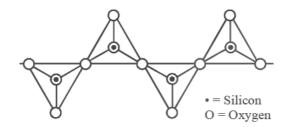
CHEMISTRY-CY

Q.1 - Q.25: Carry ONE mark each.

- The Lewis acidity of BF, is less than BCl, even though fluorine is more electronegative than chlorine. It is 1.
 - (a) stronger $2p(B)-2p(F) \sigma$ -bonding
 - (b) stronger $2p(B)-2p(F) \pi$ -bonding
 - (c) stronger 2p(B)-2p(Cl) σ-bonding
 - (d) stronger 2p(B)-2p(Cl) π -bonding
- 2. Pyrozenes are a class of silicate minerals, which exhibit a polymeric chain structure, as shown below



Its simplest repeat unit is

- (a) $\left[\text{SiO}_{4} \right]^{4-}$
- (b) $[SiO_3]^{2-}$
- (c) $[Si_2O_7]^{6-}$
- (d) $[Si_4O_{11}]^{6-}$
- Among the following pentachlorides the one which does not exist due to the 'inertpair effect' is 3.
 - (a) PCl_s
- (b) BiCl_s
- (c) SbCl_s
- (d) AsCl
- Band theory predicts that magnesium is an insulator. However, in practice it acts as a conductor due to 4.
 - (a) presence of filled 3s orbital
- (b) overlap of filled 2p and filled 3s orbital
- (c) overlap of filled 3s and emtpy 3p orbital (d) presence of unfilled 3p orbital
- The number of 'framework electron pairs' present in the borane cluster $[B_{12}H_{12}]^{2-}$ is:
 (a) 10 (b) 11 (c) 12 (d) 13 5.
 - (a) 10
- (b) 11

- The reaction between {PdCl₄]²⁻ and C₂H₄ produces a new compound. Compare to free C₂H₄, the C-C 6. bond order of the product is:
 - (a) between 1 and 2

(b) less than 1

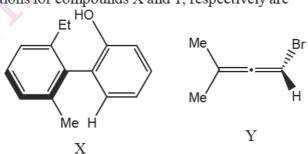
(c) unaltered

- (d) greater than 2
- 7. Among the following pair of metal ions present in Nature, the first one functions as an electron transfer agent and the second one catalyzes the hydrolysis reactions. The correct pair is
 - (a) Fe and Zn
- (b) Mg and Fe
- (c) Co and Mo
- (d) Ca and Cu
- Structurally nickellocene is similar to ferrocene. Nickellocene attains stability due to the formation of 8.
 - (a) a monocation

(b) a dication

(c) a monoanion

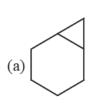
- (d) a dianion
- The absolute configurations for compounds X and Y, respectively are 9.

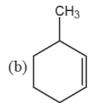


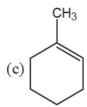
- (a) R, S
- (b) S, R
- (c) R, R
- (d) S, S

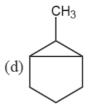
10. In the reaction,

the major product [X] is







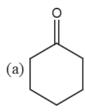


- Among the following, a pair of resolvable configurational enantiomers is given by 11.
 - (a) cis-1, 2-dimethylcyclohexane
- (b) cis-1, 3-dimethylcyclohexane
- (c) cis-1, 4-dimethylcyclohexane
- (d) trans-1, 3-dimethylcyclohexane

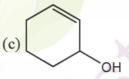
12. In the reaction,

$$\begin{array}{c}
\text{OH} & \text{HNO}_2 \\
\text{OH} & \text{HNO}_2
\end{array}$$

the major product [X] is:









The decreasing order of isoelectric point for the following α – amino acids is 13. Lysine Alanine Glutamic acid

(I)

(a) I > II > III

(II)

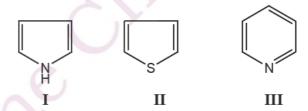
(b) II > I > III

(III)

(c) III > I > II

(d) I > III > II

The decreasing order of the reactivity of the following compounds towards electrophiles is 14.



