

## 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. The correct order of melting points of Group-14 elements is
- (1)  $C > Si > Ge > Sn > Pb$
  - (2)  $Si > C > Ge > Sn > Pb$
  - (3)  $Ge > Sn > C > Si > Pb$
  - (4)  $C > Si > Ge > Pb > Sn$

**Answer (4)**

**Sol.** Melting Points (in K)

C	Si	Ge	Sn	Pb
4373	1693	1218	505	600

Correct order will be



2.  $\alpha$ -helix protein and  $\beta$ -pleated sheets protein belong to which one of the following types of protein?
- (1) Primary
  - (2) Secondary
  - (3) Tertiary
  - (4) Quarternary

**Answer (2)**

**Sol.**  $\alpha$ -helix and  $\beta$ -pleated sheet structure belong to secondary protein or 2° protein.

3. What will be effect on pH of water when it is heated?
- (1) Increase
  - (2) Decrease
  - (3) Remains same
  - (4) pH first increases then decreases

**Answer (2)**

**Sol.** As water is heated degree of ionisation increases  $[H^+]$  ion concentration increases pH decreases.

4. Match the following List I with List II.

List-I (Alloys)		List-II (Metals)	
A.	Bronze	(i)	Fe, Cr, and Ni
B	Stainless steel	(ii)	Cu and Sn
C	UK Gold Coin	(iii)	Cu and Zn
D	Brass	(iv)	Au, Ag, Cu, Zn and Ni

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

**Answer (1)**

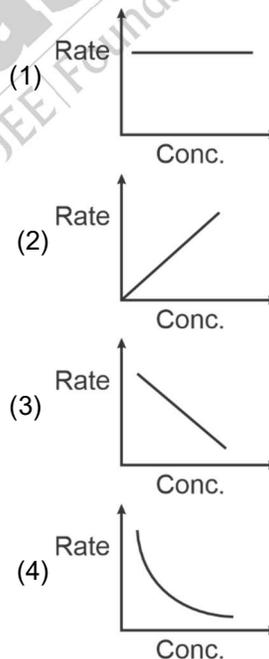
**Sol.** ▶ Bronze is Made up of copper and Tin

▶ Stainless steel is made up of Fe, Cr and Ni

▶ UK Gold coin is made up of – Au (91%), Ag, Cu, Zn and Ni.

▶ Brass is made up of Copper and Zinc.

5. Which one of the following plots represents zero order reaction?





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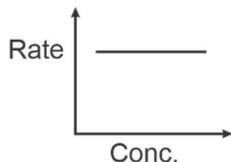
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**Answer (1)**

**Sol.** The rate of a zero order reaction remains constant throughout the reaction.

$$\text{Rate} = k [\text{Reactant}]^0$$

Plot of rate vs conc. of reactant is linear parallel to x-axis.



6. By using relation

$$\Delta G = \Delta H - T\Delta S$$

Which of the following relation is incorrect for spontaneous reaction at a given temperature?

- (1)  $\Delta H > 0, \Delta S > 0$       (2)  $\Delta H > 0, \Delta S < 0$   
 (3)  $\Delta H < 0, \Delta S > 0$       (4)  $\Delta H < 0, \Delta S < 0$

**Answer (2)**

**Sol.** If  $\Delta H > 0, \Delta S > 0$ , then process is spontaneous at high temperature

If  $\Delta H > 0, \Delta S < 0$ , process is always non spontaneous

If  $\Delta H < 0$  and  $\Delta S > 0$ , then process is always spontaneous

If  $\Delta H < 0$  and  $\Delta S < 0$ , then process is spontaneous at low temperature.

7. **Statement-I** : For a particular shell, maximum number of orbitals is  $n^2$ .

**Statement-II** : For a subshell, possible orientations lies between  $-l$  to  $+l$  including zero.

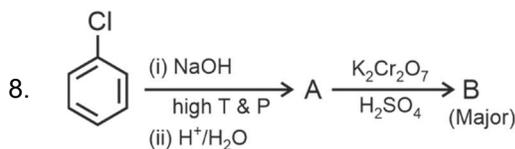
- (1) Statement-I and Statement -II both are correct  
 (2) Statement-I and Statement-II both are incorrect  
 (3) Statement-I is correct, Statement-II is incorrect  
 (4) Statement-I is incorrect, Statement-II is correct

