CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer:

1. Given below are two statements:

Statement I: Glucose is found to exist in two different anomeric form α and β

Statement II: In open chain structure C_3, C_4 and C_5 carbon of glucose & fructose both have same orientation

In the light of above statements choose the correct option.

(1) Both statement I and statement II are correct

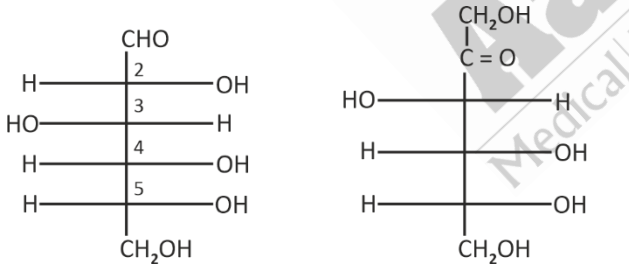
(2) Statement I is correct but statement II is incorrect

(3) Statement I is incorrect but statement II is correct

(4) Both statement I and statement II are incorrect

Answer (1)

Sol.



2. Given below are two statements:

Statement I: The shape of ICl_3 is square planar

Statement II: The shape of $ClBr_2^-$ is pyramidal

In the light of above statements choose the correct option.

(1) Both statement I and statement II are correct

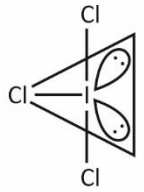
(2) Statement I is correct but statement II is incorrect

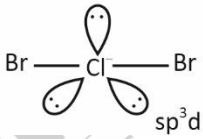
(3) Statement I is incorrect but statement II is correct

(4) Both statement I and statement II are incorrect

Answer (3)

Sol.

ICl_3  T-shaped sp^3d

$ClBr_2^-$  Linear

3. Consider the following reversible reaction

$2AB(g) \rightleftharpoons A_2(g) + B_2(g)$,

If equilibrium pressure is P and degree of dissociation is α, then K_p is

(1) $\frac{\alpha^2}{4(1-\alpha)^2}$ (2) $\frac{P.\alpha^2}{4(1-\alpha)}$

(3) $\frac{P.\alpha}{(1-\alpha)}$ (4) $\frac{P.\alpha}{4(1-\alpha)}$

Answer (1)

Sol.

	$2AB$	$\rightleftharpoons$	$1A_2$	+	$1B_2$
Initial	1		0		0
	$-\alpha$		$+\frac{\alpha}{2}$		$+\frac{\alpha}{2}$
At Eq.	$(1-\alpha)$		$\frac{\alpha}{2}$		$\frac{\alpha}{2}$

$$p'_{A_2} = p'_{B_2} = \frac{P.\alpha}{2}$$

$$p'_{AB} = P(1-\alpha)$$

$$K_p = \frac{(P.\alpha/2)^2}{\{P(1-\alpha)\}^2} = \frac{\alpha^2}{4(1-\alpha)^2}$$

4. Which compound have total molecular mass of 72 with three primary carbons

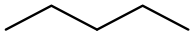
(1) n-pentane

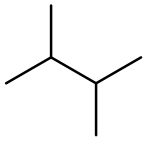
(2) 2, 2-Dimethylbutane

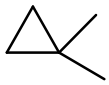
(3) 1, 1-Dimethylcyclopropane

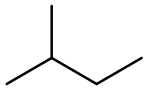
(4) 2-methylbutane

Answer (4)

Sol.  $(C_5H_{12}) \Rightarrow$ 72 g, 2-1°C

 (C_6H_{14})

 (C_5H_{10})

 $(C_5H_{12}) \Rightarrow$ 72 g, 3-1°C

5. The order of acidic strength in following compounds is

A. Phenol

B. p-nitrophenol

C. Ethanol

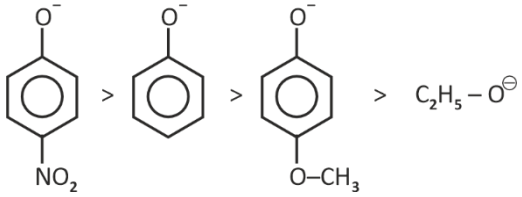
D. p-methoxyphenol

(1) B > A > D > C (2) C > B > A > D

(3) B > D > A > C (4) B > A > C > D

Answer (1)

Sol. Order of stability of conjugate base is



So, order of acidic strength is

B > A > D > C

6. Consider the following electrochemical cell

$$Zn \left| Zn^{2+}(aq) \right| \left| Ag^{+}(aq) \right| Ag$$
(1 M)

The E_{cell} was found to be 1.6 V.