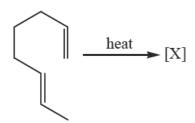
(a) II > I > III

(b) II > III > I

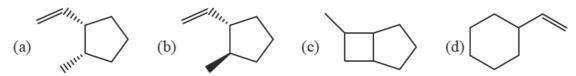
(c) III > I > II

(d) I > II > III

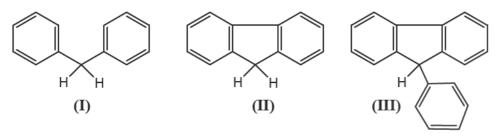
15. In the reaction,



the major product [X] is



16. The decreasing order of acidity of marked H of the following molecules is



- (a) I > II > III
- (b) III > I > II
- (c) III > II > I
- (d) II > I > III
- 17. The decreasing order of nucleophilicity for the following anions is

$$CH_3CO_2^-, CH_3O^-, C_6H_5O^-, NO_3^-$$

- (a) $CH_3CO_2^- > CH_3O^- > C_6H_5O^- > NO_3^-$ (b) $CH_3O^- > NO_3^- > C_6H_5O^- > CH_3CO_2^-$
- (c) $CH_3O^- > C_6H_5O^- > CH_3CO_2^- > NO_3^-$ (d) $C_6H_5O^- > CH_3O^- > NO_3^- > CH_3CO_2^-$
- 18. The molar entropy of crystallline CO at absolute zero is
 - (a) Zero
- $(b) R \ln 2$
- (c) Rln 2
- (d) 2Rln 2

For an ideal gas 19.

(a)
$$\left(\frac{\partial P}{\partial T}\right)_{V} \left(\frac{\partial T}{\partial V}\right)_{P} \left(\frac{\partial V}{\partial P}\right)_{T} = 0$$

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

(c)
$$\left(\frac{\partial P}{\partial T}\right)_{V} \left(\frac{\partial T}{\partial V}\right)_{p} \left(\frac{\partial V}{\partial P}\right)_{T} = +1$$

$$(d) \left(\frac{\partial P}{\partial T}\right)_{\!V} \left(\frac{\partial T}{\partial V}\right)_{\!P} \left(\frac{\partial V}{\partial P}\right)_{\!T} = +2$$

- 20. Among W (work), Q (heat), U(internal energy) and S(entropy)
 - (a) W and U are path functions but Q and S are state functions.
 - (b) W and S are path functions but Q and U are state functions.
 - (c) S and U are path functions but Q and W are state functions.
 - (d) W and O are path functions but U and S are state functions.
- For eigen functions $\psi_1 = \sqrt{\frac{1}{b}} \sin\left(\frac{\pi x}{b}\right)$ and $\psi_2 = \sqrt{\frac{2}{b}} \sin\left(\frac{2\pi x}{b}\right)$ of particle in a 1-D box of length 21. $b(0 \le x \le b)$
 - (a) ψ_1 is normalized but not orthogonal to Ψ_2
 - (b) ψ_1 is normalized but not orthogonal to Ψ_2
 - (c) Ψ_2 is normalized and orthogonal to Ψ_1
 - (d) Ψ_2 is neither normalized nor orthogonal to Ψ_1
- 22. The bond order of C₂ molecule is
 - (a) 0
- (b) 1
- (c) 2
- (d) 3

UAII	L-C1 2010	QUES	HONFAFER	•
23.	Sulfur can exist in (a) 1	four phases. The possib	ele number of triple poi (c) 3	ints is (d) 4
24.	Electrode Electrode Mg ²⁺ /Mg Zn ⁺² /Zn Fe ⁺² /Fe From this we can in (a) Zn can reduce	ction potentials at 298K ectrode Potential (volt -2.34 -0.76 -0.44 Infer that both Mg ²⁺ and Fe ²⁺ e both Zn ²⁺ and Fe ²⁺)	both Mg^{2+} and Zn^{2+}
25.	(i) $N_2(g) + 3H_2(g)$	ctions given below $g) \Longrightarrow 2NH_3(g)$ $H_2(g) \Longrightarrow NH_3(g)$		
	tively, then	emperature, K_{p_1} and K_{p_2} (b) $K_{p_1} = 2K_{p_2}^2$		nstants for reactions (i) and (ii) respect $ (d) \ K_{P1}^2 = K_{P2} $
26.	Q.26 – Q.55 : Carry TWO marks each. According to VSEPR model, the shape of [XeOF ₅] is (a) Octahedral (b) Trigonal bipyramidal (c) square pyramidal (d) pentagonal monopyramidal			
27.	The number of unpaired electron(s) present in the species $[Fe(H_2O)_5(NO)]^{2+}$ which is formed durin 'brown ring test' is: (a) 2 (b) 3 (c) 4 (d) 5			
28.	(a) 2 (b) 3 (c) 4 (d) 5 Fe ₃ O ₄ and Co ₃ O ₄ are metal oxides having spinel structure. Considering their CFSEs, the correct statment regarding their structure is (a) both have normal spinel structure (b) both have inverse spinel structure (c) Fe ₃ O ₄ has normal and Co ₃ O ₄ has inverse spinel structure (d) Fe ₃ O ₄ has inverse and Co ₃ O ₄ has normal spinel structure.			
29.	The mechanism of the reaction between $[Fe(CN)_6]^4$ and $[Fe(bpy)_3]^{3+}$ (bpy = 2, 2'-bipyridine) is (a) outer-sphere electron-transfer (b) inner-sphere electron-transfer (c) self-exchange reaction (d) ligand-exchange followed by electron transfer.			
30.	The d-d absorption band of [Fe(H ₂ O) ₆] ²⁺ is split due to (a) presence of octahedral geometry (b) static Jahn-Teller distortion (c) dynamic Jahn-Teller distortion (d) presence of trigonal bipyramidal geometry.			
31.	The crystal-field symbol for the ground-state of $[Mn(CN)_6]^4$ is			
	(a) $^2T_{2g}$	(b) $^{1}A_{lg}$	(c) ⁵ E _g	(d) $^6\mathrm{A}_{\mathrm{lg}}$