**Answer (1)**

**Sol.** If shell number is 2, then number of orbitals =  $2^2 = 4$

$$2s \rightarrow \square; 2p \rightarrow \square\square\square = 4$$

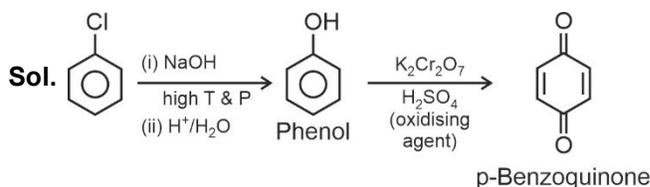
If  $l = 2$ , then value lies between  $-2, -1, 0, +1, +2$ .



Predict A and B?

- (1) (2)   
 (3) (4) None of these

**Answer (3)**



9. Which of the following complex has  $d^4$  configuration?

- (1)  $[\text{Fe}(\text{CN})_6]^{3-}$       (2)  $[\text{MnF}_6]^{3-}$   
 (3)  $[\text{Co}(\text{CN})_6]^{3-}$       (4)  $[\text{CoCl}_4]^{2-}$

**Answer (2)**

**Sol.**  $[\text{Fe}(\text{CN})_6]^{3-} \Rightarrow \text{Fe}^{3+} \Rightarrow 3d^5$  configuration

$[\text{MnF}_6]^{3-} \Rightarrow \text{Mn}^{3+} \Rightarrow 3d^4$  configuration

$[\text{Co}(\text{CN})_6]^{3-} \Rightarrow \text{Co}^{3+} \Rightarrow 3d^6$  configuration

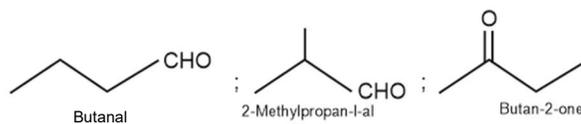
$[\text{CoCl}_4]^{2-} \Rightarrow \text{Co}^{2+} \Rightarrow 3d^7$  configuration

10. The total number of isomers possible (aldehyde & ketones) for  $\text{C}_4\text{H}_8\text{O}$  are

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

**Answer (1)**

**Sol.**



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11. Consider the following reaction

$X_2Y(s) \rightleftharpoons X_2(g) + \frac{1}{2}Y_2(g)$ . If  $\alpha$  is the degree of dissociation. Calculate  $K_P$  in terms of  $P$  (total pressure)

(1)  $K_P = \frac{2P^{3/2}}{3^{3/2}}$       (2)  $K_P = \frac{2P^{3/2}}{3}$

(3)  $K_P = \sqrt{\frac{2P}{3}}$       (4)  $K_P = \frac{\sqrt{2P}}{3}$

**Answer (1)**

**Sol.**  $X_2Y(s) \rightleftharpoons X_2(g) + \frac{1}{2}Y_2(g)$

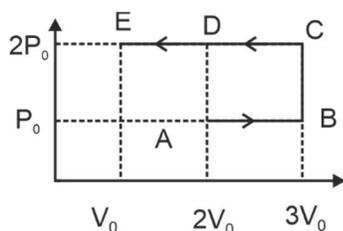
at eq.  $P' \quad \frac{P'}{2}$

$P_T = \frac{3P'}{2} \Rightarrow P' = \left(\frac{2P_T}{3}\right)$

$K_P = (P_{X_2})(P_{Y_2})^{1/2}$

$K_P = P' \left(\frac{P'}{2}\right)^{1/2} = \frac{(P')^{3/2}}{\sqrt{2}} = \frac{\left(\frac{2P}{3}\right)^{3/2}}{\sqrt{2}} = \frac{2P^{3/2}}{3^{3/2}}$

12. An ideal gas undergoes following process from  $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E$ . Find work done.



- (1)  $-3P_0V_0$
- (2)  $2P_0V_0$
- (3)  $3P_0V_0$
- (4)  $\frac{3P_0V_0}{2}$

**Answer (3)**

**Sol.**  $|W| = \text{Area under the curve}$

$= 2P_0 \times [3V_0 - V_0] - P_0 \times [3V_0 - 2V_0]$   
 $= 3P_0V_0$

Net work is done on the system.

13. When a non-volatile solute (A) is added to a volatile solvent, the vapour pressure of solvent decreases by 10 mm Hg. Mole fraction of solute in solution is 0.2. If another non-volatile solute (B) is further added to the same solution and vapour pressure of solution decreases by 20 mm Hg, calculate mole fraction of 2<sup>nd</sup> solute in the final solution.