The value of log[Ag⁺] is

Given $E^{o}_{Zn^{2+}/Zn} = -0.76$ V, $E^{o}_{Ag^{+}/Ag} = -0.8$ V

(1) $\frac{1}{3}$ (2) $\frac{2}{3}$

(3) $\frac{3}{2}$ (4) $\frac{4}{3}$

Answer (2)

Sol. $E^{o}_{cell} = 0.8 - (-0.76) = 1.56$ V

$$Zn(s) + 2Ag^{+}(aq) \rightleftharpoons Ag(s) + Zn^{2+}(aq)$$

$$E_{cell} = E^{o}_{cell} - \frac{0.06}{2}\log\frac{[Zn^{2+}]}{[Ag^{+}]^2}$$

$$1.6\text{ V} = 1.56 - 0.03\log\frac{1}{[Ag^{+}]^2}$$

$$1.6 = 1.56 + 0.03\log[Ag^{+}]^2$$

$$0.03\log[Ag^{+}]^2 = 0.04$$

$$\log[Ag^{+}] = \frac{2}{3}$$

7. Aqueous solution of a compound 'X' is acidified with H_2SO_4 and SO_2 is passed through it, turning the solution green. The compound 'X' is

(1) $KMnO_4$ (2) $Pb(CH_3COO)_2$

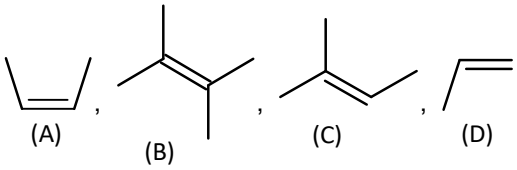
(3) $K_2Cr_2O_7$ (4) $Fe_2(SO_4)_3$

Answer (3)

Sol. $K_2Cr_2O_7 + 3SO_2 + H_2SO_4 \rightarrow$

$$K_2SO_4 + \underset{\text{green}}{Cr_2(SO_4)_3} + H_2O$$

8. Decreasing order of stability in the following compounds is



(1) A > B > C > D (2) B > C > A > D

(3) D > C > B > A (4) A > C > B > D

Answer (2)

Sol. More the number of alpha hydrogens more is the stability of alkene.

9. Consider the following sequence of reactions and determine the final major product (B) is ____.

$$CH_3CH_2CN \xrightarrow{H_3O^+} A \xrightarrow[\text{II. } H_2O]{\text{I. Red } P/Cl_2} B$$

(1) $CH_3CH_2CONHCl$ (2) $CH_3CHClCOOH$

(3) CH_3CONH_2 (4) CH_3CH_2COCl

Answer (2)

Sol.

$$CH_3CH_2CN \xrightarrow{H_3O^+} C_2H_5COOH\ (A) \xrightarrow[\text{II. } H_2O]{\text{I. Red } P/Cl_2} CH_3CHClCOOH\ (B)$$

10. Choose the incorrect statement about tertiary structure of protein.

(1) Fibrous and globular are types of tertiary structures of protein

(2) It represents the overall folding of the polypeptide chain

(3) Disulphide linkage and hydrogen bonds stabilise the tertiary structure

(4) During denaturation, tertiary structure remains intact

Answer (4)

Sol. During denaturation, primary structure remain intact.

11. **Statement I :** When Aluminium reacts with NaOH, $[Al(OH)_6]^{3-}$ is formed.

Statement II : Shape of ClO_2^-, ClO_3^- and ClO_4^- are bent, pyramidal and tetrahedral respectively.

(1) Both statement I and statement II correct

(2) Statement I is correct and statement II is incorrect

(3) Statement I is incorrect and statement II is correct

(4) Both statement I and statement II are incorrect

Answer (3)

Sol. $Al + NaOH(aq) + \xrightarrow{H_2O(\ell)} Na\left[Al(OH)_4\right] + 3H_2$

ClO_2^- – bent shape (sp^3)

ClO_3^- – pyramidal (sp^3)

ClO_4^- – tetrahedral (sp^3)

12. If the bond length of molecule AB is R_{AB}, while radii of A and B are R_A and R_B respectively, then which of the following relation is correct? ($X_A > X_B$)

(1) $R_{AB} = (R_A + R_B) \times \frac{1}{2}$ (2) $R_{AB} > (R_A + R_B)$

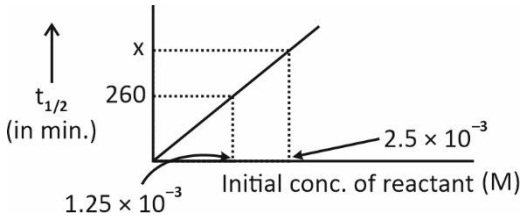
(3) $R_{AB} < (R_A + R_B)$ (4) $R_{AB} + R_A = R_B$

Answer (3)

Sol. If $(EN)_A > (EN)_B$, then bond AB is polar in nature and so $R_{AB} < (R_A + R_B)$

13. For a certain reaction a graph between half life ($t_{1/2}$) and initial concentration of reactant is given

The value of x is ____



(1) 150 min

(2) 125 min

(3) 520 min

(4) 260 min

Answer (3)

Sol. Since the graph of half-life and initial concentration in linear hence the reaction follows zero order kinetics :

$$\frac{(t_{1/2})_1}{(t_{1/2})_2} = \frac{Co_1}{Co_2}$$

$$\frac{260}{x} = \frac{1.25\times10^{-3}}{2.5\times10^{-3}}$$

x = 520 min.

