) $\Delta v = \pm 1$ only

(3) $\Delta v = \pm 2$ only

(4) $\Delta v = 0. \pm 1$

overtone are respectively:

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	(1) 300, 600	(2) 298.5, 595.5	(3) 301.5, 604.5	(4) 290, 580
58.	The energy levels fi		re $\alpha + 2\beta$, α , α and	$\alpha - 2\beta$. The delocalization
	(1) 0	(2) –4β	(3) -8β	(4) 4α
59.	Identify which of the	ne following operato	rs is not Hermitian?	Here <i>i</i> is iota.
	$(1) \ \frac{h}{i2\pi} \frac{\partial}{\partial x}$	$(2) i \frac{\partial^2}{\partial x^2}$	$(3) \ \frac{\partial^2}{\partial x^2}$	(4) X^2
60.			npaired electron in a $\mu_B = 9.273 \times 10^{-24}$.	n magnetic field of 0.33 T
	(1) 2.3 GHz	(2) 9.24 GHz	(3) 1.15 GHz	(4) 8.36 GHz
61.			ength is often much ence of which phenon	longer than the irradiation nenon?
	(1) Low extinction	n coefficients (Lamb	ert-Beer law)	
	(2) Vertical transit	tions (Kasha's rule)		
	(3) High ISC rates	s (El Sayed rule)		
	(4) The Franck-Co	ondon principle		
62.	nonvolatile nonclo	ectrolyte solid weigh	ning 2.175 g is adde	d to 39 g of benzene. The ecular weight of the solid
	(1) 42.25	(2) 55.55	(3) 65.25	(4) 72.25
63.	What is the molal	lowering of the vapo	or pressure of water is	s 100°C ?
	(1) 17.77 mm	(2) 28.28 mm	(3) 13.68 mm	(4) 24.66 mm

57. The vibrational frequency and anharmonicity constant of an alkali halide are 300 cm⁻¹ and 0.0025 respectively. The positions (in cm⁻¹) of its fundamental mode and first

(Given 1 Gallon = 3.785 liter and K, 186)

(1) 22 15 kg

(2) 18.15 kg

(3) 33.75 kg (4) 62 kg

20.27 g of Benzene containing 0.2965 g of benzoic acid (mol. wt. 122) freezes at 0.137°C below the freezing point of pure benzene. If Benzoic acid exists as a dimer in benzene, find its degree of association. (Given: K_f for Benzene is 5.12°C m.)

(1) 72.34%

(2) 86.84% (3) 96.84% (4) 66.34%

66. The surface tension of water at 21°C is 72.75×10^{-3} N/m. A 33.24% (v/v) solution of ethanol has $\gamma=33.24\times10^{-3}$ N/m at the same temperature. Given : Density of solution = 0.9614×10^3 kg/m³, density of water = 0.9982×10^3 kg/m³ and angle of contact. θ = 0°. How much less will the alcohol solution rise in the same capillary ?

(1) 34.2%

(2) 47.4%

(3) 54.3%

(4) 65.4%

67. Hyperconjugation involves overlap of the following orbitals:

 $(1) \sigma - \sigma$

(2) $\sigma - \rho$

(3) $\rho - \rho$

(4) $\pi - \pi$

68. The z-isomer among the following is:

(1)
$$C = C$$

$$C = C$$

$$C = Br$$

(2)
$$H_3C$$
 CH_2OH CHO

(3)
$$C_6H_5$$
 COOH
$$Ce H$$

(4)
$$H_3C$$
 H $C = C$

69. Out of the following the molecule that exhibits optical isomerism is:

(1) 2-methyl-2-pentene

(2) 3-methyl-2-pentene

(3) 3-methyl-1-pentene

(4) 4-methyl-1-pentene

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The stablest radical among the following is:

(1) CH₃CH₂ C H₂

(2) *CH*₃*CHCH*₃

(3) $C_6H_5CH_2 \stackrel{\bullet}{C}H_2$

(4) $C_6H_5CH_2CH_3$

The alkyl halides required to prepare \times by Wurtz reaction are:

- (1) \bigwedge_{Ce} and \bigwedge_{Ce}
- (3) \bigvee_{Ce} and \bigvee_{Ce}
- (2) $\bigvee_{\text{Ce}} \text{ and } \bigvee_{\text{Ce}}$ (4) $\bigvee_{\text{Ce}} \text{ and } \bigvee_{\text{Ce}}$

Ozonolysis of an alkene produces only one dicarbonyl compound. The structure of the alkene is:

- (1) $CH_3 CH = CH CH_2 CH_3$

(4) All of the above

Which one of the following compound is aromatic in nature?

Diels-Alder reaction is:

- (1) 4 + 2 cycloaddition
- (2) 2 + 2 cycloaddition
- (3) Electrophilic addition
- (4) Nucleophilic addition

75. Which of the following can be used as the halide component for Friedel-Crafts reaction?

(1) Chlorobenzene

(2) Bromobenzene

(3) Chloroethane

(4) Isopropyl chloride

Which of the following alcohol is resistant to oxidation? CH_3

(1)
$$H_3C - C - OH$$
 CH_3

(3) $CH_3 - OH$

 $\begin{array}{ccc}
(4) & H_3C - CH - OH \\
& & | \\
& CH_3
\end{array}$

The product of the following reaction is:

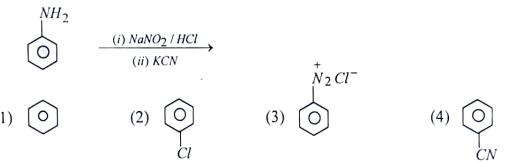
$$H_3C \xrightarrow{CH_3} + CH_3CH_2OH \xrightarrow{H^{\oplus}}$$

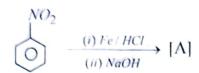
- (1) $H_3C C CH_2OH$ OCH_2CH_3
- CH_3 (2) $H_3C - C - CH_2 - OH$
- CH_3 (3) $H_3C - C - CH_2 - O - CH_2CH_3$ (4) None of these OH

- **78.** Phenol reacts with bromine in CS_2 to give :
 - (1) o-bromophenol
 - (2) m- bromophenol
 - (3) o- and p-bromophenol
 - (4) 2, 4, 6-tribromophenol
- 79. The carboxylic acid that does not undergo Hell-Volhard-Zelinsky reaction is :
 - (1) CH₃COOH
 - (2) $(CH_3)_2CHCOOH$
 - (3) CH₃CH₂CII₂COOH
 - (4) $(CH_3)_3CCOOH$
- 80. Which one of the following is a reagent in Gabriel amine synthesis?
 - (1) an acyl or arylhalide
- (2) phthalimide

(3) hydroxylamine

- (4) sodium azide
- **81.** The product of the following reaction is:





- $\bigcirc \qquad \qquad (2) \quad \bigcirc \longrightarrow NH_2 \qquad (3) \quad \bigcirc \longrightarrow Cl$

83. The most suitable reagent for the conversion of $RCH_2OH \rightarrow RCHO$ is :

- (1) CrO_3/H_2SO_4
- (2) $KMnO_4 / KOH$
- (3) PCC
- (4) $K_2Cr_2O_7/H_2SO_4$

84. Which of the following combination of aldehydes give cross Cannizzaro reaction?

- (1) CH₃CHO, HCHO
- (2) C_6H_5CHO , CH_3CHO
- (3) $C_6H_5CHO, HCHO$
- (4) All of these

85. Which of the following compound used alone will undergo an aldol reaction?

- (1) CH₂O
- (2) CH_3COCII_3
- (3) $C_6H_5COC_6H_5$
- (4) $CH_2 = CIICHO$

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86. The diasaccharide sucrose is composed of monosaccharides:

- (1) D-glucose + D-glucose
- (2) D-fructose + D-fructose
- (3) D-glucose + D-galactose
- (4) D-glucose + D-fructose

87. Which of the following statements about anomers is true?

- (1) Anomers are diastereoisomers
- (2) Anomers are enantiomers
- (3) Anomers are constitutional isomer
- (4) All of these

88. The reaction of CH_3CH_2MgBr with water yield :

 $(1) CH_3CH_3$

(2) $CH_2 = CH_2$

(3) CH_3CH_2OH

 $(4) CH_2 - CH_2$ $| \qquad |$ OH OH

89. Pyrrole is less basic than pyridine because the lone-pair of electrons on N-atom in pyrrole:

- (1) reside in sp hybrid orbital
- (2) reside in sp^2 hybrid orbital
- (3) is not part of the delocalized π molecular orbital
- (4) is part of the delocalized π molecular orbital

- **90.** Quinoline undergo nucleophilic substitution on heating with $NaNII_2$ to give:
 - (1) 6-Aminoquinoline
 - (2) 2-Aminoquinoline
 - (3) 3-Aminoquinoline
 - (4) 4-Aminoquinoline
- 91. Complete the following reaction [A] is:

(1)

(2) OH

(3) $\langle -S | Na^+$

- (4) None of these
- 92. Base-catalyzed condensation of two ester molecules to form an alcohol and β -keto ester is called :
 - (1) Claisen condensation
 - (2) Corey-House reaction
 - (3) Aldol condensation
 - (4) Kolbe's reaction
- **93.** What is used to initiate a tree-radical polymerization?
 - (1) Benzoyl peroxide

(2) Benzoic acid

(3) Benzyl alcohol

(4) Benzil

g4. The α -Helix is common form of:

A

- (1) Primary structure of protein
- (2) Secondary structure of protein
- (3) Tertiary structure of protein
- (4) None of these

95. An auxochrome is one which is:

- (1) colour enhancing
- (2) a group or atom with lone pairs of electron
- (3) extended conjugation
- (4) all of these

96. The energy required for various transition follow the order :

- (1) $\pi \to \pi^* \ge n \to \pi^* \ge \sigma \to \sigma^* \ge n \to \sigma^*$
- (2) $n \to \pi^* \ge \sigma \to \sigma^* \ge n \to \sigma^* \ge \pi \to \pi^*$
- (3) $\sigma \rightarrow \sigma^* \ge n \rightarrow \sigma^* \ge \pi \rightarrow \pi^* \ge n \rightarrow \pi^*$
- (4) $\sigma \rightarrow \sigma^* \ge \pi \rightarrow \pi^* \ge n \rightarrow \sigma^* \ge n \rightarrow \pi^*$

97. In infra-red spectroscopy, the pair of isomers, which cannot be distinguished:

- (1) Cis-trans isomers
- (2) Functional isomers
- (3) Enantiomers
- (4) Position isomers

98.	8. The cycloalkanones, the frequency of absorption for carbonyl group is:				
	(1) 1000-1100 cm	-1	(2) 1280-1300 cm	₁ -1	
	(3) 1580-1600 cm ⁻¹		(4) 1705-1725 cm ⁻¹		
99.	99. The signal(s) for a compound like $A - CH_2 - CH_2 - B$ will be:				
	(1) Two singlets	(2) Two triplet	(3) One singlet	(4) One triplet	
100.	How many ¹ H NN	MR signal in case of	benzene?		
	(1) Zero	(2) One	(3) Three	(4) Six	

Total No. of Printed Pages: 21

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU

В

ARE ASKED TO DO SO)
PG-EE-July, 2024

SET-Z

SUBJECT: Chemistry

10426

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.

- 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 shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
- 5. 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.

