

- 1. The INCORRECT statement(s) about heavy water is (are)
 - (a) Used as moderator in nuclear reactor
 - (b) Obtained as a by-product in fertilizer industry
 - (c) Used for the study of reaction mechanism
 - (d) Has a higher dielectric constant than water

Choose the correct answer from the option given below:

- a. (B) only
- c. (C) only

b. (B) and (D) onlyd. (D) only

Ans : d

Solution

 $D_20 = 78.06$ (Dielectric constant) $H_20 = 78.39$ (Dielectric constant)

2. Given below are two statements:

Statement I: Potassium permanganate on heating at 573 K forms potassium manganate. Statement II: Both potassium permanganate and potassium manganate are tetrahedral and paramagnetic in nature.

In the light of the above statements, choose the most appropriate Ans from the options given below:

- a. Both statement I and statement II are true
- b. Both statement I and statement II are false
- c. Statement I is true but and statement II is false
- d. Statement I is false but statement II is true

Ans: (c)

Solution

 $\rightarrow K_2 MnO_4 + MnO_2 + O_2$ 573K KMnO.

Dimagnetic Potassium Manganate one unpaired electron (Paramagnetic)

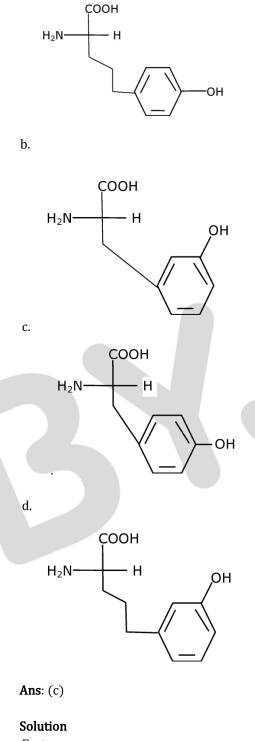
 $\begin{array}{ll} KMnO_4 & - \rightarrow & Both \ are \ tetrahedral \\ K_2MnO_4 & \end{array}$

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3. Which of the following is correct structure of tyrosine?

a.



Fact.

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4. Given below are two statements:

Statement I : Retardation factor (Rf) can be measured in meter/centimeter

Statement II : Rf value of a compound remains constant in all solvents.

Choose the most appropriate Ans from the options given below:

a. Statement I is false but statement II is true

b. Both statement I and statement II are false

- c. Both statement I and statement II are true
- d. Statement I is true but statement II is false

Ans: (b)

Solution

Rf (Retardation factor is dimension less)

- 5. Mesityl oxide is a common name of :
 - a. 3-Methyl cyclohexane carbaldehyde
 - b. 4-Methyl pent-3-en-2-one
 - c. 2,4-Dimethyl pentan-3-one
 - d. 2-Methyl cyclohexanone

Ans: (b)

Solution

$$CH_{3} - CH_{3} - CH_{3} = CH_{3} - CH_{3} (Mesityl oxide)$$

5 | 3 2 1
CH₃

4-methylpent-3-en-2-one

6. What is the spin-only magnetic moment value (BM) of a divalent metal ion with atomic number 25, in it's aqueous solution?

a.	5.92	b.	5.26
c.	Zero	d.	5.0

Ans: (a)

Solution

 $_{25}$ Mn — $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$ spin – only magnetic moment == $\sqrt{n(n+2)}$ BM (n = 5) = $\sqrt{5(5+2)}$ = $\sqrt{35}$ = 5.92 BM

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- 7. A central atom in a molecule has two lone pairs of electrons and forms three single bonds. The shape of this molecule is:
 - a. Trigonal pyramidal

See-saw

- b. T-shaped
- d. Planar triangular

Ans: (b)

c.

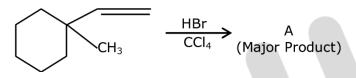
Solution

Steric number = 2 L.P + 3 B.P \Rightarrow 5 (sp³d)

T-shape

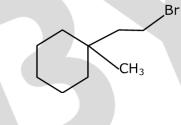


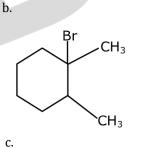
8.

