

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. If  $[H^+]$  in concentration is increased by a factor of 1000. Then pH?
- (1) Decreased by 3
  - (2) Increased by 3
  - (3) There is no change in pH
  - (4) Decreased by 1

**Answer (1)**

**Sol.** If  $[H^+]$  is increased by 1000 times then pH will be decreased by 3.

2. Arrange the following elements in increasing order of metallic character

Si, K, Mg and Be

- (1)  $Si < Mg < Be < K$
- (2)  $Be < Mg < Si < K$
- (3)  $Si < Be < Mg < K$
- (4)  $K < Mg < Si < Be$

**Answer (3)**

**Sol.** Based on the electronegativity of the given elements, the correct increasing order of metallic character is

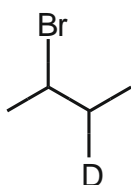
$Si < Be < Mg < K$

3. Which of the following has two chiral centres

- (1) 2- Bromo - 3- deutro butane
- (2) 1- Bromo - 2- deutro butane
- (3) 1- Bromo - 3- deutro butane
- (4) 1- Bromo - 4- deutro butane

**Answer (1)**

**Sol.**



2 - Bromo - 3 deutro butane has two chiral centres.

4. **A :** Carbon form two oxides CO and  $CO_2$ , where CO is neutral while  $CO_2$  is acidic.

**R :**  $CO_2$  will combine with water to give carbonic acid and CO is soluble in water

- (1) [A] and [R] both are correct and [R] is correct explanation of [A]
- (2) [A] and [R] both are correct and [R] is not correct explanation of [A]
- (3) [A] is correct while [R] is false
- (4) [A] is false while [R] is correct

**Answer (2)**

**Sol.**  $CO_2$  will form carbonic acid with water and it is acidic in nature, while CO is neutral but there is no relation of neutrality with solubility.

5. Which of the following element is the weakest reducing agent in aqueous solution.

- (1) Na
- (2) K
- (3) Li
- (4) Rb

**Answer (1)**

**Sol.** As per the standard reduction potential values, Na is the weakest reducing agent.

6. Match **List-I** with **List-II**

**(List-I)**

**Amine**

**List-II**

**$pK_b$  (Aqueous medium)**

- |                            |         |
|----------------------------|---------|
| (a) Aniline                | 1. 9.0  |
| (b) Ethanamine             | 2. 3.29 |
| (c) N-ethylethanamine      | 3. 3.25 |
| (d) N, N-diethylethanamine | 4. 3.0  |

- (1)  $a \rightarrow 1, b \rightarrow 2, c \rightarrow 4, d \rightarrow 3$
- (2)  $a \rightarrow 1, b \rightarrow 4, c \rightarrow 3, d \rightarrow 2$
- (3)  $a \rightarrow 1, b \rightarrow 2, c \rightarrow 3, d \rightarrow 4$
- (4)  $a \rightarrow 2, b \rightarrow 3, c \rightarrow 4, d \rightarrow 1$

**Answer (1)**

**Sol.** The order of basicity is:

$c > d > b > a$

$\therefore pK_b$  order is :  $\rightarrow c < d < b < a$

7. Select the correct match.
- A. Hexan-2-one and hexan-3-one – Position isomers
- B. Pentan-3-one and pentan-2-one – Functional isomers
- C. 2-pentene and 1-pentene – Metamers
- D. Pentanoic acid and hexanoic acid – Functional isomers
- (1) A (2) B  
(3) C (4) D

**Answer (1)**

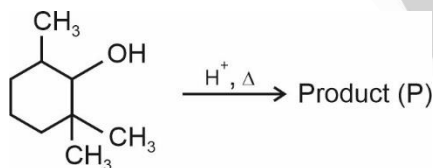
**Sol.** Hexan-2-one and hexan-3-one are position isomers.

8. Chloride salt of M is treated with excess of  $\text{AgNO}_3$ . It forms curdly white precipitate 'A'. When 'A' is treated with  $\text{NH}_4\text{OH}$ , it forms a soluble salt 'B'. The A and B respectively is
- (1)  $\text{AgCl}$ ,  $[\text{Ag}(\text{NH}_3)_2]^+$  (2)  $\text{AgBr}$ ,  $[\text{Ag}(\text{OH})_2]^-$   
(3)  $\text{AgCl}$ ,  $[\text{Ag}(\text{OH})_4]^{2-}$  (4)  $\text{AgBr}$ ,  $[\text{Ag}(\text{OH})_4]^{2-}$

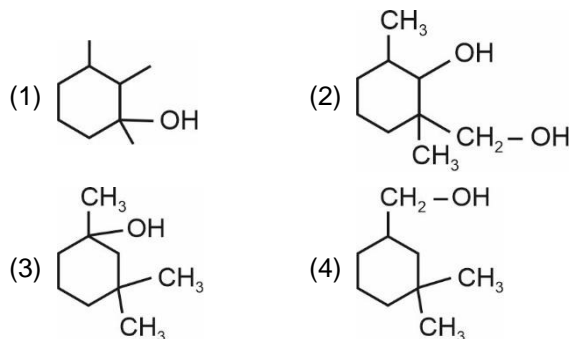
**Answer (1)**

**Sol.**  $\text{AgCl}$  forms white ppt. which is soluble in  $\text{NH}_4\text{OH}$ .  
The correct answer of this question is (1).