PG-EE-July-2024/(Chemistry)(SET-Z)/(B)

SEAL

- 1. The alkyl halides required to prepare \times by Wurtz reaction are:
 - (1) \bigwedge Ce and \bigwedge Ce

(2) \bigvee_{Ce} and \bigvee_{Ce}

- (3) \bigvee_{Ce} and \bigvee_{Ce}
- (4) \leftarrow Ce and \leftarrow Ce
- 2. Ozonolysis of an alkene produces only one dicarbonyl compound. The structure of the alkene is:
 - (1) $CH_3 CH = CH CH_2 CH_3$
- (2)

(3)

- (4) All of the above
- 3. Which one of the following compound is aromatic in nature?
 - (1)

(2) \bigoplus CH_3

(3)

(4)

- **4.** Diels-Alder reaction is :
 - (1) 4 + 2 cycloaddition
 - (2) 2 + 2 cycloaddition
 - (3) Electrophilic addition
 - (4) Nucleophilic addition
- 5. Which of the following can be used as the halide component for Friedel-Crafts reaction?
 - (1) Chlorobenzene

(2) Bromobenzene

(3) Chloroethane

(4) Isopropyl chloride

6. Which of the following alcohol is resistant to oxidation?



(3)
$$CH_3 - OH$$
 (4) $H_3C - CH - OH$ CH_3

7. The product of the following reaction is:

$$H_3C \xrightarrow{CH_3} + CH_3CH_2OH \xrightarrow{H^{\oplus}}$$

$$CII_3$$

$$|$$
(3) $H_3C - C - CII_2 - O - CH_2CH_3$

$$|$$
 OII
(4) None of these

8. Phenol reacts with bromine in CS_2 to give :

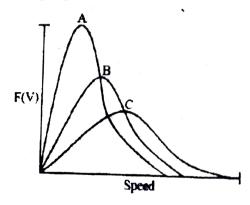
- (1) o-bromophenol
- (2) m- bromophenol
- (3) o- and p-bromophenol
- (4) 2, 4, 6-tribromophenol

- 9. The carboxylic acid that does not undergo Hell-Volhard-Zelinsky reaction is:
 - (1) CH_3COOH
 - (2) $(CH_3)_2CHCOOH$
 - (3) CH₃CH₂CH₂COOH
 - (4) (CH₃)₃CCOOH
- 10. Which one of the following is a reagent in Gabriel amine synthesis?
 - (1) an acyl or arylhalide

(2) phthalimide

(3) hydroxylamine

- (4) sodium azide
- 11. Electrolysis of an aqueous solution of 1.0 M NaOH results in :
 - (1) Na at the cathode and O₂ at the anode
 - (2) H₂ at the cathode and O₂ at the anode
 - (3) Na and H_2 at the cathode, and O_2 at the anode
 - (4) O_2 at the cathode and H_2 at the anode
- 12. Identify the speed distribution functions of Neon, Argon and Krypton gas in the three curves (A or B or C) in the graph given below:



(1) Ne-A, Ar-B, Kr-C

(2) Ne-B, Ar-C, Kr-A

(3) Ne-C, Ar-B, Kr-A

(4) Ne-C, Ar-A, Kr-B

(1) 1/T^{1/2}

 $(1) H_2$

	(1) 112	(-) -2		
15.	Raman spectrometer	er is 2048/cm . Wi	The wave numben at is the wave numben	r of incident radiation in a ber of first scattered Stokes
	line (in cm ⁻¹) of ¹⁴ (1) 20479	⁴ N ₂ ? (2) 20475	(3) 20499	(4) 20495
16.	For the vibrational		a homonuclear diato	mic molecule, the selection
	(1) $\Delta v = 0$ only	c approximation in	(2) $\Delta v = \pm 1$ only	
	(3) $\Delta v = \pm 2$ only		$(4) \ \Delta \mathbf{v} = 0, \pm 1$	
17.	The vibrational free and 0.0025 respectovertone are respective.	tively. The positions	nicity constant of an s (in cm ⁻¹) of its fi	alkali halide are 300 cm ⁻¹ indamental mode and first
	(1) 300, 600		(2) 298.5, 595.5	
	(3) 301.5, 604.5		(4) 290, 580	
18.	The energy levels energy in this mole	for cyclobutadiene an	re $\alpha + 2\beta$, α , α and	$\alpha - 2\beta$. The delocalization
_	(1) 0		(3) -8β	(4) 4α
19.	Identify which of the	he following operator	rs is not Hermitian?	Here <i>i</i> is iota.
	$(1) \ \frac{h}{i2\pi} \frac{\partial}{\partial x}$	$(2) i \frac{\partial^2}{\partial x^2}$	$(3) \ \frac{\partial^2}{\partial x^2}$	(4) X^2
20.	Calculate the ESR given that for a free	I frequency of an under the electron, $g_e = 2$ and	spaired electron in a $\mu_B = 9.273 \times 10^{-24} \text{J}$	magnetic field of 0.33 T
	(1) 2.3 GHz		(2) 9.24 GHz	,
	(3) 1.15 GHz		(4) 8.36 GHz	
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13. The root mean square speed of the molecules of a perfect gas is proportional to:

14. At room temperature, which molecule has the maximum rotational entropy?

(2) T

(2) O_2

(3) T^{1/2}

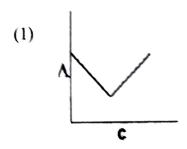
(3) D_2

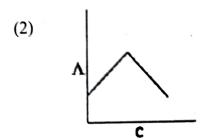
(4) 1/T

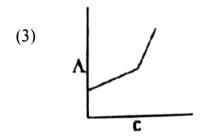
(4) N_2

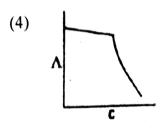
21.	Copper has role in:				
	(1) Hb formation		(2)	ATP production	by reformation
	(3) Formation of fi	bres elastic	(4)	All of the above	:
22.	maximum electron		conf	igurations repres	sent the elements with the
	$(1) 1s^{2}2s^{2}2p^{6}$ $(3) 1s^{2}2s^{2}2p^{6}3s^{1}$			$1s^{2}2s^{2}2p^{6}3s^{2}3p^{5}$ $1s^{2}2s^{2}2p^{5}$,
23.	Which one of the fo	ollowing is most easi	ly red	duced ?	
	(1) Ni(CO) ₄	(2) Cr(CO) ₆	(3)	Fe(CO) ₅	(4) V(CO) ₆
24.	The value of d ₁₁₁ in	a cubic crystal is 32	5.6 p	m. The value of	d ₃₃₃ is:
	(1) 325.6 pm	(2) 976.8 pm	(3)	108.5 pm	(4) 625.6 pm
25.	the state of the s	s in FCC structure waycc, the molar mass			f 500 pm. If the density of o:
	(1) 23	(2) 24	(3)	25	(4) 26.
26.	half-life of this rearate constant (in To	ction is 400 s when t	the in	itial pressure is seconds) respect	second-order kinetics. The 250 Torr. What will be the ively, if the initial pressure
	(1) 10^5 and 500 sec	conds	(2)	10^{-5} and 400 s	econds
	(3) 10^{-4} and 400 s	seconds	(4)	10^{-5} and 500 s	econds
27.	$min^{-1}g^{-1}$. Calculation	ate the age of the o	old v	vood sample, if	to be 14.2 disintegrations for a fresh wood sample on-14 is 5730 years), is:
	(1) 5,000 years	(2) 4,000 years	(3)	877 years	(4) 617 years
28.	. Kohlrausch's law i	s applicable to a dilu	te so	lution of:	
	(1) Potassium chlo	oride in hexane	(2)	Acetic acid in	water
	(3) Hydrochloric	acid in water	(4)	Benzoic acid in	n benzene
		•			

- 29. The concentration of a MgSO₄ solution having the same ionic strength as that of a 0.1 M Na₂SO₄ solution is:
 - (1) 0.05 M
- (2) 0.067 M
- (3) 0.075 M
- (4) 0.133 M
- **30.** The molar conductivity \(\simes \) versus concentration (c) plot of sodium dodecylsufate in water is expected to look like:









- 31. The chemical composition of brown ring produced in the test of NO_2 is:
 - (1) [FeNO]SO₄
- (2) [FeNO]Cl₂
- (3) $[FeSO_4]NO_2$
- (4) [FeCl₂[NO
- 32. Under physiological condition, oxygen is binding to deoxy-hemoglobin and deoxy-rnyoglobin, the binding curve and its pH dependence respectively are:
 - (1) sigmoidal & pH dependent; hyperbolic and pH independent.
 - (2) hyperbolic and pH independent; sigmoidal & pH dependent.
 - (3) sigmoidal & pH independent; hyperbolic and pH dependent.
 - (4) hyperbolic and pH independent; sigmoidal & pH dependent.
- 33. The total number of isomers of $[Co(en)_2Cl_2]$, (en = ethylenediamine) is :
 - (1) 4
- (2) 3
- (3) 6
- (4) 5
- 34. Arrange the following in decreasing order of axial C-O bond length and increasing order of axial v_{M-C} :

(1) ii > iv > iii > i

(2) iv > ii > iii > i

(3) ii > iv > i > iii

- (4) i > ii > iii > iv
- 35. Identify the correct statement for the two reactions given below:

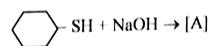
$$Xe + PtF_6 \xrightarrow{SF_6} [Xe]^+ [PtF_6]^-$$

$$XeF_4 + Me_4NF \longrightarrow [Me_4N]^{\dagger} [XeF_5]^{\dagger}$$

- (1) Xe and XeF₄ both act as acids
- (2) Xe and XeF₄ both act as bases
- (3) Xe acts as an acid and XeF4 act as base
- (4) Xe acts as a base and XeF4 act as an acid

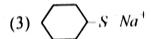
- The separation of lanthanides in the ion-exchange method is based on : 36.
 - (1) Basicity of hydroxides
- (2) Size of the hydrated ions
- (3) Size of the unhydrated ion
- (4) The solubility of their nitrates
- Which one of the following conductometric titration will show a linear increase of the conductance with volume of titrant added upto the break point and almost constant 37. conductance afterwards?
 - (1) A strong acid with a strong base
- (2) A strong acid with a weak base
- (3) A weak acid with a strong base
- (4) A weak acid with a weak base
- The electronic configuration of chromium is $4s^13d^5$. The element tungsten (W) belongs to the same group and has atomic number = 74. The configuration of its valence shell 38. is:
 - $(1) 5s^{1}4d^{1}$

- (2) $6s^{1}5d^{5}$ (3) $6s^{2}5d^{4}$ (4) $6s^{0}5d^{6}$
- The nephelauxetic parameter (β) is highest for : 39.
 - (1) Br
- (2) Cl
- (3) CN
- (4) F
- Among the following series of transition metal ions, the one where all metal ions have 40. $3d^2$ electronic configuration is :
 - (1) Ti^{2+} , V^{3+} , Cr^{4+} , Mn^{5+}
- (2) Ti^{2+} , V^{2+} , Cr^{3+} , Mn^{4+}
- (3) Ti^+ , V^{4+} , Cr^{6+} , Mn^{7+}
- (4) Ti^{4+} , V^{3+} , Cr^{2+} , Mn^{3+}
- Complete the following reaction [A] is: 41.









- (4) None of these
- 42. Base-catalyzed condensation of two ester molecules to form an alcohol and β -keto ester is called:
 - (1) Claisen condensation
- (2) Corey-House reaction

(3) Aldol condensation

(4) Kolbe's reaction

- 43. What is used to initiate a tree-radical polymerization?
 - (1) Benzoyl peroxide

(2) Benzoic acid

(3) Benzyl alcohol

- (4) Benzil
- 44. The α -Helix is common form of :
 - (1) Primary structure of protein
 - (2) Secondary structure of protein
 - (3) Tertiary structure of protein
 - (4) None of these
- **45.** An auxochrome is one which is:
 - (1) colour enhancing
 - (2) a group or atom with lone pairs of electron
 - (3) extended conjugation
 - (4) all of these
- **46.** The energy required for various transition follow the order :
 - (1) $\pi \to \pi^* > n \to \pi^* > \sigma \to \sigma^* > n \to \sigma^*$
 - (2) $n \to \pi^* \ge \sigma \to \sigma^* \ge n \to \sigma^* \ge \pi \to \pi^*$
 - (3) $\sigma \rightarrow \sigma^* > n \rightarrow \sigma^* > \pi \rightarrow \pi^* > n \rightarrow \pi^*$
 - (4) $\sigma \rightarrow \sigma^* > \pi \rightarrow \pi^* > n \rightarrow \sigma^* > n \rightarrow \pi^*$
- 47. In infra-red spectroscopy, the pair of isomers, which cannot be distinguished:
 - (1) Cis-trans isomers
 - (2) Functional isomers
 - (3) Enantiomers
 - (4) Position isomers