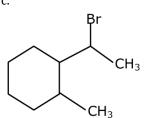


Product "A" in the above chemical reaction is:

a.

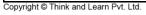






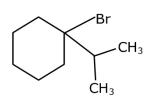
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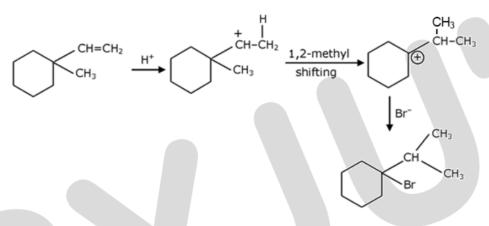


d.

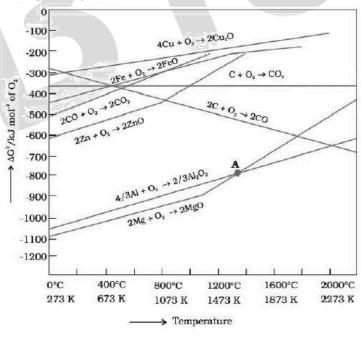


Ans: (d)

Solution



9. The point of intersection and sudden increase in the slope, in the diagram given below respectively, indicates :





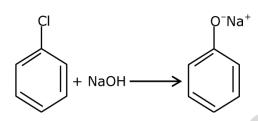
- a. $\Delta G = 0$ and melting or boiling point of the metal oxide.
- b. $\Delta G < 0$ and decomposition of the metal oxide.
- c. $\Delta G = 0$ and reduction of the metal oxide.
- d. $\Delta G > 0$ and decomposition of the metal oxide.

Ans: (a)

Solution

At the point of intersection $\Delta G = 0$ for involved reaction.

10.



The above reaction requires which of the following reaction conditions

- a. 623 K, 300 atm
- c. 573 K, Cu, 300 atm

- b. 573 K, 300 atm
- d. 623 K, Cu 300 atm

Ans: (a)

Solution

The required conditions were 623 K and 300 atm.

- 11. The correct order of conductivity of ions in water is:
 - a. $Cs^+>Rb^+>K^+>Na^+$
 - b. $K^+ > Na^+ > Cs^+ > Rb^+$
 - c. $Rb^+>Na^+>K^+>Li^+$
 - d. $Na^+>K^+>Rb^+>Cs^+$

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Ans: (a)
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Solution

Cs⁺(aq.) has lower hydrated radius so its electrical conductivity is higher.

12. A colloidal system consisting of a gas dispersed in a solid is called a/an:

- a. Aerosol b. Solidsol
- c. Foam d. Gel

B

Ans: (b)

SolutionDispered phaseDispersionGasSolid

Dispersion medium Solid

Type of colloid Solid Sol

13. The absolute value of the electron gain enthalpy of halogen satisfies:

a.	I > Br > Cl > F	2
••••	.,	

c. Cl > F > Br > I

b. F >Cl> Br > I
d. Cl> Br > F > I

Ans: (c)

Solution

Chlorine has higher electron gain enthalpy then flourine due to less electron density.

14. Which of the following reaction is an example of ammonolysis?

- a. $C_6H_5CH_2CN \rightarrow C_6H_5CH_2CH_2NH_2$
- b. $C_6H_5COCl + C_6H_5NH_2 \rightarrow C_6H_5CONHC_6H_5$
- c. $C_6H_5CH_2Cl + NH_3 \rightarrow C_6H_5CH_2NH_2$
- d. $C_6H_5NH_2 \rightarrow C_6H_5NH_3^+Cl^-$

Ans: (c)

Solution C₆H₅CH₂Cl +NH₃ \rightarrow C₆H₅CH₂NH₂

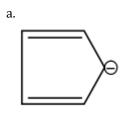
- 15. Reducing smog is a mixture of:
 - a. Smoke, fog and N_2O_3
 - b. Smoke, fog and O_3
 - c. Smoke, fog and SO₂
 - d. Smoke, fog and CH₂=CH-CHO

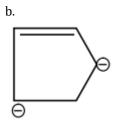
Ans: (c)

Solution Reducing smog = smoke + fog + SO₂

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16. Which of the following is an aromatic compound?