- (1) 0.3
- (2) 0.4
- (3) 0.5
- (4) 0.6

**Answer (3)**

**Sol.** For solute (A),

$X_A = 0.2$

$\Delta P = 10 \text{ mm Hg}$

Let  $P_{\text{solvent}}^{\circ}$  be vapour pressure of pure solvent

$\frac{\Delta P}{P_{\text{solvent}}^{\circ}} = X_A$

$P_{\text{solvent}}^{\circ} = \frac{10}{0.2} = 50 \text{ mm Hg}$

For solute (B),

Let number of moles of solvent be 0.8 and  $n_B$  be the number of moles of (B) added, then

$X_B = \frac{n_B}{0.2 + 0.8 + n_B} = \frac{n_B}{1 + n_B}$

$\Delta P' = 10 + 20 = 30 \text{ mm Hg}$

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$$\frac{\Delta P'}{P_{\text{solvent}}^{\circ}} = \frac{0.2 + n_B}{1 + n_B}$$

$$\frac{30}{50} = \frac{0.2 + n_B}{1 + n_B}$$

$$\Rightarrow n_B = 1$$

$$X_B = \frac{1}{1+1} = 0.5$$

14. Consider the following  $E^{\circ}$  values of given half cell

$$E_{\text{Ag}^+/\text{Ag}}^{\circ} = 0.8 \text{ V}, E_{\text{Zn}^{2+}/\text{Zn}}^{\circ} = -0.76 \text{ V}$$

$$E_{\text{Cu}^{2+}/\text{Cu}}^{\circ} = 0.34 \text{ V}, E_{\text{Mg}^{2+}/\text{Mg}}^{\circ} = -2.36 \text{ V}$$

Then which of the following will have the most negative value of  $\Delta G^{\circ}$ ?

- (1)  $\text{Zn}|\text{Zn}^{2+}||\text{Cu}^{2+}|\text{Cu}$
- (2)  $\text{Mg}|\text{Mg}^{2+}||\text{Ag}^+|\text{Ag}$
- (3)  $\text{Mg}|\text{Mg}^{2+}||\text{Zn}^{2+}|\text{Zn}$
- (4)  $\text{Cu}|\text{Cu}^{2+}||\text{Ag}^+|\text{Ag}$

**Answer (2)**

**Sol.** The cell which has most positive value of  $E_{\text{Cell}}^{\circ}$  will have most negative value of  $\Delta G^{\circ}$ .

$$E_{\text{cell}}^{\circ} = E_{\text{Ag}^+|\text{Ag}}^{\circ} - E_{\text{Mg}^{2+}|\text{Mg}}^{\circ} = 0.8 - (-2.36) = 3.16 \text{ V}$$

$$\Delta G^{\circ} = -nFE_{\text{Cell}}^{\circ}$$

15. Match the following

	Reactant		Product
(A)		(i)	
(B)		(ii)	

(C)		(iii)	
(D)		(iv)	

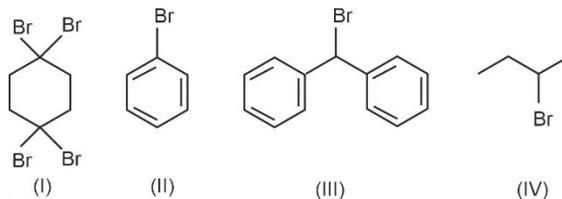
Give correct product of oxidative ozonolysis ( $\text{O}_3/\text{H}_2\text{O}$ )

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

**Answer (2)**

**Sol.**

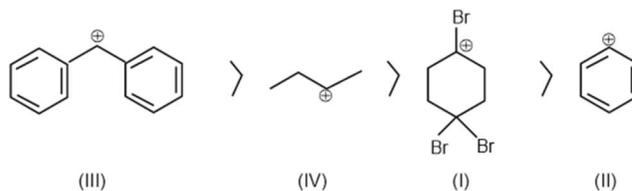
16. Arrange the following compounds in the decreasing order of rate of hydrolysis



- (1) (I) > (II) > (III) > (IV)
- (2) (III) > (IV) > (I) > (II)
- (3) (IV) > (III) > (I) > (II)
- (4) (III) > (II) > (IV) > (I)

**Answer (2)**

**Sol.** Rate of hydrolysis of the given compounds will be decided on the basis of stability of carbocation intermediate. Higher the stability of carbocation, higher will be the rate of hydrolysis of the parent compound. Stability order of carbocations obtained from the given compounds.