	-
4	^

(1) 1000-1100 cm⁻¹

(3) 1580-1600 cm⁻¹

	(3)			
49.	The signal(s) for a c	compound like $A-C$	$H_2 - CH_2 - B$ will be) i
			(3) One singlet	(4) One triplet
50.	How many 1/1 NM	IR signal in case of b	enzene?	
,	(1) Zero	(2) One	(3) Three	(4) Six
51.	The fact that the f	luorescence wavelers shift) is a consequer	ngth is often much lace of which phenom	longer than the irradiation enon?
		coefficients (Lambe		
	(2) Vertical transit	ions (Kasha's rule)		
	(3) High ISC rates			
	(4) The Franck-Co			
52.	1.4!1- hanala	atralyte solid weigh	ing 2.175 g is added	erature is 640 mmHg. A is to 39 g of benzene. The ecular weight of the solid
	(1) 42.25	(2) 55.55	(3) 65.25	(4) 72.25
53.	What is the molal l	lowering of the vapor	pressure of water is	100°C ?
50.	(1) 17.77 mm	(2) 28.28 mm	(3) 13.68 mm	(4) 24.66 mm
54.	freezing point of	water in automobile	e radiator. What mu	e, effectively depresses the nimum weight of ethylene om freezing at -24°C?
			(Given : 1 Gallon =	= 3.785 liter and $K_f = 186$)
	(1) 22.15 kg	(2) 18.15 kg	(3) 33.75 kg	(4) 62 kg
PG-E	E-July-2024/(Chem	nistry)(SET-Z)/(B)		

The cycloalkanones, the frequency of absorption for carbonyl group is:

(2) $1280-1300 \,\mathrm{cm}^{-1}$

(4) 1705-1725 cm⁻¹

- 55. 20.27 g of Benzene containing 0.2965 g of benzoic acid (mol. wt. 122) freezes at 0.137°C below the freezing point of pure benzene. If Benzoic acid exists as a dimer in benzene, find its degree of association. (Given: K_f for Benzene is 5.12°C. m⁻¹)
 - (1) 72.34%
- (2) 86.84%
- (3) 96.84%
- (4) 66.34%
- 56. The surface tension of water at 21°C is 72.75×10^{-3} N/m. A 33.24% (v/v) solution of ethanol has $\gamma = 33.24 \times 10^{-3}$ N/m at the same temperature. Given: Density of solution = 0.9614×10^{3} kg/m³, density of water = 0.9982×10^{3} kg/m³ and angle of contact, $\theta = 0^{\circ}$. How much less will the alcohol solution rise in the same capillary?
 - (1) 34.2%
- (2) 47.4%
- (3) 54.3%
- (4) 65.4%
- **57.** Hyperconjugation involves overlap of the following orbitals:
 - (1) σ-σ
- (2) σ-ρ
- (3) ρ-ρ
- (4) $\pi \pi$

58. The z-isomer among the following is:

(1)
$$Ce$$
 $CH_2CH_2CH_2CH_3$ Ce $CH_2CH_3CH_3$

(2)
$$H_3C$$
 $C = C$ CH_2OH CHO

(3)
$$C_6H_5$$
 COOH

(4)
$$H_3C$$
 $C = C$ CH

- 59. Out of the following the molecule that exhibits optical isomerism is:
 - (1) 2-methyl-2-pentene

(2) 3-methyl-2-pentene

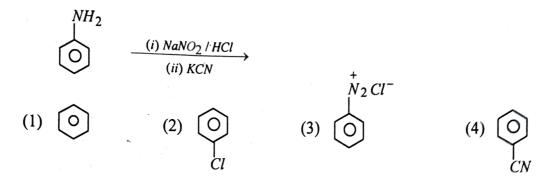
(3) 3-methyl-1-pentene

- (4) 4-methyl-1-pentene
- **60.** The stablest radical among the following is:
 - (1) $CH_3CH_2\overset{\bullet}{C}H_2$

(2) *CH*₃*CHCH*₃

(3) $C_6H_5CH_2 \overset{\bullet}{C} H_2$

(4) $C_6H_5\dot{C}H_2CH_3$



62. The product [A] of the following reaction is:

$$\begin{array}{c}
NO_2 \\
\hline
(i) Fe/HCl \\
(ii) NaOH
\end{array}$$
[A]

63. The most suitable reagent for the conversion of $RCH_2OH \rightarrow RCHO$ is :

- (1) CrO_3/H_2SO_4
- (2) $KMnO_4 / KOH$
- (3) PCC
- (4) $K_2Cr_2O_7/H_2SO_4$

64. Which of the following combination of aldehydes give cross Cannizzaro reaction?

- (1) CH_3CHO , HCHO
- (2) C_6H_5CHO, CH_3CHO
- (3) $C_6H_5CHO, HCHO$
- (4) All of these

1

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- 65. Which of the following compound used alone will undergo an aldol reaction?
 - (1) CH_2O

(2) CH_3COCH_3

(3) $C_6H_5COC_6H_5$

- (4) $CH_2 = CHCHO$
- **66.** The diasaccharide sucrose is composed of monosaccharides:
 - (1) D-glucose + D-glucose
 - (2) D-fructose + D-fructose
 - (3) D-glucose + D-galactose
 - (4) D-glucose + D-fructose
- 67. Which of the following statements about anomers is true?
 - (1) Anomers are diastereoisomers
 - (2) Anomers are enantiomers
 - (3) Anomers are constitutional isomer
 - (4) All of these
- **68.** The reaction of CH_3CH_2MgBr with water yield :
 - (1) CH_3CH_3

(2) $CH_2 = CH_2$

(3) CH_3CH_2OH

- (4) $CH_2 CH_2$ | | | OH OH
- **69.** Pyrrole is less basic than pyridine because the lone-pair of electrons on N-atom in pyrrole:
 - (1) reside in sp hybrid orbital
 - (2) reside in sp^2 hybrid orbital
 - (3) is not part of the delocalized π molecular orbital
 - (4) is part of the delocalized π molecular orbital

- 70. Quinoline undergo nucleophilic substitution on heating with NaNH2 to give:
 - (1) 6-Aminoquinoline

(2) 2-Aminoquinoline

(3) 3-Aminoquinoline

- (4) 4-Aminoquinoline
- 71. Indicate which one of the following relations is not correct:

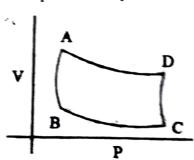
$$(1) - \left(\frac{\partial T}{\partial V}\right)_{S} = \left(\frac{\partial P}{\partial S}\right)_{V}$$

(2)
$$-\left(\frac{\partial T}{\partial P}\right)_{S} = \left(\frac{\partial V}{\partial S}\right)_{P}$$

(3)
$$-\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$$

$$(4) - \left(\frac{\partial S}{\partial P}\right)_T = \left(\frac{\partial V}{\partial T}\right)_P .$$

- 72. When two moles of liquid A are mixed with two moles of liquid B at 300K, the excess molar Gibbs energy of the solution is -1.5 kJ mol-1. The corresponding value of Gibbs energy of mixing (in kJ) is closest to:
 - (1) -12.9
- (2) 6.0
- (3) -1.5 (4) -0.9
- The minimum work required by an engine to transfer 5 J of heat from a reservoir at 100 **73**. K to one at 300 K is:
 - (1) 5 J
- (2) 10 J
- (3) 15 J
- (4) 20 J
- The figure below describes how a reversible Carnot heat engine works. It starts from the adiabatic compression step denoted by:



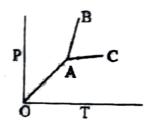
- (1) AB
- (2) BC
- (3) DC
- (4) AD

- 75. A thermodynamic equation that relates the chemical potential to the composition of a mixture is known as:
 - (1) Gibb's-Helmholtz equation
 - (2) Gibb's-Duhem equation
 - (3) Joule-Thomson equation
 - (4) Debye-Huckel equation
- 76. The heat capacity of a species is independent of temperature if it is:
 - (1) Tetratomic

(2) Triatomic

(3) Diatomic

- (4) Monatomic
- 77. The phase diagram of a compound is shown below:



The slopes of the lines OA, AC and AB are $\tan \frac{\pi}{4}$, $\tan \frac{\pi}{6}$ and $\tan \frac{\pi}{3}$ respectively. If melting point and ΔH of melting are 300K and 3 kJ mol⁻¹ respectively, the change in the volume on melting is:

(1) 10 $\tan \frac{\pi}{3}$

(2) $10 \tan \frac{\pi}{4}$

(3) $10 \cot \frac{\pi}{3}$

- (4) $10 \cot \frac{\pi}{4}$
- **78.** The number of phases, components, and degrees of freedom, when Argon is added to an equilibrium mixture of NO, O_2 and NO_2 in the gas phase are, respectively:
 - (1) 1, 3, 5

(2) 1, 4, 5

(3) 1, 3, 4

(4) 1, 4, 4

6		
79.	For a potentiometric titration, in the cadded, the equivalence point is indicate	curve of emf (E) vs volume (V) of the titrant d by:
	(1) $ dE/dV = 0$; $ d^2E/d^2V = 0$	(2) $ dE/dV = 0$; $ d^2E/d^2V > 0$
	(3) $ dE/dV > 0$; $ d^2E/d^2V = 0$	(4) $ dE/dV > 0$; $ d^2E/d^2V > 0$
80.	The Daniel cell is:	
	(1) $Pt_I(s) Zn(s) Zn^{2+}(aq) Cu^{2+}(aq) Cu(s) $	$ Pt_{II} $
	(2) $Pt_1(s) Zn(s) Zn^{2+}(aq) Ag^{2+}(aq) Ag($	$s) Pt_{\Pi}$

(3) $Pt_I(s)|Fe(s)|Fe^{2+}(aq)||Cu^{2+}(aq)|Cu(s)|Pt_{II}$

(4) $Pt_I(s)|H_2(s)|H_2SO_4(aq)||Cu^{2+}(aq)|Cu(s)|Pt_{II}$

- **81.** Coordination number and geometry of $[Ce(NO_3)_6]^{2-}$:
 - (1) 6, octahedral

(2) 12, octahedral

(3) 8, octahedral

- (4) 12, icosaheral
- 82. If an element has seven electrons in its outermost shell then it is likely to have the atomic size among all the elements in the same period.
 - (1) largest

(2) smallest

(3) same

- (4) both (1) and (2)
- 83. The tripositive lanthanoid ion which does not show sharp peak in the absorption spectra:
 - (1) Gd^{3+}
- (2) Pm^{3+}
- (3) Ce^{3+}
- $(4) Pr^{3+}$

84. C_{60} has:

- (1) 14 pentagons and 18 hexagons
- (2) 10 pentagons and 20 hexagons
- (3) 12 pentagons and 20 hexagons
- (4) 12 pentagons and 18 hexagons

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- 85. If Δ_0 is the octahedral splitting energy and P is the pairing energy, then the crystal field stabilization energy (CFSE) of [Co(NH₃)₆]²⁺ is:
 - (1) $-0.8 \Delta_0 + 2P$ (2) $-0.8 \Delta_0$
- (3) $-1.8 \Delta_0 + 3P$ (4) $-0.8 \Delta_0 + P$
- **86.** Consider the following complex ions, P, Q and R, $P = [FeF_6]^{3-}$, $Q = [V(H_2O)_6]^{2+}$ and $R = [Fe(H_2O)_6]^{2+}$; The correct order of the complex ions, according to their spin-only magnetic moment values (in B.M.) is:
 - (1) Q < P < R

(2) R < Q < P

(3) R < P < 0

- (4) Q < R < P
- 87. Glycerol is more viscous than glycol, the reason is:
 - (1) Higher molecular wt.
 - (2) More covalent
 - (3) More extent of hydrogen bonding
 - (4) Complex structure
- In BF₃, the B-F bond length is 1.30 Å, when BF₃ is allowed to be treated with Me₃N, it forms an adduct, $[Me_3N \rightarrow BF_3]$ The bond length of B-F in the adduct is :
 - (1) Greater than 1.30Å
 - (2) Smaller than 1.30Å
 - (3) Equal to 1.30Å
 - (4) None of these
- 89. Name the type of the structure of silicate in which one oxygen atom of $[SiO_4]^{4-}$ is shared?
 - (1) Linear chain silicate
 - (2) Sheet silicate
 - (3) Pyrosilicate
 - (4) Three dimensional