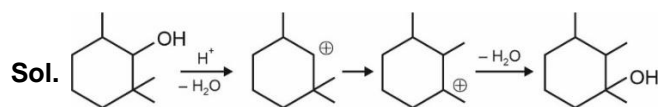
9. Consider the following reaction



The correct product 'P' is



**Answer (1)**



10. Final oxidation number of Cr when  $\text{K}_2\text{Cr}_2\text{O}_7$  is used in acidic medium during titration.
- (1) +6 (2) +2  
(3) +3 (4) +4

**Answer (3)**

**Sol.**  $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$

11. Match the following

(I)	Neoprene	(a)	Synthetic Wool
(II)	Acrolein	(b)	Paint
(III)	LDP	(c)	Flexible Pipes
(IV)	Glyptal	(d)	Gaskets

- (1) II-(d), IV-(b), III-(a), I-(c)  
(2) II-(d), IV-(b), III-(c), I-(a)  
(3) II-(a), IV-(b), III-(c), I-(d)  
(4) II-(b), IV-(c), III-(d), I-(a)

**Answer (3)**

**Sol.** Neoprene is a synthetic rubber. It is used for manufacturing of gaskets.

Acrolein is used for making synthetic wool. LDP is used for making flexible pipes. Glyptal is used for making paints.

12. **Assertion** : BHA is added to butter to increase shelf life.

**Reason** : BHA reacts with oxygen more than butter.

- (1) Assertion is correct Reason is correct  
(2) Assertion is correct Reason is incorrect  
(3) Assertion is incorrect Reason is correct  
(4) Assertion is incorrect Reason is incorrect

**Answer (1)**

**Sol.** Butylated hydroxy anisole (BHA) is an antioxidant. It is added to butter to increase its shelf life from months to years. BHA reacts with  $\text{O}_2$  present in air in preference to butter. So, both the assertion and reason are correct.

13. A hydrocarbon is having molar mass  $84 \text{ g mol}^{-1}$  and 85.8% C by mass. Calculate the number of H atoms in the molecule?

- (1) 8 (2) 10  
(3) 12 (4) 14

**Answer (3)**

**Sol. C** 85.8%  $\frac{85.8}{12} = 7 = 1$

H 14.2  $\frac{14.2}{1} = 14 = 2$

Empirical formula = CH<sub>2</sub>

molecular formula = n × empirical formula

$$n = \frac{\text{molar mass}}{\text{empirical mass}} = \frac{84}{14} = 6$$

∴ molecular formula = C<sub>6</sub>H<sub>12</sub>

14. Which of the following options contains the correct match.

	List-I		List-II
(A)	Adiabatic	(P)	ΔT = 0
(B)	Isothermal	(Q)	Heat exchange is zero
(C)	Isochoric	(R)	ΔP = 0
(D)	Isobaric	(S)	Work done is zero

- (1) A → Q; B → P; C → S; D → R  
 (2) A → P; B → Q; C → R; D → S  
 (3) A → S; B → R; C → Q; D → P  
 (4) A → P; B → R; C → S; D → Q

**Answer (1)**

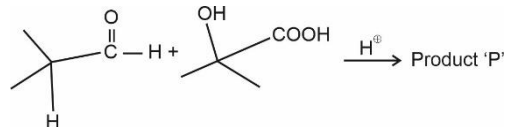
**Sol.** Adiabatic → Heat exchange is zero

Isothermal → ΔT = 0

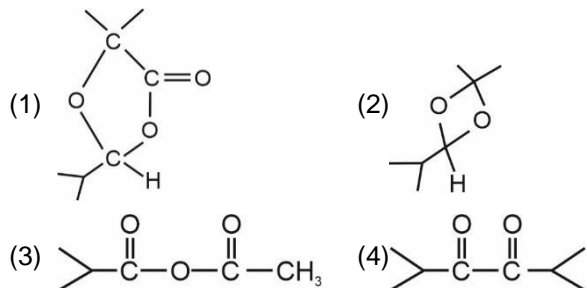
Isobaric → ΔP = 0

Isochoric → Work done is zero

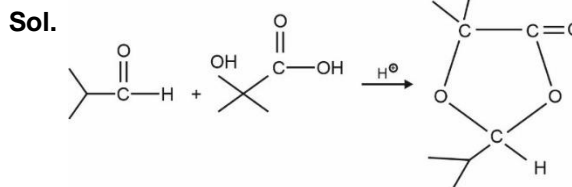
15. Consider the following reaction:



The product 'P' is



**Answer (1)**



16. Find out mass ratio of ethylene glycol (62 g) required to make 500 ml, 0.25 m and 250 M, 0.25 M solution.

- (1) 1 : 1 (2) 1 : 2  
 (3) 2 : 1 (4) 4 : 1

**Answer (3)**

**Sol.** Millimoles of ethylene glycol in 1<sup>st</sup> case

$$= 500 \times 0.25$$

Millimoles of ethylene glycol in second case

$$= 250 \times 0.25$$

$$\therefore \text{Molar ratio} = \frac{50}{25} = \frac{10}{5}$$

$$\text{Mass ratio} = \frac{2}{1}$$

17. **A** : Alkali metals show characteristic colour in reducing flame.