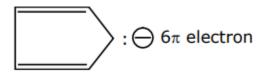




d.

Ans: (a)

Solution





17. With respect to drug-enzyme interaction, identify the wrong statement.

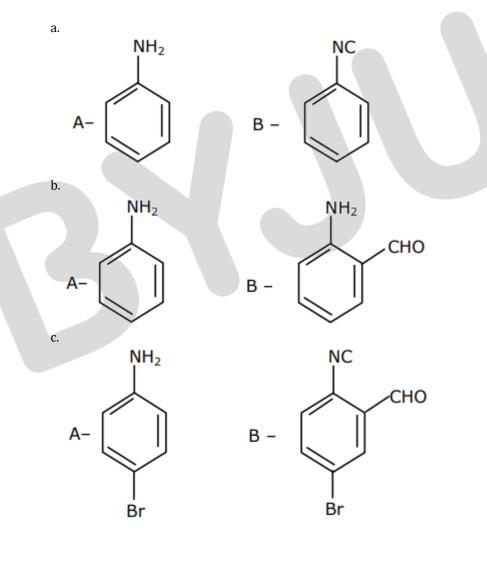
- a. Allosteric inhibitor competes with the enzyme's active side
- b. Competitive inhibitor binds to the enzyme's active site
- c. Non-competitive inhibitor binds to the allosteric site
- d. Allosteric inhibitor changes the enzyme's active site

Ans: (a)

Solution:

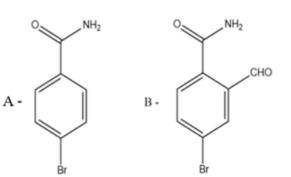
Lewis bases are electron donar and since PCl_5 donot contain a lone pair therefore it cannot act as a lewis base.

18. Hoffmann bromomide degradation of benzamide gives product A, which upon heating with CHCl3 and NaOH gives product B. The structures of A and B are:



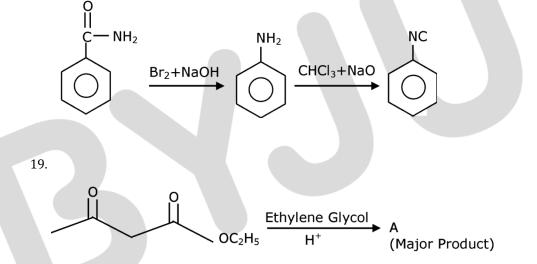
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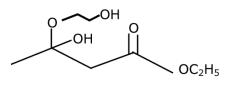


Ans: (a)