32. In the following reactions:

the reagent/conditions X and Y are

- (a) $X = BF_3$; Y = heating at 1250°C
- (b) X = NaF; Y = heating at 25°C

(c) $X = NH_AF$; Y = HC1

- (d) $X = CF_3SO_3H$; $Y = H_2SO_4$
- [CoCl₄]²⁻ is a blue coloured complex. Controlled-treatment of this complex with water generates two 33. isomeric light pink coloure complexes of composition [Co(H2O)4Cl2].

Identify the correct point groups for $[CoCl_{a}]^{\frac{1}{2}}$ and two isomeric complexes

 $[Co(H_2O)_4Cl_2].$

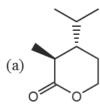
(d) D_{2h} and $(C_{2v}$ and C_{2h}) (e) D_{4h} and $(C_{2v}$ and D_{4h})

 $\begin{array}{c} \text{(b) T}_{\rm d} \text{ and (C}_{\rm 2v} \text{ and D}_{\rm 4h}) \\ \text{(d) T}_{\rm d} \text{ and (C}_{\rm 2v} \text{ and C}_{\rm 4v}) \end{array}$

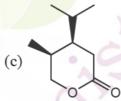
34. In the reaction

EtO₂C
$$\stackrel{\stackrel{}}{\underset{\text{Me}}{\underbrace{\text{CO}_2}\text{H}}} \stackrel{\text{(i) } \text{B}_2\text{H}_6}{\underset{\text{(ii) } \text{H}^+}{\underbrace{\text{(ii) } \text{H}^+}}} [\text{X}]$$

the major product [X] is:



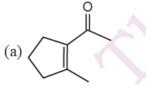
(b)

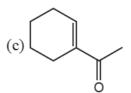


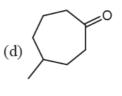
35. In the reaction,

$$\begin{array}{c}
OH \\
\hline
\hline
(i) heat \\
\hline
(ii) H_2SO_4
\end{array}$$
[X]

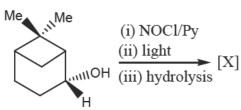
the major product [X] is:





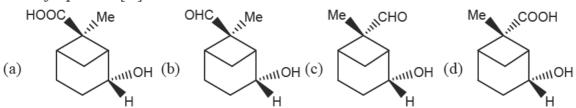


In the following reaction sequence 36.



6

the major product [X] is



37. In the reaction,

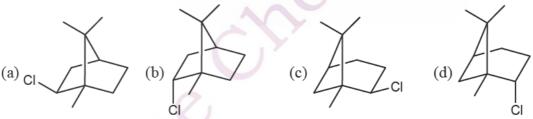
$$[Y] \xrightarrow{HNO_3} \underbrace{mCPBA}_{[X]}$$

the major products, $[\mathbf{X}]$ and $[\mathbf{Y}],$ respectively, are

38. In the reaction,

$$SnCl_4$$
 [X]

the major product [X] is



39. In the reaction sequence

$$\begin{array}{c|c}
 & CH_2OH \\
 & H \\
 & OH \\$$

the major products, [X] and [Y] respectively, are

- The change in entropy when two moles of Argon gas are heated at constant volume from 300K to 40. 500K is:
 - (a) $-12.74 \text{ J K}^{-1} \text{ mole}^{-1}$

(b) -6.37 J K⁻¹ mole⁻¹ (d) 12.74 J K⁻¹ mole⁻¹

(c) 6.37 J K⁻¹ mole⁻¹

- 41. At any temperature T, the fugacity coefficient (γ) is given by

In
$$\gamma = \int_{0}^{P} \frac{Z-1}{P'} dP'$$

where Z is the compressibility factor. The fugacity coefficient of a real gas governed by equations of state, P(V-b) = RT with 'b' a constant is given by