	WD: 1 Cd (Siliania a sanconto o	cet of hard acid	and soft base respectively?			
90.			(2) Fe ^{$3+$} and	1 s ²⁻			
	(1) Fe^{3+} and F						
	(3) Ag and S	2 -	(4) Ag ar	nd F			
91.	The quantum r	number of 20th electr	on of Fe $(Z = 26)$) would be :			
	(1) 3, 2, -2, -	1/2					
	(2) 3, 2, 0, 1/2	2					
	(3) 4, 0, 0, +1	/2					
	(4) 4, 1, -1, +	1/2					
92.	The number o	of orbitals in $n = 3$ are	:				
	(1) 1	(2) 4	(3) 9	(4) 16			
93.	Electronegativ	vity of the following e	elements increase	es in the order :			
	(1) O, N, S, F		(2) P, S, P	1 , O			
	(3) P, N, S, C)	(4) S, P, P	N, O			
94.	Predict the correct order of repulsion among the following:						
	(1) lone pair – lone pair – bond pair – bond pair – bond pair						
	(2) lone pair – lone pair > bond pair – bond pair > lone pair – bond pair						
	(3) bond pair	r – bond pair > lone p	air – bond pair >	lone pair -lone pair			
	(4) lone pair	– bond pair > bond p	air – bond pair >	lone pair – lone pair			
95.		ncorrect statement :					
	(1) sp^3d hyb	oridisation involves d	$(x^2 - y^2)$ orbital				
				laps with other orbitals.			
		ecule is more polar th					
	(4) o-nitroph	enol is more volatile	than p-nitrophen	ol.			
o e	E I.I. 2024//	Chemistry)(SET-Z)/	(B)				

96. Which of the following order is not correct?

- (1) $SF_2 > SF_4 > SF_6$ (ionic character)
- (2) $AlF_3 < Al_2O_3 < AIN$ (covalent character)
- (3) $CaCl_2 < SnCl_2 < CdCl_2$ (covalent character)
- (4) ZnCl₂ < CdCl₂ < HgCl₂ (ionic character)

97. Which one of the following molecules is expected to exhibit diamagnetic behaviour?

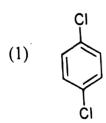
(1) C_2

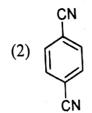
(2) N_2^-

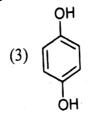
(3) O_2

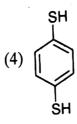
 $(4) S_2$

98. For which of the following molecule significant $\mu \neq 0$:









(1) Only (3)

(2) (3) and (4)

(3) Only (1)

(4) (1) and (2)

99. The geometry with respect to the central atom of the following molecules are $N(SiH_3)_3$, Me_3N , $(SiH_3)_3P$:

- (1) planar, pyramidal, planar
- (2) planar, pyramidal, pyramidal
- (3) pyramidal, pyramidal, pyramidal
- (4) pyramidal, planar, pyramidal

100. The IUPAC name of [Co(NH₃)₅ONO]²⁻ ion is :

- (1) Pentaamminenitritocobalt (IV) ion
- (2) Pentaamminenitrocobalt (IV) ion
- (3) Pentaamminenitrocobalt (III) ion
- (4) Pentaamminenitritocobalt (III) ion

Total No. of Printed Pages: 21

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C ARE ASKED TO DO SO)
PG-EE-July, 2024

SET-Z

10427

SUBJECT: Chemistry

		Sr. No
Time : 1¼ Hours Roll No. (in figures)	Max. Marks : 100 (in words)	Total Questions : 100
Name	Date of Birth	
Father'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 shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
- 5. 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.

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1. Indicate which one of the following relations is *not* correct:

$$(1) - \left(\frac{\partial T}{\partial V}\right)_{S} = \left(\frac{\partial P}{\partial S}\right)_{V}$$

(2)
$$-\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$$

(3)
$$-\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$$

$$(4) \quad -\left(\frac{\partial S}{\partial P}\right)_T = \left(\frac{\partial V}{\partial T}\right)_P$$

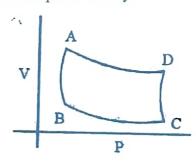
2. When two moles of liquid A are mixed with two moles of liquid B at 300K, the excess molar Gibbs energy of the solution is -1.5 kJ mol⁻¹. The corresponding value of Gibbs energy of mixing (in kJ) is closest to:

- (1) -12.9
- (2) 6.0
- (3) -1.5
- (4) -0.9

3. The minimum work required by an engine to transfer 5 J of heat from a reservoir at 100 K to one at 300 K is:

- (1) 5 J
- (2) 10 J
- (3) 15 J
- (4) 20 J

4. The figure below describes how a reversible Carnot heat engine works. It starts from the adiabatic compression step denoted by:

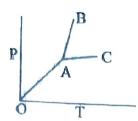


- (1) AB
- (2) BC
- (3) DC
- (4) AD

5. A thermodynamic equation that relates the chemical potential to the composition of a mixture is known as:

- (1) Gibb's-Helmholtz equation
- (2) Gibb's-Duhem equation
- (3) Joule-Thomson equation
- (4) Debye-Huckel equation

- The heat capacity of a species is independent of temperature if it is:
 - (1) Tetratomic
- (2) Triatomic
- (3) Diatomic
- (4) Monatomic
- 7. The phase diagram of a compound is shown below:



The slopes of the lines OA, AC and AB are $\tan \frac{\pi}{4}$, $\tan \frac{\pi}{6}$ and $\tan \frac{\pi}{3}$ respectively. If melting point and AH of melting are 300K and 3 kJ mol-1 respectively, the change in the volume on melting is:

- (1) 10 $\tan \frac{\pi}{3}$
- (2) $10 \tan \frac{\pi}{4}$ (3) $10 \cot \frac{\pi}{3}$ (4) $10 \cot \frac{\pi}{4}$
- The number of phases, components, and degrees of freedom, when Argon is added to an equilibrium mixture of NO, O_2 and NO_2 in the gas phase are, respectively:
 - (1) 1, 3, 5
- (2) 1, 4, 5
- (3) 1, 3, 4
- (4) 1, 4, 4
- 9. For a potentiometric titration, in the curve of emf (E) vs volume (V) of the titrant added, the equivalence point is indicated by:
 - (1) |dE/dV| = 0; $|d^{2}E/d^{2}V| = 0$ (2) |dE/dV| = 0; $|d^{2}E/d^{2}V| > 0$ (3) |dE/dV| > 0; $|d^{2}E/d^{2}V| = 0$ (4) |dE/dV| > 0; $|d^{2}E/d^{2}V| > 0$

- 10. The Daniel cell is:
 - (1) $Pt_I(s)|Zn(s)|Zn^{2+}(aq)||Cu^{2+}(aq)|Cu(s)|Pt_{II}$
 - (2) $Pt_{I}(s)|Zn(s)|Zn^{2+}(aq)||Ag^{2+}(aq)|Ag(s)|Pt_{II}$
 - (3) $Pt_{I}(s)|Fe(s)|Fe^{2^{+}}(aq)||Cu^{2^{+}}(aq)||Cu(s)|Pt_{II}$
 - (4) $Pt_1(s)|H_2(s)|H_2SO_4(aq)||Cu^{2+}(aq)|Cu(s)|Pt_{11}$

	(1) 6, octahedral (2) 12, octahedral (3) 8, octahedral (4) 12, icosaheral
12.	If an element has seven electrons in its outermost shell then it is likely to have the atomic size among all the elements in the same period.
	(1) largest (2) smallest (3) same (4) both (1) and (2)
13.	The tripositive lanthanoid ion which does not show sharp peak in the absorption spectra:
	(1) Gd^{3+} (2) Pm^{3+} (3) Ce^{3+} (4) Pr^{3+}
14.	C ₆₀ has:
	(1) 14 pentagons and 18 hexagons
	(2) 10 pentagons and 20 hexagons
	(3) 12 pentagons and 20 hexagons
	(4) 12 pentagons and 18 hexagons
15.	If Δ_0 is the octahedral splitting energy and P is the pairing energy, then the crystal field stabilization energy (CFSE) of $\left[\text{Co(NH}_3)_6\right]^{2+}$ is:
	(1) $-0.8 \Delta_0 + 2P$ (2) $-0.8 \Delta_0$ (3) $-1.8 \Delta_0 + 3P$ (4) $-0.8 \Delta_0 + P$
16.	Consider the following complex ions, P, Q and R, $P = [FeF_6]^{3-}$, $Q = [V(H_2O)_6]^{2+}$ and $R = [Fe(H_2O)_6]^{2+}$; The correct order of the complex ions, according to their spin-only magnetic moment values (in B.M.) is:
	(1) $Q < P < R$ (2) $R < Q < P$ (3) $R < P < Q$ (4) $Q < R < P$
17.	Glycerol is more viscous than glycol, the reason is:
	(1) Higher molecular wt.
	(2) More covalent
	(3) More extent of hydrogen bonding

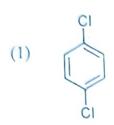
11. Coordination number and geometry of $[Ce(NO_3)_6]^2$:

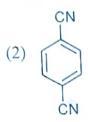
(4) Complex structure

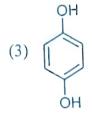
18.	(1) Greater than 1.3 (3) Equal to 1.30Å	$1e_3N \rightarrow BP_3$ The bole 80Å	(2) Smaller than 1 (4) None of these	30/1		
19.	(1) Linear chain sil(3) Pyrosilicate	icate	(2) Sheet silicate(4) Three dimension			
20.	Which of the follow	ving represents a set of	of hard acid and soft	base respectively?		
	(1) Fe^{3+} and F	(2) Fe^{3+} and S^{2-}	(3) Ag^{+} and S^{2-}	(4) Ag and F		
21.	The quantum numb	er of 20th electron of	f Fe (Z = 26) would be	pe:		
	(1) 3, 2, -2 , $-1/2$		(2) 3, 2, 0, 1/2			
	(3) 4, 0, 0, +1/2	•	(4) 4, 1, -1 , $+$ $1/2$			
22.	The number of orbi	tals in $n = 3$ are:				
	(1) 1	(2) 4	(3) 9	(4) 16		
23.	Electronegativity o	f the following eleme	ents increases in the	order:		
		(2) P, S, N, O				
24.	Predict the correct order of repulsion among the following: (1) lone pair – lone pair > lone pair – bond pair > bond pair – bond pair (2) lone pair – lone pair > bond pair – bond pair > lone pair – bond pair (3) bond pair – bond pair > lone pair – bond pair > lone pair – lone pair (4) lone pair – bond pair > bond pair > lone pair – lone pair					
25.	(2) Hybridised orb(3) SF₂ molecule	ect statement: ation involves $dx^2 - y$ pital form sigma-bond is more polar than C is more volatile than	d when overlaps with S_2 .	other orbitals.		

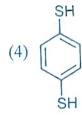
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- 26. Which of the following order is *not* correct?
 - (1) $SF_2 \ge SF_4 \ge SF_6$ (ionic character)
 - (2) $AlF_3 < Al_2O_3 \le AIN$ (covalent character)
 - (3) CaCl₂ < SnCl₂ < CdCl₂ (covalent character)
 - (4) ZnCl₂ < CdCl₂ < HgCl₂ (ionic character)
- 27. Which one of the following molecules is expected to exhibit diamagnetic behaviour?
 - (1) C₂
- (2) N_2^-
- $(3) O_{2}$
- (4) S_2
- **28.** For which of the following molecule significant $\mu \neq 0$:









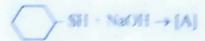
(1) Only (3)

(2) (3) and (4)

(3) Only (1)

- (4) (1) and (2)
- 29. The geometry with respect to the central atom of the following molecules are N(SiH₃)₃, Me₃N, (SiH₃)₃P:
 - (1) planar, pyramidal, planar
 - (2) planar, pyramidal, pyramidal
 - (3) pyramidal, pyramidal, pyramidal
 - (4) pyramidal, planar, pyramidal
- **30.** The IUPAC name of $[Co(NH_3)_5ONO]^{2-}$ ion is :
 - (1) Pentaamminenitritocobalt (IV) ion
 - (2) Pentaamminenitrocobalt (IV) ion
 - (3) Pentaamminenitrocobalt (III) ion
 - (4) Pentaamminenitritocobalt (III) ion

31. Complete the following reaction [A] is:



(1)

(2) OH

(3) S Na+

(4) None of these

32. Base-catalyzed condensation of two ester molecules to form an alcohol and β -keto ester is called:

- (1) Claisen condensation
- (2) Corey-House reaction
- (3) Aldol condensation
- (4) Kolbe's reaction *

33. What is used to initiate a tree-radical polymerization?

(1) Benzoyl peroxide

(2) Benzoic acid

(3) Benzyl alcohol

(4) Benzil

34. The o.-Helix is common form of:

- (1) Primary structure of protein
- (2) Secondary structure of protein
- (3) Tertiary structure of protein
- (4) None of these