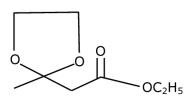
Solution

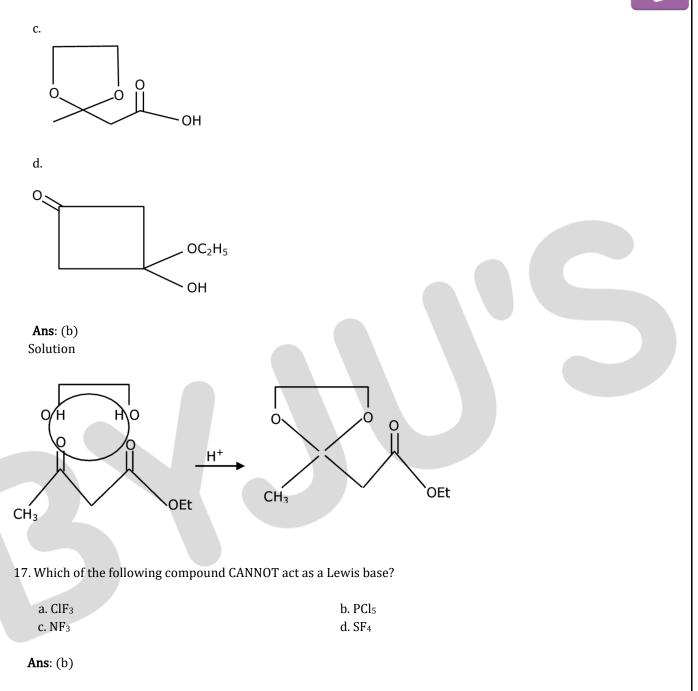


The product "A" in the above reaction is : a.



b.





Solution:

 NF_3 has no vacant orbital neither in nitrogen nor in fluorine so it cannot accept the electron & hence cannot acts as lewis acid and but for PCI_5 P has no L.P & hence it cannot acts as base but CIF_3 (3 B.P + 2 L.P) & SF_4 (4 B.P + 1 L.P)

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Section-B

1. A certain orbital has n = 4 and $m_1 = -3$. The number of radial nodes in this orbital is ____. (Round off to the Nearest Integer).

Ans: 0

Solution

Number of radial nodes = n - l - 1 n = 4, $m_l = -3$ so l = 3radial nodes = 4 - 3 - 1 = 0

15 mL of aqueous solution of Fe²⁺ in acidic medium completely reacted with 20 mL of 0.03 M aqueous Cr 207²⁻. The molarity of the Fe²⁺ solution is _____× 10⁻²M. (Round off to the Nearest Integer).

Ans: 24

Solution

By law of equivalence M_{eq} of $Fe^{2+}=M_{eq}$ of Cr $_2O7^{2-}$ M \times 15 \times 1 = 0.03 \times 6 \times 20 M = 0.24 M = 24 \times 10 $^{-2}$ M

3. The reaction of white phosphorus on boiling with alkali in inert atmosphere resulted in the formation of product 'A'. The reaction of 1 mol of 'A' with excess of AgNO₃ in aqueous medium gives _____ mol(s) of Ag. (Round off to the Nearest Integer).

Ans: 8

Solution

$$P_{4} + NaOH + H_{2}O \longrightarrow PH_{3} + NaH_{2}PO_{2}$$

$$aq$$

$$AgNO_{3} + PH_{3} \longrightarrow Ag$$

$$\left[e^{-} + Ag^{+} \longrightarrow Ag$$

$$P^{-3} \longrightarrow P^{+5} + 8e^{-} \right] \times 8$$

$$8Ag^{+} + P^{3-} \longrightarrow 8Ag + P^{5+}$$

So, final reaction along with stoichiometric coefficient is. $8AgNO_3 + PH_3 + 4H_2O \rightarrow 8Ag + H_3PO_4 + 8HNO_3$ Excess 1 mol Hence, 1 mol produce 8 mol Ag

4. The oxygen dissolved in water exerts a partial pressure of 20 kPa in the vapour above water. The molar solubility of oxygen in water is _____ \times 10⁻⁵ mol dm⁻³. Round off to the Nearest Integer). [Given : Henry's law constant = K_H = 8.0 × 10⁴ kPa for O₂. Density of water with dissolved oxygen = 1.0 kg dm⁻³]

Ans: 25

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Solution

$$\begin{split} P_{(g)} &= [K_H]X\\ 20 \times 10^3 &= [8.0 \times 10^3 \times 10^4] \times \text{Solubility}\\ \text{Solubility} &= \frac{20 \times 10^3}{8.0 \times 10^7}\\ \text{Solubility} &= 25 \times 10^{-5} \text{ mol/dm}^3 \end{split}$$

5. The standard enthalpies of formation of Al_2O_3 and CaO are $-1675 \text{ kJ mol}^{-1}$ and -635 kJ mol⁻¹ respectively. For the reaction $3CaO + 2Al \rightarrow 3Ca + Al_2O_3$ the standard reaction enthalpy $\Delta_r H^0 =$ ____ kJ. (Round off to the Nearest Integer)