- (b) $e^{\frac{RT}{bP}}$

- 42. The specific rate constant of decomposition of a compound is represented by

$$Ink = 5.0 - \frac{12000}{T}$$

The activation energy of decomposition for this compound at 300K is

- (a) 24 kcal/mole
- (b) 12 kcal/mole
- (c) 24 cal/mole
- (d) 12 cal/mole

- The commutator $[x^3, p_x]$ is equal to 43.
- (c) $\frac{hx^2}{2\pi i}$
- (d) $\frac{3hx^2}{2\pi i}$
- 44. An electron of mass 'm' is confined to a one dimensional box of length 'b'. If it makes a radiative transition from second excited state to the ground state, the frequency of the photon emitted is
- (b) $\frac{3h}{8mb^2}$
- (c) $\frac{h}{mb^2}$
- (d) $\frac{2h}{mb^2}$

- 45. The point group of CIF₂ molecule and its corresponding number of irreducible representation are respec-
 - (a) C_{3v} and 4
- (b) C_{2v} and 4
- (c) C_{3v} and 3
- (d) C_{2v} and 3
- The most populated rotational state for $HCl(B = 8.5 \text{ cm}^{-1})$ at 300 K is: 46.
 - (a) 2
- (b) 3
- (c) 5
- (d)7
- 47. The ratio of life times of two states that gives rise to line widths of 1.0 cm⁻¹ and 0.2 cm⁻¹ respectively is:
 - (a) 1:2
- (b) 1:5
- (c) 2 : 1
- (d) 5:1

Commond Data Questions:

Commond data for Q.48 and Q.49:

A six-coordinate transition-metal complex is ESR and Mossbauer active. The effective magnetic moment of this complex is -5.9 B.M.

- The metal-ion along with its oxidation state and the number of unpaired electron present are 48.
 - (a) Fe(II) and 4
- (b) Mn(II) and 5
- (c) Fe(III) and 1
- (d) Fe(III) and 5

- The complex is 49.
 - (a) $[Mn(H_2O)_6]^{2+}$
- (b) $[Fe(CN)_6]^{3-}$ (c) $[Fe(H_2O)_6]^{2+}$ (d) $[Fe(H_2O)_6]^{3+}$

Common data for Q.50 and Q.51:

An organic compound [X] $(C_{10}H_{16}O_3)$ exhibits the following spectral data IR: -1720 cm⁻¹ ¹H NMR: 2.35 (s, 6H), 3.30 (s, 3H), 3.83 (t, 2H), 4.42 (t, 2H), 7.07 (s, 1H), 7.58 (s, 2H) The compound [X] with an excess of MeMgBr gives a 1:1 mixture of compounds [Y] and [Z]. The

compound [Z] exhibits the following ¹H NMR data: 2.0(bs, 1H), 3.30 (s, 3H), 3.56(t, 2H), 3.70 (t, 2H)

The compound [X] is: 50.

51. The compound [Y] is:

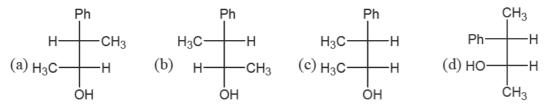
Linked Answer Q.52 and Q.53:

In the reaction sequence

Ph

$$H_3C^{\text{MM}}$$
 H_3C^{MM}
 H_3C^{MM}

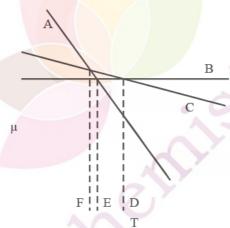
52. The compound [X] is:



53. The compound [Z] is:

Statement for Linked Answer Q.54 and Q.55:

In the m vs T diagram for different phases of the same substance at one atmospheric pressure, the lines A, B and C compound to



54. Based on the above diagram.

- (a) A represents the change in chemical potential as a function of temperature for the solid phase, B for the liquid and C for the gas.
- (b) A represents the change in chemical potential as a function of temperature for the gas phase, B for the gas and C for the solid
- (c) A represents the change in chemical potential as a function of temperature for the liquid phase, B for the gas and C for the solid
- (d) A represents the change in chemical potential as a function of temperature for the gas phase, B for the gas and C for the liquid.

55. From the same diagram

- (a) D represents boiling point, E sublimation point and F melting point.
- (b) E represents boiling point, D sublimation point and F melting point.
- (c) E represents melting point, F sublimation point and D boiling point.
- (d) D represents melting point, F boiling point and E sublimation point.

***** END OF THE QUESTION PAPER *****

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