- An auxochrome is one which is:
 - (1) colour enhancing
 - (2) a group or atom with lone pairs of electron
 - (3) extended conjugation
 - (4) all of these
- The energy required for various transition follow the order: 36.
 - (1) $\pi \to \pi^* \ge n \to \pi^* \ge \sigma \to \sigma^* \ge n \to \sigma^*$
 - (2) $n \to \pi^* \ge \sigma \to \sigma^* \ge n \to \sigma^* \ge \pi \to \pi^*$
 - (3) $\sigma \rightarrow \sigma^* \ge n \rightarrow \sigma^* \ge \pi \rightarrow \pi^* \ge n \rightarrow \pi^*$
 - (4) $\sigma \rightarrow \sigma^* > \pi \rightarrow \pi^* > n \rightarrow \sigma^* > n \rightarrow \pi^*$
- 37. In infra-red spectroscopy, the pair of isomers, which cannot be distinguished:
 - (1) Cis-trans isomers
 - (2) Functional isomers
 - (3) Enantiomers
 - (4) Position isomers
- The cycloalkanones, the frequency of absorption for carbonyl group is:
 - (1) 1000-1100 cm⁻¹
 - (2) 1280-1300 cm⁻¹
 - (3) 1580-1600 cm⁻¹
 - (4) 1705-1725 cm⁻¹
- The signal(s) for a compound like $A-CH_2-CH_2-B$ will be:
 - (1) Two singlets
- (2) Two triplet (3) One singlet (4) One triplet

40. How many 1// NMR signal in case of benzene?

	(1) Zero	(2) One	(3) Three	(4) Six							
41.			ngth is often much nce of which phenom	longer than the irradiation nenon?							
	(1) Low extinction coefficients (Lambert-Beer law)										
	(2) Vertical transit	(2) Vertical transitions (Kasha's rule)									
	(3) High ISC rates (El Sayed rule)										
	(4) The Franck-Condon principle										
42.	The vapor pressure of pure benzene at a certain temperature is 640 mmHg. A nonvolatile nonelectrolyte solid weighing 2.175 g is added to 39 g of benzene. The vapor pressure of the solution is 600 mmHg. The molecular weight of the solid substance is:										
	(1) 42.25	(2) 55.55	(3) 65.25	(4) 72.25							
43.	What is the molal	lowering of the vapo	r pressure of water is	100°C ?							
	(1) 17.77 mm (2) 28.28 mm										
	(3) 13.68 mm	,	(4) 24.66 mm								
44.	freezing point of	water in automobil	e radiator. What mi	ze, effectively depresses the nimum weight of ethylene om freezing at -24°C?							
			(Given: 1 Gallon	$= 3.785$ liter and $K_f = 186$)							
	(1) 22.15 kg	(2) 18.15 kg	(3) 33.75 kg	(4) 62 kg							
45.	0.137°C below th		ure benzene. If Benz	d (mol. wt. 122) freezes at coic acid exists as a dimer in for Benzene is 5.12°C. m ⁻¹)							
	(1) 72.34%		(2) 86.84%								
	(3) 96.84%		(4) 66.34%								
PG-E	E-July-2024/(Chen	nistry)(SET-Z)/(C)									

- 46. The surface tension of water at 21°C is 72.75×10^{-3} N/m. A 33.24% (v/v) solution of ethanol has $\gamma = 33.24 \times 10^{-3}$ N/m at the same temperature. Given: Density of solution = 0.9614×10^{3} kg/m³, density of water = 0.9982×10^{3} kg/m³ and angle of contact. $\theta = 0^{\circ}$. How much less will the alcohol solution rise in the same capillary?
 - (1) 34.2%
- (2) 47.4%
- (3) 54.3%
- (4) 65.4%
- 47. Hyperconjugation involves overlap of the following orbitals:
 - $(1) \sigma \sigma$
- (2) σ-ρ
- (3) $\rho \rho$
- (4) $\pi \pi$

48. The z-isomer among the following is:

(2)
$$H_3C$$
 CH_2OH CH_2OH CHO

(3)
$$C_6H_5$$
 COOH
$$Ce H$$

(4)
$$H_3C$$
 H $C = C$

- 49. Out of the following the molecule that exhibits optical isomerism is:
 - (1) 2-methyl-2-pentene

(2) 3-methyl-2-pentene

(3) 3-methyl-1-pentene

- (4) 4-methyl-1-pentene
- 50. The stablest radical among the following is:
 - $(1) \ CH_3CH_2 \ \overset{\bullet}{C} \ II_2$

(2) *CH*₃ *CHCH*₃

(3) $C_6H_5CII_2 \stackrel{\bullet}{C}II_2$

 $(4) C_6H_5\dot{C}H_2CH_3$

- 51. Copper has role in:
 - (1) Hb formation
 - (2) ATP production by reformation
 - (3) Formation of fibres elastic
 - (4) All of the above

maximum electron affinity?

(3) Hydrochloric acid in water

(4) Benzoic acid in benzene

PG-EE-July-2024/(Chemistry)(SET-Z)/(C)

		(2) $1s^2 2s^2 2p^6 3s$ (4) $1s^2 2s^2 2p^5$	² 3p ³
Which one of the fo			(I) 11/((O))
(1) Ni(CO) ₁	$(2) \operatorname{Cr}(\operatorname{CO})_6$	(3) $Fe(CO)_5$	(4) $V(CO)_6$
The value of d ₁₁₁ in	a cubic crystal is 3	25.6 pm. The valu	e of d ₃₃₃ is:
(1) 325.6 pm	(2) 976.8 pm	(3) 108.5 pm	(4) 625.6 pm
A metal crystallize the crystal is 1.33 g	s in FCC structure /cc, the molar mass	with a unit cell sice of the metal is clo	de of 500 pm. If the density of ose to:
(1) 23	(2) 24	(3) 25	(4) 26
half-life of this rea rate constant (in To	ction is 400 s when orr ⁻¹ s ⁻¹) and half-li	the initial pressur fe (in seconds) res	e is 250 Torr. What will be the pectively, if the initial pressure
$(1) 10^5 $ and 500 sec	conds		
(2) 10^{-5} and 400 s	seconds		
(3) 10^{-4} and 400 s	seconds		
(4) 10^{-5} and 500 s	seconds		
$min^{-1}g^{-1}$. Calcul	ate the age of the	old wood sample	e, if for a fresh wood sampl
(1) 5,000 years	(2) 4,000 years	(3) 877 years	(4) 617 years
Kohlrausch's law i	s applicable to a dil	ute solution of:	
(1) Potassium chl	oride in hexane		
(2) Acetic acid in	water		
	(1) Ni(CO) ₁ The value of d ₁₁₁ in (1) 325.6 pm A metal crystallize the crystal is 1.33 g (1) 23 The decomposition half-life of this rearate constant (in To of the acetaldehydo (1) 10 ⁵ and 500 se (2) 10 ⁻⁵ and 400 s (3) 10 ⁻⁴ and 400 s (4) 10 ⁻⁵ and 500 s The carbon-14 ac min ⁻¹ g ⁻¹ . Calcul carbon-14 activity (1) 5.000 years Kohlrausch's law in (1) Potassium chles	Which one of the following is most ease (1) Ni(CO) ₁ (2) Cr(CO) ₆ The value of d ₁₁₁ in a cubic crystal is 3 (1) 325.6 pm (2) 976.8 pm A metal crystallizes in FCC structure the crystal is 1.33 g/cc, the molar mass (1) 23 (2) 24 The decomposition of gaseous acetald half-life of this reaction is 400 s when rate constant (in Torr ⁻¹ s ⁻¹) and half-life of the acetaldehyde is 200 Torr at the seconds (1) 10 ⁵ and 500 seconds (2) 10 ⁻⁵ and 400 seconds (3) 10 ⁻⁴ and 400 seconds (4) 10 ⁻⁵ and 500 seconds The carbon-14 activity of an old we min ⁻¹ g ⁻¹ . Calculate the age of the carbon-14 activity is 15.3 disintegration (1) 5.000 years (2) 4,000 years	Which one of the following is most easily reduced? (1) Ni(CO) ₁ (2) Cr(CO) ₆ (3) Fe(CO) ₅ The value of d ₁₁₁ in a cubic crystal is 325.6 pm. The value (1) 325.6 pm (2) 976.8 pm (3) 108.5 pm A metal crystallizes in FCC structure with a unit cell side the crystal is 1.33 g/cc, the molar mass of the metal is closed (1) 23 (2) 24 (3) 25 The decomposition of gaseous acetaldehyde at T(K) followed half-life of this reaction is 400 s when the initial pressur rate constant (in Torr ⁻¹ s ⁻¹) and half-life (in seconds) resof the acetaldehyde is 200 Torr at the same temperature of the acetaldehyde is 200 Torr at the same temperature of (1) 10 ⁵ and 500 seconds (2) 10 ⁻⁵ and 400 seconds (3) 10 ⁻⁴ and 400 seconds (4) 10 ⁻⁵ and 500 seconds The carbon-14 activity of an old wood sample is for min ⁻¹ g ⁻¹ . Calculate the age of the old wood sample carbon-14 activity is 15.3 disintegrations min ⁻¹ g ⁻¹ (t _{1/2} (1) 5.000 years (2) 4,000 years (3) 877 years Kohlrausch's law is applicable to a dilute solution of: (1) Potassium chloride in hexane

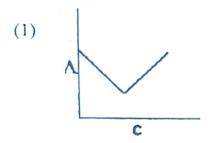
52. Which among the following electronic configurations represent the elements with the

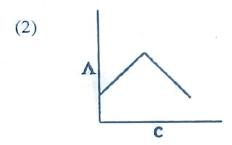
- 59. The concentration of a MgSO₄ solution having the same ionic strength as that of a 0.1 M Na₂SO₄ solution is:
 - (1) 0.05 M

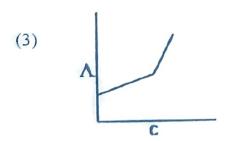
(2) 0.067 M

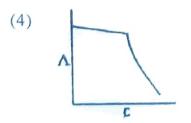
(3) 0.075 M

- (4) 0.133 M
- 60. The molar conductivity \(\simes \) versus concentration (c) plot of sodium dodecylsufate in water is expected to look like:









- **61.** The alkyl halides required to prepare \times by Wurtz reaction are:
 - (1) $\wedge \wedge \wedge_{Ce}$ and $\wedge \wedge_{Ce}$
- (2) \bigvee_{Ce} and \bigvee_{Ce}
- (3) \bigvee_{Ce} and \bigwedge^{Ce}
- (4) + Ce and \downarrow Ce
- **62.** Ozonolysis of an alkene produces only one dicarbonyl compound. The structure of the alkene is:
 - $(1) CH_3 CH = CH CH_2 CH_3$
- (2)

(3)

- (4) All of the above
- 63. Which one of the following compound is aromatic in nature?
 - (1)



(3)

(4) S

- **64.** Diels-Alder reaction is:
 - (1) 4 + 2 cycloaddition
 - (2) 2 + 2 cycloaddition
 - (3) Electrophilic addition
 - (4) Nucleophilic addition
- **65.** Which of the following can be used as the halide component for Friedel-Crafts reaction?
 - (1) Chlorobenzene

(2) Bromobenzene

(3) Chloroethane

(4) Isopropyl chloride

Which of the following alcohol is resistant to oxidation?