14. 20 g of haemoglobin is present in 1 litre solution at 300 K. The osmotic pressure was found be 80 mm of Hg. The molar mass(g/mol) of haemoglobin is (approximately)

(1) 4424 g/mol (2) 4674 g/mol

(3) 4576 g/mol (4) 4722 g/mol

Answer (2)

Sol. $\frac{80}{760} = \frac{20}{M_0 \times 1} \times 0.082 \times 300$

M_0 = 4674 g/mol

15. Consider the following statements

Statement I : When value of azimuthal quantum number for subshells is same, then higher the value of principal quantum number, higher is the energy.

Statement II : Energy of 4s subshell is greater than 3d subshell.

Choose the correct option.

(1) Both statement I and statement II are correct

(2) Statement I is correct but statement II is incorrect

(3) Statement I is incorrect but statement II is correct

(4) Both statement I and statement II are incorrect

Answer (2)

Sol. Energy in multielectron species is decided by (n + ℓ) value.

If ℓ value same $\Rightarrow$ n$\uparrow$ $\Rightarrow$ Energy $\uparrow$

16. Which set among the following has the same character of oxides

(1) Al_2O_3 and V_2O_3 (2) Cr_2O_3 and NO

(3) CO and N_2O (4) SnO and N_2O_5

Answer (3)

Sol. Basic – V_2O_3

Amphoteric – Al_2O_3, Cr_2O_3, SnO

Acidic – N_2O_5

Neutral – NO, N_2O and CO

17. The correct order of specific heat capacity at 25°C is

(1) He(g) > Cu(s) > Ba(s)

(2) Cu(s) > Ba(s) > He(g)

(3) Ba(s) > Cu(s) > He(g)

(4) He(g) > Ba(s) > Cu(s)

Answer (1)

Sol. $He(g) \rightarrow 5.19\ Jg^{-1}\ K^{-1}$

$Cu(s) \rightarrow 0.39\ Jg^{-1}\ K^{-1}$

$Ba(s) \rightarrow 0.2\ Jg^{-1}\ K^{-1}$

18.

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. Consider the following cases in octahedral complexes.

d^3 (low spin)

d^5 (low spin)

d^7 (high spin)

d^6 (high spin)

Sum of total number of unpaired e^- present is

Answer (11)

Sol. d^3 (low spin) $\rightarrow\ t_{2g}^3 e_g^0\ (n=3)$

d^5 (low spin) $\rightarrow\ t_{2y}^5 e_g^0\ (n=1)$

d^7 (high spin) $\rightarrow\ t_{2g}^5 e_g^2\ (n=3)$

d^6 (high spin) $\rightarrow\ t_{2g}^4 e_g^2\ (n=4)$

22. 20 gram of pure zinc reacts with 50 ml of H_2SO_4 solution whose purity is 50%. Density of H_2SO_4 solution is 1.3 g/ml. The volume of H_2 gas liberated at STP (in litres) is _____.

(Consider volume of 1 mol of gas at STP to be 22.4 litre)

(Atomic mass : Zn = 65, H = 1, S = 32, O = 16)

Answer (7)

Sol. Moles of Zn = $\frac{20}{65} = 0.31$

Mass of H_2SO_4 solution = 50 × 1.3 = 65 gram

Mass of $H_2SO_4 = 65 \times \frac{50}{100} = 32.5$ g

Moles of $H_2SO_4 = \frac{32.5}{98} = 0.33$

Zn	+	H_2SO_4	$\rightarrow$	$ZnSO_4$	+	H_2
0.31		0.33		0		0

Limiting reactant = Zn

Moles of $H_{2(g)}$ formed = 0.31

Volume of $H_{2(g)}$ liberated at STP = 0.31 × 22.4

= 6.94 litres $\simeq$ 7 litres

23. Consider the reaction sequence :

$R - MgX + H_2O \rightarrow R - H$

1.4 dm^3/g at STP

$R - H + I_2 \rightarrow R - I$

(1eq.)

$2R - I + Na \xrightarrow[\text{ether}]{} R - R$

Find molar mass or R – R in g/mol

Answer (30)

Sol. 1.4 litre is equal to 1 g

22.4 litres is equal to $\frac{1}{1.4} \times 22.4$ g

16 g

R – H is CH_4

So, molar mass of R – R = 30 g/mol

24.

25.