**R** : They can be identified by flame test

- (1) Assertion is true and reason is false  
 (2) Assertion is false and reason is true  
 (3) Both assertion and reason are true reason is the correct explanation of assertion  
 (4) Both assertion and reason are true. But reason is not the correct explanation of assertion

**Answer (2)**

**Sol.** Alkali metals show characteristic colour in oxidising flame.

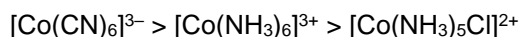
18. Which of the following option contains the correct match?

	List-I (Complex)		List-II (λ, absorbed)
(A)	[Co(CN) <sub>6</sub> ] <sup>3-</sup>	(P)	535 nm
(B)	[Co(NH <sub>3</sub> ) <sub>6</sub> ] <sup>3+</sup>	(Q)	375 nm
(C)	[Co(NH <sub>3</sub> ) <sub>5</sub> Cl] <sup>2+</sup>	(S)	600 nm

- (1) A → S, B → P, C → Q  
 (2) A → P, B → Q, C → S  
 (3) A → Q, B → P, C → S  
 (4) A → S, B → Q, C → P

**Answer (3)**

**Sol.** The CFSE value order of the given complexes are:



$\therefore \lambda$ , absorbed will be in the reverse order.

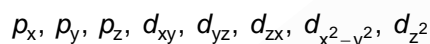
19.

20.

**SECTION - B**

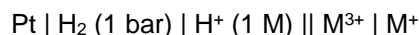
**Numerical Value Type Questions:** This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, -00.33, -00.30, 30.27, -27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

21. How many of the following orbitals is/are considered as axial orbital(s).

**Answer (5)**

**Sol.**  $p_x, p_y, p_z, d_{x^2-y^2}$  and  $d_{z^2}$  orbitals are called axial orbitals.

22. Consider the following cell :



If the value of  $\frac{[\text{M}^{3+}]}{[\text{M}^+]}$  is  $10^x$ , then find the value of

'x'. [Given :  $E_{\text{M}^{3+}/\text{M}^+}^{\circ} = 2 \text{ V}$  and  $E_{\text{cell}} = 1.1 \text{ V}$ ]

**Answer (30)**

$$\text{Sol. } 1.1 = 2 - \frac{0.06}{2} \log \frac{[\text{M}^{3+}]}{[\text{M}^+]}$$

$$0.9 = 0.03 \log \frac{[\text{M}^{3+}]}{[\text{M}^+]}$$

$$\therefore \frac{[\text{M}^{3+}]}{[\text{M}^+]} = 10^{30}$$

$$\therefore x = 30$$

23. For a reaction  $\text{A} \longrightarrow \text{B}$

$$k = 2 \times 10^{-3} \text{ s}^{-1}$$

Consider the following statements for the above reaction.

SI : The reaction is complete in 1000 sec.

SII : Half life of the reaction is 500 sec.

SIII : Units of rate constant is same as that of rate

SIV : Degree of dissociation is  $(1 - e^{-kt})$

SV : It is a zero order reaction.

How many statements are incorrect?

**Answer (4)**

**Sol.** Except (4), all statements are incorrect

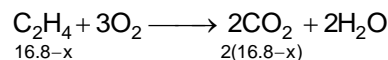
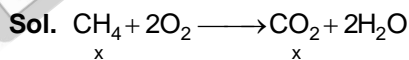
$$\text{As } [\text{B}] = a(1 - e^{-kt})$$

$$\therefore, \left[ \alpha = \frac{[\text{B}]}{a} = 1 - e^{-kt} \right]$$

24. Consider a mixture of  $\text{CH}_4$  and  $\text{C}_2\text{H}_4$  having volume 16.8 L at 273 K and 1 atm.

It undergoes combustion to form  $\text{CO}_2$  with total volume 28 L at the same temperature and pressure.

If the enthalpy of combustion of  $\text{CH}_4$  is  $-900 \text{ kJ/mol}$  and enthalpy of combustion of  $\text{C}_2\text{H}_4$  is  $-1400 \text{ kJ/mol}$  then find the magnitude of heat released on combustion of given mixture in kJ

**Answer (925)**

$$x + 2(16.8 - x) = 28$$

$$x = 5.6 \text{ L}$$

$$\begin{aligned} \therefore \text{Heat released} &= \frac{1}{4} \times 900 + \frac{1}{2} \times 1400 \\ &= 225 + 700 \\ &= 925 \text{ kJ} \end{aligned}$$

25.

26.

27.

28.

29.

30.