Ans: 230

Solution

$$\begin{split} &\Delta_r H^{0}{}_{f} = \Delta_r H^{0}{}_{f} (\text{Products}) - \Delta_r H^{0}{}_{f} (\text{Reactants}) \\ &= \Delta_r H^{0}{}_{f} (\text{Al}_2 \text{O}_3) - 3 \times \Delta_r H^{0}{}_{f} (\text{CaO}) \\ &= -1675 - 3 (-635) \\ &= 230 \text{ kJ} \end{split}$$

6. For a certain first order reaction 32% of the reactant is left after 570s. The rate constant of this reaction is _____ × 10⁻³ s⁻¹. (Round off to the Nearest Integer). [Given: log₁₀2 = 0.301, ln10 = 2.303]

Ans: 2

Solution $k = \frac{1}{t} \ln \frac{a}{[a-x]}$ $k = \frac{2.303}{570} \log \frac{100}{32}$

 $k = \frac{2.303}{570} \times 0.5$ k = 2 × 10⁻³ s⁻¹

7. The pressure exerted by a non-reactive gaseous mixture of 6.4 g of methane and 8.8 g of carbon dioxide in a 10 L vessel at 27°C is _____ kPa. (Round off to the Nearest Integer). [Assume gases are ideal, R = 8.314 J mol⁻¹ K⁻¹ Atomic masses: C : 12.0u, H : 1.0u, O : 16.0 u]

Ans: 150

Solution

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$$\begin{split} V &= 10 \text{ L}, \text{T} = 27^{\circ} \text{ C} = 300 \text{ K} \\ (\text{m})_{\text{methane}} &= 6.4 \text{ g}, \text{CO2} \text{ (m)} = 8.8 \text{ g} \\ \text{PV} &= n_{\text{total}} \text{RT} \\ \text{P} &\times 10^{-2} = (0.4 + 0.2) \times 8.314 \times 300 \\ \text{P} &= 149652 \text{ Pa} \Rightarrow \text{P} = 149.652 \text{ kPa} \approx 150 \text{ kPa} \end{split}$$

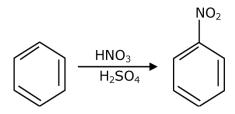
8. The mole fraction of a solute in a 100 molal aqueous solution is $___ \times 10^{-2}$. (Round off to the Nearest Integer). [Given : Atomic masses : H : 1.0 u, 0 : 16.0 u]

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B

Ans: 64

9.



In the above reaction, 3.9 g of benzene on nitration gives 4.92 g of nitrobenzene. The percentage yield of nitrobenzene in the above reaction is ____%. (Round off to the Nearest Integer).

(Given atomic mass : C : 12.0 u, H : 1.0 u, O : 16.0 u, N : 14.0 u)

Ans : 80

Solution

Moles of $C_6H_6 = 3.9/78 = 0.05 \text{ mol}$ Moles of $C_6H_5NO_2 = 4.92/123 = 0.04 \text{ mol}$ By conserving moles of carbon, mole of $C_6H_5 NO_2$ Formed theoretically are 0.05 mol %yield = $\frac{\text{moles formed actually}}{\text{moles formed theoretically}} \times 100$ %yield = $\frac{0.04}{0.05} \times 100 = 80 \%$

10. 0.01 moles of a weak acid HA (Ka = 2.0×10^{-6}) is dissolved in 1.0 L of 0.1 M HCl solution. The degree of dissociation of HA is_____ $\times 10^{-5}$ (Round off to the Nearest Integer). Assume degree of dissociation << 1

Ans : 2

Solution

	HA ≓	H + +	A -
C_1	0.01	0	0
C_{eq}	0.01 (1 -α)	$.01\alpha + 0.1$	0.01α

$$K_{\alpha} = \frac{[H^{+}][A^{-}]}{(PA)}
 (0.1) (0.01 w)
 (0.2) (0.2) (0.01 w)
 (0.2) (0.$$