(1)
$$H_3C - C - OH$$

(3) $CH_3 - OII$

- $\begin{array}{ccc}
 (4) & H_3C CH OH \\
 & | \\
 & CH_3
 \end{array}$
- The product of the following reaction is:

$$H_3C$$
 + CH_3CH_2OH $\xrightarrow{H^{\oplus}}$

$$CH_{3}$$

$$|$$

$$(1) H_{3}C - C - CH_{2}OH$$

$$|$$

$$OCH_{2}CH_{3}$$

 CH_3 | $(2) H_3C - C - CH_2 - OH$ | OH

$$CH_3$$

$$|$$
(3) $H_3C-C-CH_2-O-CH_2CH_3$ (4) None of these
$$|$$
 OII

- **68.** Phenol reacts with bromine in CS_2 to give :
 - (1) o-bromophenol
 - (2) m- bromophenol
 - (3) o- and p-bromophenol
 - (4) 2, 4, 6-tribromophenol

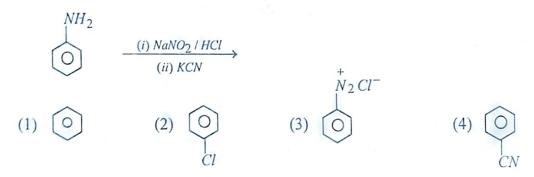
69. The carboxylic acid that does not undergo Hell-Volhard-Zelinsky reaction is:

- (1) CH3COOII
- (2) (CH₃)₂CHCOOH
- (3) CH3CH2CH2COOH
- (4) (CH₃)₃CCOOH

70. Which one of the following is a reagent in Gabriel amine synthesis?

- (1) an acyl or arylhalide
- (2) phthalimide
- (3) hydroxylamine
- (4) sodium azide

71. The product of the following reaction is:



72. The product $[\Lambda]$ of the following reaction is :

$$\begin{array}{c}
NO_2 \\
\hline
(i) Fe/HCl \\
\hline
(ii) NaOH
\end{array}$$
[A]

(1) \bigcirc (2) \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc (4) \bigcirc

73. The most su	ullable reagent	for the	conversion	01	RCH	2011	->	RCI	IO	18 :
-----------------	-----------------	---------	------------	----	-----	------	----	-----	----	------

- (1) CrO_3/H_2SO_4
- (2) KMnO₄ / KOH
- (3) PCC
- (4) K2Cr2O7/112SO4

74. Which of the following combination of aldehydes give cross Cannizzaro reaction?

- (1) CH3CHO, HCHO
- (2) C_6H_5CHO, CH_3CHO
- (3) C_6H_5CHO , HCHO
- (4) All of these

75. Which of the following compound used alone will undergo an aldol reaction?

- (1) CH_2O
- (2) CH₃COCH₃
- (3) $C_6H_5COC_6H_5$
- (4) $CH_2 = CIICHO$

76. The diasaccharide sucrose is composed of monosaccharides:

- (1) D-glucose + D-glucose
- (2) D-fructose + D-fructose
- (3) D-glucose + D-galactose
- (4) D-glucose + D-fructose

- 77. Which of the following statements about anomers is true?
 - (1) Anomers are diastereoisomers
 - (2) Anomers are enantiomers
 - (3) Anomers are constitutional isomer
 - (4) All of these
- **78.** The reaction of CH_3CH_2MgBr with water yield:
 - (1) CH3CH3

(2) $CH_2 = CH_2$

(3) CH₃CH₂OH

- (4) $CH_2 CH_2$ | | | OH OH
- 79. Pyrrole is less basic than pyridine because the lone-pair of electrons on N-atom in pyrrole:
 - (1) reside in sp hybrid orbital
 - (2) reside in sp^2 hybrid orbital
 - (3) is not part of the delocalized π molecular orbital
 - (4) is part of the delocalized π molecular orbital
- 80. Quinoline undergo nucleophilic substitution on heating with $NaNH_2$ to give :
 - (1) 6-Aminoquinoline
 - (2) 2-Aminoquinoline
 - (3) 3-Aminoquinoline
 - (4) 4-Aminoquinoline

- 81. The chemical composition of brown ring produced in the test of NO_2 is:
 - (1) [FeNO]SO₄
- (2) [FeNO]Cl₂
- (3) $[FeSO_4]NO_2$
- (4) [FeCl₂]NO
- 82. Under physiological condition, oxygen is binding to deoxy-hemoglobin and deoxy-rnyoglobin, the binding curve and its pH dependence respectively are:
 - (1) sigmoidal & pH dependent; hyperbolic and pH independent.
 - (2) hyperbolic and pH independent; sigmoidal & pH dependent.
 - (3) sigmoidal & pl1 independent; hyperbolic and pH dependent.
 - (4) hyperbolic and pH independent; sigmoidal & pH dependent.
- 83. The total number of isomers of $[Co(en)_2Cl_2]$, (en = ethylenediamine) is:
 - (1) 4
- (2) 3
- (3) 6
- (4) 5
- 84. Arrange the following in decreasing order of axial C-O bond length and increasing order of axial v_{M-C} :

(1) ii > iv > iii > i

(2) iv > ii > iii > i

(3) ii > iv > i > iii

- (4) i > ii > iii > iv
- 85. Identify the correct statement for the two reactions given below:

$$Xe + PtF_6 \xrightarrow{SF_6} [Xe]^+ [PtF_6]^-$$

 $XeF_4 + Me_4NF \longrightarrow [Me_4N]^+[XeF_5]^-$

- (1) Xe and XeF4 both act as acids
- (2) Xe and XeF₄ both act as bases
- (3) Xe acts as an acid and XeF4 act as base
- (4) Xe acts as a base and XeF4 act as an acid

86.

(1) Basicity of hydroxides

(2) Size of the hydrated ions

(3) Size of the unhydrated ion

(4) The solubility of their nitrates

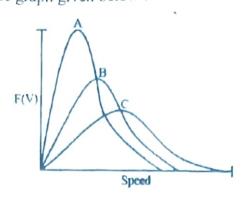
(4) O2 at the cathode and H2 at the anode

PG-EE-July-2024/(Chemistry)(SET-Z)/(C)

87.	Which one of the following conductometric titration will show a linear increase of conductance with volume of titrant added upto the break point and almost const conductance afterwards?					
	(1) A strong acid v	vith a weak base				
	(3) A weak acid w	ith a strong base	A weak acid with a weak base			
88. The electronic configuration of chromium is 4s ¹ 3d ⁵ . The element tungsten (V to the same group and has atomic number = 74. The configuration of its val is:					ment tungsten (W) belongs uration of its valence shell	
		$(2) 6s^{1}5d^{5}$	(3)	$6s^25d^4$	$(4) 6s^{0}5d^{6}$	
89.	The nephelauxetic	parameter (β) is high	est f	or:		
	(1) Br	(2) Cl ⁻	(3)	CN	(4) F ⁻	
90.	Among the following $3d^2$ electronic confi		n me	etal ions, the one	where all metal ions have	
	(1) Ti^{2+} , V^{3+} , Cr^{3}	$^{4+}, Mn^{5+}$, ,	Ti^{2+} , V^{2+} , Cr^3		
	$^{+}, Mn^{3+}$					
91.	Electrolysis of an a	queous solution of 1	.0 M	NaOH results in	:	
	(1) Na at the catho	de and O ₂ at the ano	de			
	(2) H ₂ at the catho	de and O_2 at the another	le			
	(3) Na and H ₂ at th	e cathode, and O2 at	the a	node		

The separation of lanthanides in the ion-exchange method is based on :

Identify the speed distribution functions of Neon, Argon and Krypton gas in the three curves (A or B or C) in the graph given below:



(1) Ne-A, Ar-B, Kr-C

(2) Ne-B, Ar-C, Kr-A

(3) Ne-C, Ar-B, Kr-A

- (4) Ne-C, Ar-A, Kr-B
- 93. The root mean square speed of the molecules of a perfect gas is proportional to:
 - $(1) 1/T^{1/2}$
- (2) T
- (3) $T^{1/2}$
- (4) 1/T
- 94. At room temperature, which molecule has the maximum rotational entropy?
 - $(1) H_2$
- $(2) O_2$
- (3) D_2
- $(4) N_2$
- The rotational constant 14 N₂ is $2 \, \text{cm}^{-1}$. The wave number of incident radiation in a Raman spectrometer is $20487 \, \text{cm}^{-1}$. What is the wave number of first scattered Stokes line (in cm $^{-1}$) of 14 N₂?
 - (1) 20479
- (2) 20475
- (3) 20499
- (4) 20495
- 96. For the vibrational Raman spectrum of a homonuclear diatomic molecule, the selection rule under harmonic approximation is:
 - (1) $\Delta v = 0$ only

(2) $\Delta v = \pm 1$ only

(3) $\Delta v = \pm 2$ only

- (4) $\Delta v = 0, \pm 1$
- 97. The vibrational frequency and anharmonicity constant of an alkali halide are 300 cm⁻¹ and 0.0025 respectively. The positions (in cm⁻¹) of its fundamental mode and first overtone are respectively:
 - (1) 300, 600
- (2) 298.5, 595.5 (3) 301.5, 604.5 (4) 290, 580

- 98. The energy levels for cyclobutadiene are $\alpha + 2\beta$, α , α and $\alpha 2\beta$. The delocalization energy in this molecule is:
 - (1) 0
- $(2) -4\beta$
- $(3) 8\beta$
- (4) 4α
- Identify which of the following operators is not Hermitian? Here i is iota.
 - (1) $\frac{h}{i2\pi} \frac{\partial}{\partial x}$ (2) $i \frac{\partial^2}{\partial x^2}$ (3) $\frac{\partial^2}{\partial x^2}$
- $(4) X^2$
- 100. Calculate the ESR frequency of an unpaired electron in a magnetic field of 0.33 T given that for a free electron, $g_e = 2$ and $\mu_B = 9.273 \times 10^{-24}$ J/T.
 - (1) 2.3 GHz
- (2) 9.24 GHz
- (3) 1.15 GHz
- (4) 8.36 GHz

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

PG-EE-July, 2024

SUBJECT: Chemistry

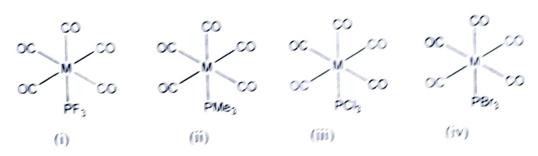
Time 1% Hours Roll No. (in figures)	Max. Marks 100	Total Questions 100
Marrie		
Father's Name		
Date of Examination		
(Signature of the Candidate		(Signature of the Invigilator)

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 Examinator Hall, failing which a case of use of unfairmeans I 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.
- Keeping in view the transparency of the examination system, carboniess 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 shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/compliant if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. 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.
- Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
- 8. Before ariswering 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.

PG-EE-July-2024/(Chemistry)(SET-Z)/(D)

- 1. The chemical composition of brown ring produced in the test of NO2 is
- (1) [FeNO]SO, (2) [FeNO]CI, (3) [FeSO,(NO, (4) [FeCI,(NO
- 2. Under physiological condition, oxygen is binding to deoxy-hemoglobin and deoxymyoglobin, the hinding curve and its pH dependence respectively are
 - sigmoidal & pH dependent; hyperbolic and pH independent
 - (2) hyperbolic and pH independent, sigmoidal & pH dependent
 - (3) sigmoidal & pH independent; hyperbolic and pH dependent.
 - (4) hyperbolic and pH independent; sigmoidal & pH dependent.
- The total number of isomers of [Co(en)₂Cl₂], (en = ethylenediamine) is:
 - (1) 4
- (2) 3
- (3) 6
- (4) 5
- 4. Arrange the following in decreasing order of axial C-O bond length and increasing order of axial Ower:



(1) ii > iv > iii > i

(2) iv > ii > iii > i

(3) ii > iv > i > iii

- (4) i > ii > iii > iv
- 5. Identify the correct statement for the two reactions given below:

$$Xe + PtF_6 \xrightarrow{SF_6} [Xe]^{\dagger} [PtF_6]$$

 $XeF_4 + Me_4NF \longrightarrow [Me_4N][XeF_4]$

- (1) Xe and XeF₄ both act as acids
- Xe and Xel⁻¹ both act as bases
- (3) Xe acts as an acid and XeF₄ act as base
- (4) Xe acts as a base and XeF4 act as an acid

- 6. The separation of lanthanides in the ion-exchange method is based on
 - (1) Basicity of hydroxides
- (2) Size of the hydrated ions
- (3) Size of the unhydrated ion
- (4) The solubility of their nitrates
- 7. Which one of the following conductometric titration will show a linear increase of the conductance with volume of titrant added upto the break point and almost constant conductance afterwards?
 - (1) A strong acid with a strong base
- (2) A strong acid with a weak base
- (3) A weak acid with a strong base
- (4) A weak acid with a weak base
- **8.** The electronic configuration of chromium is $4s^13d^5$. The element tungsten (W) belongs to the same group and has atomic number = 74. The configuration of its valence shell is: (2) $6s^{1}5d^{5}$ (3) $6s^{2}5d^{4}$ (4) $6s^{0}5d^{6}$
 - $(1) 5s^{1}4d^{1}$

- The nephelauxetic parameter (β) is highest for :
 - (1) Br
- (2) Cl
- (3) CN
- (4) F
- 10. Among the following series of transition metal ions, the one where all metal ions have $3d^2$ electronic configuration is:
 - (1) Ti^{2+} , V^{3+} , Cr^{4+} , Mn^{5+}
 - (2) Ti^{2+} , V^{2+} , Cr^{3+} , Mn^{4+}
 - (3) Ti^+ , V^{4+} , Cr^{6+} , Mn^{7+}
 - (4) Ti^{4+} , V^{3+} , Cr^{2+} , Mn^{3+}
- Complete the following reaction [A] is:

(4) None of these

12.	Base-catalyzed condensation of two ester is called:	ter molecules	to form	an	alcohol	and	ß-keto
	(1) Claisen condensation						
	(2) Corey-House reaction						
	(3) Aldol condensation						
	(4) Kolbe's reaction						
13.	What is used to initiate a tree-radical pol	lymerization?					
	(1) Benzoyl peroxide	(2) Benzoic a	icid				
	(3) Benzyl alcohol	(4) Benzil					
14.	The α -Helix is common form of :						
	(1) Primary structure of protein						
	(2) Secondary structure of protein						
	(3) Tertiary structure of protein						
	(4) None of these						
15.	An auxochrome is one which is:						
	(1) colour enhancing						
	(2) a group or atom with lone pairs of e	electron					
	(3) extended conjugation						
	(4) all of these						

16. The energy required for various transition follow the order:

- (1) $\pi \to \pi^* \ge n \to \pi^* \ge \sigma \to \sigma^* \ge n \to \sigma^*$
- (2) $n \to \pi^* \ge \sigma \to \sigma^* \ge n \to \sigma^* \ge \pi \to \pi^*$
- (3) $\sigma \rightarrow \sigma^* \ge n \rightarrow \sigma^* \ge \pi \rightarrow \pi^* \ge n \rightarrow \pi^*$
- (4) $\sigma \rightarrow \sigma^* \ge \pi \rightarrow \pi^* \ge n \rightarrow \sigma^* \ge n \rightarrow \pi^*$

17. In infra-red spectroscopy, the pair of isomers, which cannot be distinguished:

- (1) Cis-trans isomers
- (2) Functional isomers
- (3) Enantiomers
- (4) Position isomers

18. The cycloalkanones, the frequency of absorption for carbonyl group is:

(1) 1000-1100 cm⁻¹

(2) $1280-1300 \,\mathrm{cm}^{-1}$

(3) $1580-1600 \,\mathrm{cm}^{-1}$

(4) $1705-1725 \,\mathrm{cm}^{-1}$

19. The signal(s) for a compound like $A - CH_2 - CH_2 - B$ will be:

- (1) Two singlets
- (2) Two triplet
- (3) One singlet
- (4) One triplet

20. How many 1/1 NMR signal in case of benzene?

- (1) Zero
- (2) One
- (3) Three
- (4) Six

21. The alkyl halides required to prepare by Wurtz reaction are :

(1) $\wedge \wedge \wedge_{Ce}$ and $\wedge \wedge_{Ce}$

(2) \bigvee_{Ce} and \bigvee_{Ce}

(3) \bigvee_{Ce} and \bigvee_{Ce}

(4) \leftarrow Ce and \leftarrow Ce

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- 22. Ozonolysis of an alkene produces only one dicarbonyl compound. The structure of the alkene is:
 - (1) $CH_3 CH = CH CH_2 CH_3$ (2)
- (2)

(3)

- (4) All of the above
- 23. Which one of the following compound is aromatic in nature?
 - (1)

(2) \(\big(\pi \) \(CH_3 \)

(3)

(4)

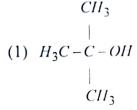
- 24. Diels-Alder reaction is:
 - (1) 4 + 2 cycloaddition

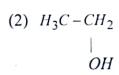
- (2) 2 + 2 cycloaddition
- (3) Electrophilic addition
- (4) Nucleophilic addition
- 25. Which of the following can be used as the halide component for Friedel-Crafts reaction?
 - (1) Chlorobenzene

(2) Bromobenzene

(3) Chloroethane

- (4) Isopropyl chloride
- 26. Which of the following alcohol is resistant to oxidation?





$$(3)$$
 $CH_3 - OII$

$$(4) H_3C - CH - OH$$

$$|$$

$$CH_2$$

27. The product of the following reaction is:

$$H_3C \xrightarrow{CH_3} CH_2OH \xrightarrow{H^{\oplus}}$$

$$CH_{3} \qquad CH_{3} \\ (1) H_{3}C - C - CH_{2}OH \qquad (2) H_{3}C - C - CH_{2} - OH \\ \\ - CH_{2}CH_{3} \qquad OH$$

(3)
$$H_3C - C - CH_2 - O - CH_2CH_3$$
 (4) None of these OH

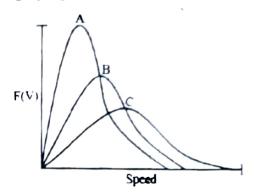
- **28.** Phenol reacts with bromine in CS_2 to give :
 - (1) o-bromophenol
 - (2) m- bromophenol
 - (3) o- and p-bromophenol
 - (4) 2, 4, 6-tribromophenol
- 29. The carboxylic acid that does not undergo Hell-Volhard-Zelinsky reaction is :
 - (1) CH_3COOII
 - (2) $(CH_3)_2CIICOOH$
 - (3) $CH_3CH_2CH_2COOH$
 - (4) $(CH_3)_3CCOOH$

- 30. Which one of the following is a reagent in Gabriel amine synthesis?
 - (1) an acyl or arythalide

(2) phthalimide

(3) hydroxylamine

- (4) sodium azide
- 31. Electrolysis of an aqueous solution of 1.0 M NaOH results in :
 - (1) Na at the cathode and O2 at the anode
 - (2) H_2 at the cathode and O_2 at the anode
 - (3) Na and H₂ at the cathode, and O₂ at the anode
 - (4) O₂ at the cathode and H₂ at the anode
- 32. Identify the speed distribution functions of Neon, Argon and Krypton gas in the three curves (Λ or B or C) in the graph given below:

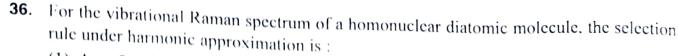


(1) Ne-A, Ar-B, Kr-C

(2) Ne-B, Ar-C, Kr-A

(3) Ne-C, Ar-B, Kr-A

- (4) Ne-C, Ar-A, Kr-B
- 33. The root mean square speed of the molecules of a perfect gas is proportional to:
 - (1) $1/T^{1/2}$
- (2) T
- (3) $T^{1/2}$
- (4) 1/T
- 34. At room temperature, which molecule has the maximum rotational entropy?
 - (1) H_2
- (2) O_2
- (3) D_2
- $(4) N_2$
- 35. The rotational constant ¹⁴N₂ is 2cm⁻¹. The wave number of incident radiation in a Raman spectrometer is 20487 cm⁻¹. What is the wave number of first scattered Stokes line (in cm⁻¹) of ¹⁴N₂?
 - (1) 20479
- (2) 20475
- (3) 20499
- (4) 20495



(1) $\Delta v = 0$ only

(2) $\Delta v = \pm 1$ only

(3) $\Delta v = \pm 2$ only

(4) $\Delta v = 0, \pm 1$

The vibrational frequency and anharmonicity constant of an alkali halide are 300 cm⁻¹ 37. and 0.0025 respectively. The positions (in cm⁻¹) of its fundamental mode and first overtone are respectively:

(1) 300, 600

(2) 298.5, 595.5

(3) 301.5, 604.5 (4) 290, 580

38. The energy levels for cyclobutadiene are $\alpha + 2\beta$, α , α and $\alpha - 2\beta$. The delocalization energy in this molecule is:

(1) 0

 $(2) -4\beta$

 $(3) -8\beta$

(4) 4α

Identify which of the following operators is not Hermitian? Here i is iota. 39.

(1) $\frac{h}{i2\pi} \frac{\partial}{\partial x}$ (2) $i \frac{\partial^2}{\partial x^2}$ (3) $\frac{\partial^2}{\partial x^2}$

(4) X^2

Calculate the ESR frequency of an unpaired electron in a magnetic field of 0.33 T 40. given that for a free electron, $g_e = 2$ and $\mu_B = 9.273 \times 10^{-24}$ J/T.

(1) 2.3 GHz

(2) 9.24 GHz

(3) 1.15 GHz

(4) 8.36 GHz

41. Copper has role in:

(1) Hb formation

(2) ATP production by reformation

(3) Formation of fibres elastic

(4) All of the above

Which among the following electronic configurations represent the elements with the 42. maximum electron affinity?

(1) $1s^2 2s^2 2p^6$

(2) $1s^2 2s^2 2p^6 3s^2 3p^5$

 $(3) 1s^2 2s^2 2p^6 3s^1$

(4) $1s^2 2s^2 2p^5$

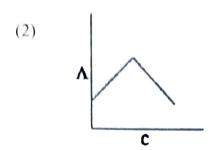
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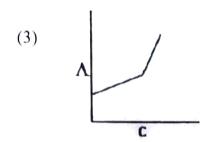
(3) 0.075 M

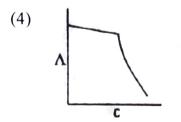
D

50. The molar conductivity \(\simes \) versus concentration (c) plot of sodium dodecylsufate in water is expected to look like:

(1)







- **51.** Coordination number and geometry of $[Ce(NO_3)_6]^{2-}$:
 - (1) 6, octahedral

(2) 12, octahedral

(3) 8, octahedral

(4) 12, icosaheral

52.	If an element has seven electrons in its outermost shell then it is likely to have the atomic size among all the elements in the same period.					
	(1) largest	(2) smallest	(3) same	(4) both (1) and (2)		
53.	The tripositive spectra:	lanthanoid ion whi	ch does not show	sharp peak in the absorption		
	(1) Gd^{3+}	(2) Pm^{3+}	(3) Ce^{3+}	(4) Pr ³ °		
54.	C ₆₀ has :					
	(1) 14 pentagons and 18 hexagons					
	(2) 10 pentagons and 20 hexagons					
	(3) 12 pentagor	ns and 20 hexagons				
	(4) 12 pentagor	ns and 18 hexagons				
55.	If Δ_0 is the octahedral splitting energy and P is the pairing energy, then the crystal field stabilization energy (CFSE) of $[Co(NH_3)_6]^{2+}$ is:					
	(1) $-0.8 \Delta_0 + 2$	P (2) $-0.8 \Delta_0$	(3) $-1.8 \Delta_0^+$	3P (4) $-0.8 \Delta_0^+ P$		
56.	Consider the following complex ions, P, Q and R, $P = [FeF_6]^3$, $Q = [V(H_2O)_6]^2$ and $R = [Fe(H_2O)_6]^{2^3}$; The correct order of the complex ions, according to their spin-only magnetic moment values (in B.M.) is:					
	(1) $Q < P < R$		(2) $R < Q < 1$	Р		
	(3) $R < P < Q$		(4) $Q < R < R$			
57.	Glycerol is more viscous than glycol, the reason is:					
	(1) Higher molecular wt.					
	(2) More covalent					
	(3) More exten	nt of hydrogen bondin	ng			

(4) Complex structure

58.		30 Å, when BF; is allowed to be treated with Me,N.; The bond length of B-F in the adduct is:			
	(1) Greater than 1.30Å	(2) Smaller than 1.30A			
	(3) Equal to 1.30Å	(4) None of these			
59.	Name the type of the structure of silicate in which one oxygen atom of $[SiO_{\epsilon}]^{'}$ shared ?				

Linear chain silicate

- (2) Sheet silicate
- (3) Pyrosilicate
- (4) Three dimensional

Which of the following represents a set of hard acid and soft base respectively? 60.

- (2) Fe^{3+} and S^{2-} (3) Ag^{-} and S^{2-} (4) Ag^{-} and F

Indicate which one of the following relations is not correct: 61.