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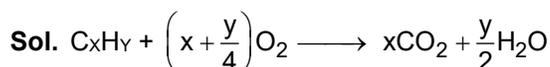
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17. 0.01 mole of an organic compound (Hydrocarbon) gives 1.76 gm CO<sub>2</sub> and 0.9 gm H<sub>2</sub>O on complete combustion. Find out chemical formula of compound.

- (1) C<sub>3</sub>H<sub>8</sub>
- (2) C<sub>4</sub>H<sub>10</sub>
- (3) C<sub>5</sub>H<sub>12</sub>
- (4) C<sub>6</sub>H<sub>14</sub>

**Answer (2)**



$$x = \frac{0.04}{0.01} = 4$$

$$\frac{y}{2} = 5$$

$$y = 10$$

Formula is C<sub>4</sub>H<sub>10</sub>

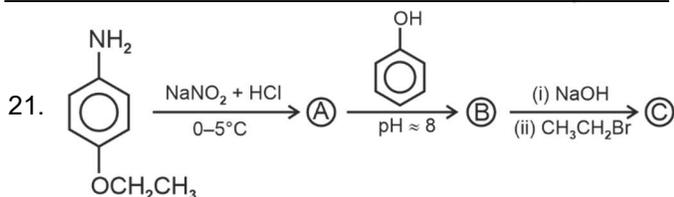
18.

19.

20.

**SECTION - B**

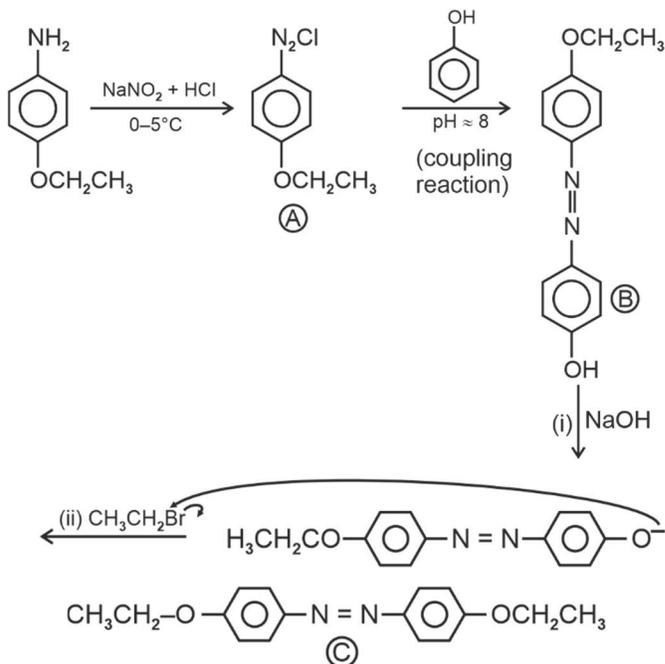
**Numerical Value Type Questions:** This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.



Number of sp<sup>3</sup> hybridised carbon atoms in C is :

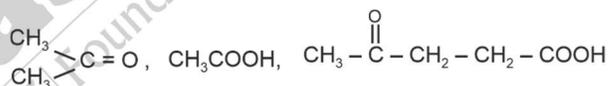
**Answer (4)**

**Sol.**



Total 4 sp<sup>3</sup> hybridised carbon atoms are present in C

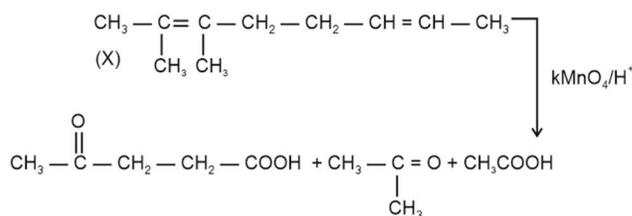
22. A compound X consumes two moles of H<sub>2</sub> and when 'X' heated with KMnO<sub>4</sub>/H<sup>+</sup> gives



Number of σ bonds in X are \_\_\_\_\_.

**Answer (27)**

**Sol.** Compound X has 27 σ-bonds



23.

24.

25.

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