(1)
$$-\left(\frac{\partial T}{\partial V}\right)_{S} = \left(\frac{\partial P}{\partial S}\right)_{V}$$

(2)
$$-\left(\frac{\partial T}{\partial P}\right)_{S} = \left(\frac{\partial V}{\partial S}\right)_{P}$$

(3)
$$-\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$$

(4)
$$-\left(\frac{\partial S}{\partial P}\right)_T = \left(\frac{\partial V}{\partial T}\right)_P$$

When two moles of liquid A are mixed with two moles of liquid B at 300K, the excess 62. molar Gibbs energy of the solution is -1.5 kJ mol-1. The corresponding value of Gibbs energy of mixing (in kJ) is closest to:

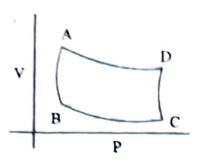
- (1) -12.9
- (2) 6.0 (3) -1.5
- (4) -0.9

The minimum work required by an engine to transfer 5 J of heat from a reservoir at 100 63. K to one at 300 K is:

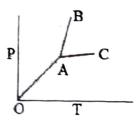
- (1) 5 J
- (2) 10 J
- (3) 15 J
- (4) 20 J

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The figure below describes how a reversible Carnot heat engine works. It starts from the adiabatic compression step denoted by



- (1) AB
- (2) BC
- (3) DC
- (4) AD
- A thermodynamic equation that relates the chemical potential to the composition of a 65. mixture is known as:
 - (1) Gibb's-Helmholtz equation
- (2) Gibb's-Duhem equation
- (3) Joule-Thomson equation
- (4) Debye-Huckel equation
- The heat capacity of a species is independent of temperature if it is: 66.
 - (1) Tetratomic
- (2) Triatomic
- (3) Diatomic
- (4) Monatomic
- The phase diagram of a compound is shown below:



The slopes of the lines OA, AC and AB are $\tan \frac{\pi}{4}$, $\tan \frac{\pi}{6}$ and $\tan \frac{\pi}{3}$ respectively. If melting point and ΔH of melting are 300K and 3 kJ mol⁻¹ respectively, the change in the volume on melting is:

- (1) 10 tan $\frac{\pi}{3}$

- (2) $10 \tan \frac{\pi}{4}$ (3) $10 \cot \frac{\pi}{3}$ (4) $10 \cot \frac{\pi}{4}$

- The number of phases, components, and degrees of freedom, when Argon is added to an equilibrium mixture of NO, O_2 and NO_2 in the gas phase are, respectively:
 - (1) 1, 3, 5
- (2) 1, 4, 5 (3) 1, 3, 4
- (4) 1, 4, 4
- 69. For a potentiometric titration, in the curve of emf (E) vs volume (V) of the titrant added, the equivalence point is indicated by:
 - (1) |dE/dV| = 0: $|d^2E/d^2V| = 0$
 - (2) |dE/dV| = 0: $|d^2F/d^2V| > 0$
 - (3) $|dE/dV| > 0 : |d^2E/d^2V| = 0$
 - (4) |dE/dV| > 0: $|d^2E/d^2V| > 0$
- 70. The Daniel cell is:
 - $(1) \ Pt_I(s)|Zn(s)|Zn^{2^+}(aq)||Cu^{2^+}(aq)|Cu(s)|Pt_{II}$
 - (2) $Pt_{l}(s)|Zn(s)|Zn^{2+}(aq)||Ag^{2+}(aq)|Ag(s)|Pt_{ll}$
 - (3) $Pt_{I}(s)|Fe(s)|Fe^{2+}(aq)||Cu^{2+}(aq)|Cu(s)|Pt_{II}$
 - (4) $Pt_1(s)|H_2(s)|H_2SO_4(aq)||Cu^{2+}(aq)|Cu(s)|Pt_{11}$
- 71. The fact that the fluorescence wavelength is often much longer than the irradiation wavelength (Stokes shift) is a consequence of which phenomenon?
 - (1) Low extinction coefficients (Lambert-Beer law)
 - (2) Vertical transitions (Kasha's rule)
 - (3) High ISC rates (El Sayed rule)
 - (4) The Franck-Condon principle
- The vapor pressure of pure benzene at a certain temperature is 640 mmHg. A nonvolatile nonelectrolyte solid weighing 2.175 g is added to 39 g of benzene. The vapor pressure of the solution is 600 mmHg. The molecular weight of the solid substance is:
 - (1) 42.25
- (2) 55.55
- (3) 65.25
- (4) 72.25

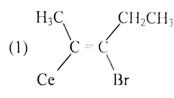
- What is the molal lowering of the vapor pressure of water is 100°C ? 73.
 - (1) 17.77 mm
- (2) 28.28 mm (3) 13.68 mm (4) 24.66 rore
- Ethylene glycol a major component of permanent antifreeze, effectively depresses the freezing point of water in automobile radiator. What minimum weight of ethylerse glycol must be mixed with 6 gallons of water of protect it from freezing at 7/4"d. "

(Given: 1 Gallon = 3.785 liter and $K_f = (26)$)

- (1) 22.15 kg
- (2) 18.15 kg
- (3) 33.75 kg (4) 62 kg
- 20.27 g of Benzene containing 0.2965 g of benzoic acid (mol. wt. 122) freezes & 75. 0.137°C below the freezing point of pure benzene. If Benzoic acid exists as a direct in benzene, find its degree of association. (Given: K_f for Benzene is 5.12%. ∞)
 - (1) 72.34%

- (2) 86.84% (3) 96.84% (4) 66.34%
- **76.** The surface tension of water at 21°C is 72.75×10^{-3} N/m. A 33.24% (v/v) solution of ethanol has $\gamma = 33.24 \times 10^{-3}$ N/m at the same temperature. Given : Density of solution = 0.9614×10^3 kg/m³, density of water = 0.9982×10^3 kg/m³ and angle of contact $\theta = 0^{\circ}$. How much less will the alcohol solution rise in the same capillary?
 - (1) 34.2%
- (2) 47.4%
- (3) 54.3%
- (4) 65.4%
- 77. Hyperconjugation involves overlap of the following orbitals:
 - $(1) \sigma \sigma$
- $(2) \sigma \rho$
- (3) $\rho \rho$
- $(4) \pi \pi$

78. The z-isomer among the following is:



(2)
$$H_3C$$
 CH_2OI

$$C = C$$

$$CHO$$

(3)
$$C_6H_5$$
 COOH
$$Ce H$$

- 79. Out of the following the molecule that exhibits optical isomerism is:
 - (1) 2-methyl-2-pentene

(2) 3-methyl-2-pentene

(3) 3-methyl-1-pentene

(4) 4-methyl-1-pentene

80. The stablest radical among the following is:

(1) CH₃CH₂CH₂

(2) *CH*₃*CHCH*₃

(3) $C_6H_5CH_2\stackrel{\bullet}{C}H_2$

(4) $C_6H_5CH_2CH_3$

81. The quantum number of 20th electron of Fe (Z = 26) would be:

(1) 3, 2, -2, -1/2

(2) 3, 2, 0, 1/2

(3) 4, 0, 0, $\pm 1/2$

(4) 4, 1, -1, +1/2

82. The number of orbitals in n = 3 are:

- (1) 1
- (2) 4
- (3) 9
- (4) 16

83. Electronegativity of the following elements increases in the order:

- (1) O, N, S, P
- (2) P, S, N, O
- (3) P, N, S, O
- (4) S, P, N, O

84. Predict the correct order of repulsion among the following:

- (1) lone pair lone pair lone pair bond pair bond pair bond pair
- (2) lone pair lone pair > bond pair bond pair > lone pair bond pair
- (3) bond pair bond pair > lone pair bond pair > lone pair -lone pair
- (4) lone pair bond pair bond pair lone pair lone pair

85. Pick out the incorrect statement :

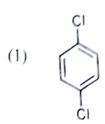
- (1) sp^3d hybridisation involves $dx^2 y^2$ orbital
- (2) Hybridised orbital form sigma-bond when overlaps with other orbitals.
- (3) SF_2 molecule is more polar than CS_2 .
- (4) o-nitrophenol is more volatile than p-nitrophenol.

0

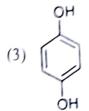
86. Which of the following order is not correct?

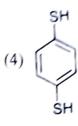
- SF₂ ≥ SF₄ ≃ SF₆ (ionic character)
- (2) AIF₁ ≤ AI₂O₁ ≤ AIN (covalent character)
- (3) CaCl₂ < SnCl₂ < CdCl₂ (covalent character)
- (4) ZnCl₂ < CdCl₂ < HgCl₂ (ionic character)
- 87. Which one of the following molecules is expected to exhibit diamagnetic behaviour?
 - (1) C_2
- (2) N_2^-
- (3) O_2
- $(4) S_2$

88. For which of the following molecule significant $\mu \neq 0$:

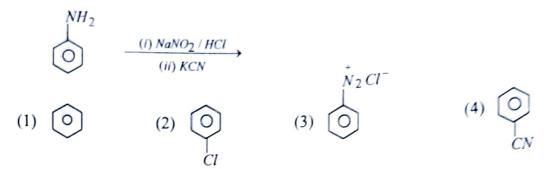


(2) CN





- (1) Only (3)
- (2) (3) and (4)
- (3) Only (1)
- (4) (1) and (2)
- 89. The geometry with respect to the central atom of the following molecules are N(SiH₃)₃, Me₃N, (SiH₃)₃P:
 - (1) planar, pyramidal, planar
 - (2) planar, pyramidal, pyramidal
 - (3) pyramidal, pyramidal, pyramidal
 - (4) pyramidal, planar, pyramidal
- **90.** The IUPAC name of $[Co(NH_3)_5ONO]^{2-}$ ion is :
 - (1) Pentaamminenitritocobalt (IV) ion
 - (2) Pentaamminenitrocobalt (IV) ion
 - (3) Pentaamminenitrocobalt (III) ion
 - (4) Pentaamminenitritocobalt (III) ion



92. The product [A] of the following reaction is:

$$\begin{array}{c}
NO_2 \\
\hline
\bigcirc & (i) Fe/HCl \\
\hline
(ii) NaOH
\end{array}$$
[A]
$$\begin{array}{c}
(2) & \bigcirc -NH_2 \\
\hline
\end{array}$$
(3) $\bigcirc -Cl$
(4) \bigcirc

- **93.** The most suitable reagent for the conversion of $RCH_2OH \rightarrow RCHO$ is :
 - $(1) CrO_3/H_2SO_4$
 - (2) $KMnO_4 / KOH$
 - (3) PCC
 - (4) $K_2Cr_2O_7/H_2SO_4$
- 94. Which of the following combination of aldehydes give cross Cannizzaro reaction?
 - (1) CH_3CHO , HCHO
 - (2) C_6H_5CHO, CH_3CHO
 - (3) $C_6H_5CHO, HCHO$
 - (4) All of these

95. Which of the following compound used alone will undergo an aldol reaction?

- (1) CH₂O
- (2) CH₃COCH₃
- (3) $C_6H_5COC_6H_5$
- (4) $CH_2 = CHCHO$

96. The diasaccharide sucrose is composed of monosaccharides:

- (1) D-glucose + D-glucose
- (2) D-fructose + D-fructose
- (3) D-glucose + D-galactose
- (4) D-glucose + D-fructose

97. Which of the following statements about anomers is *true*?

- (1) Anomers are diastereoisomers
- (2) Anomers are enantiomers
- (3) Anomers are constitutional isomer
- (4) All of these

98. The reaction of CH_3CH_2MgBr with water yield :

(1) CH_3CH_3

(2) $CH_2 = CH_2$

(3) CH_3CH_2OH

 $\begin{array}{c|c}
(4) & CH_2 - CH_2 \\
 & | & | \\
OH & OH
\end{array}$

- 99. Pyrrole is less basic than pyridine because the lone-pair of electrons on N-atom in pyrrole;
 - (1) reside in sp hybrid orbital
 - (2) reside in sp^2 hybrid orbital
 - (3) is not part of the delocalized π molecular orbital
 - (4) is part of the delocalized π molecular orbital
- 100. Quinoline undergo nucleophilic substitution on heating with NaNH2 to give :
 - (1) 6-Aminoquinoline
 - (2) 2-Aminoquinoline
 - (3) 3-Aminoquinoline
 - (4) 4-Aminoquinoline

0. NO	Answer keys of M.Sc. (
Q. NO,	A	В	С	D
1	3	3	2	1
2	3	2	1	1
3	2	4	2	2
4	1	1	2	1
5	1	4	2	4
6	4	1	4	4
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9	2	4	3	4
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	1	2	2	2
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46	4	3	2	4
	3	3	2	4
47			1	3
48	3	4		3
49	3	2	3 4	4

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	Answer keys of M.Sc. (Chemistry) entrance e	exam dated 15.07.202	4
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87	1	3	4	1
88	1	1	3	2
89	4	3	4	2
90	2	2	1	4
91	3	3	2	4
	1	3	3	2
32		2	3	3
93	1		2	3
94	2	1		
95	4	1	2	2
96	3	4	2	4
97	3	1	2	1
98	4	2	1	1
99	2	2	2	4
100	2	4	2	2

(b)(x)

A Sage

age 2 of 2