

CHEMISTRY

SECTION - A

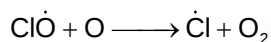
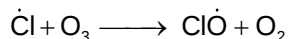
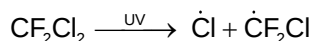
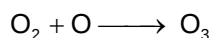
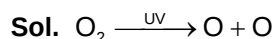
Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer:

1. In which of the following free radical helps in depletion of ozone layer?

- (1) NO
- (2) Cl
- (3) OH
- (4) CH_3

Answer (2)



2. In which of the following option the species changes from paramagnetic to diamagnetic and bond order increases?

- (1) $\text{N}_2 \rightarrow \text{N}_2^+$
- (2) $\text{O}_2 \rightarrow \text{O}_2^{2-}$
- (3) $\text{NO} \rightarrow \text{NO}^+$
- (4) $\text{O}_2 \rightarrow \text{O}_2^+$

Answer (3)

Sol. NO is paramagnetic with BO = 2.5 NO⁺ is diamagnetic with BO = 3.0

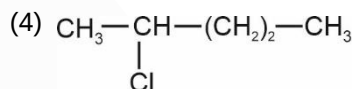
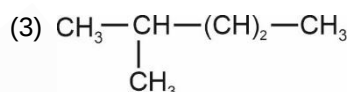
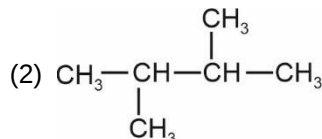
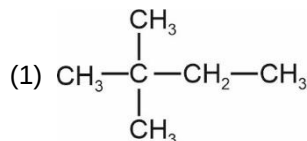
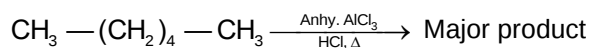
3. What happens when lyophilic sol is added to lyophobic sol?

- (1) Prevention from coagulation
- (2) Precipitation
- (3) Emulsion
- (4) Electrophoresis

Answer (1)

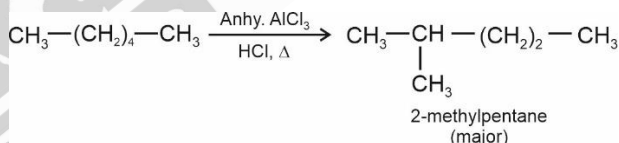
Sol. On addition of lyophilic sol to lyophobic sol, prevention from coagulation takes place in the sense that more amount of electrolyte is needed to cause coagulation of same colloidal sol.

4. What is the major product formed in the following reaction



Answer (3)

Sol. n-Alkanes on heating in this presence of anhydrous AlCl_3 and hydrogen chloride gas isomerise to branched chain alkanes. The major product has one methyl side chain.



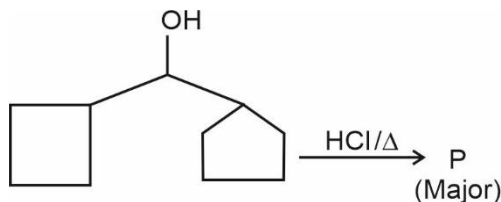
5. Which one of the following shows incorrect method of refining?

- (1) Zinc : Liquefaction
- (2) Copper : Electrolysis
- (3) Titanium : Van Arkel Method
- (4) Nickel : Mond's Process

Answer (1)

Sol. Zinc is refined by distillation, method used for metals having low boiling point.

6. Consider a reaction

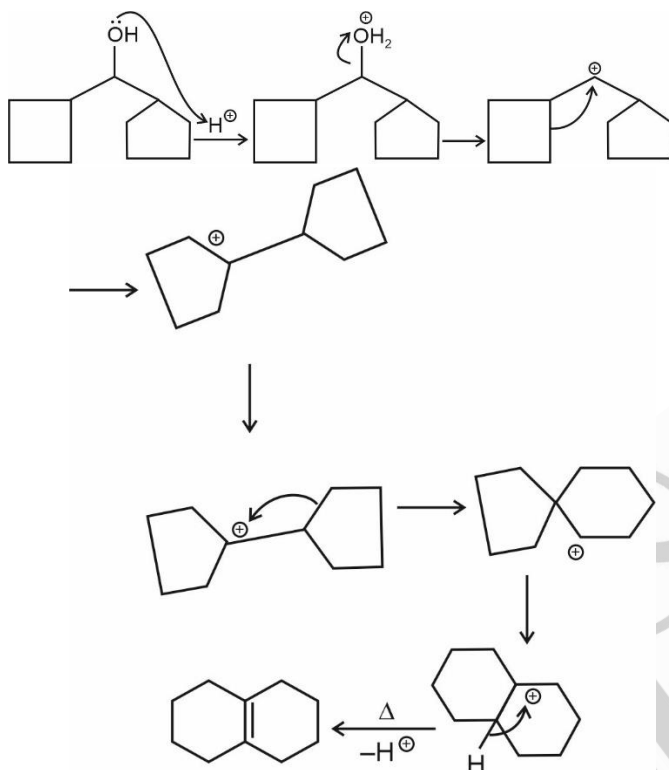


Which of the following conclusions is correct about the product P?

- (1) Both ring will be 5-membered
- (2) Both ring will be 6-membered
- (3) One ring is 5-membered and other is 6-membered
- (4) One of the rings is 4-membered

Answer (2)

Sol.



7. The pair of lanthanoids with exceptionally high 3rd ionisation enthalpy than neighbour elements.
- (1) Lu and Yb
 - (2) Eu and Gb
 - (3) Eu and Yb
 - (4) Dy and Yb

Answer (3)

Sol. Eu: [Xe] 4f⁷ 6s² } Exceptionally high IE due to half filled & fully filled configurations
Yb: [Xe] 4f¹⁴ 6s² }

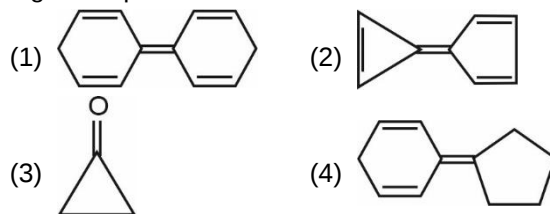
8. ClF₅ exist in which state at room temperature?
- (1) Gaseous state and square pyramidal, colourless
 - (2) Liquid state and trigonal bipyramidal, colourless
 - (3) Gaseous state and trigonal bipyramidal, colourless
 - (4) Liquid state and square pyramidal, colourless

Answer (4)

Sol. ClF₅ is a colourless liquid with square pyramidal structure. Hence the correct option is (4).

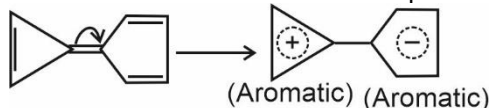
[Reference : NCERT]

9. Which one of the following compounds has the highest dipole moment?

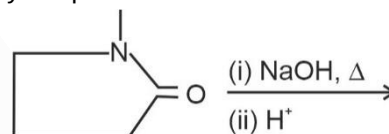


Answer (2)

Sol. Among the given compounds, the following compound has the highest dipole moment because both the +ve and -ve ends acquire aromaticity.



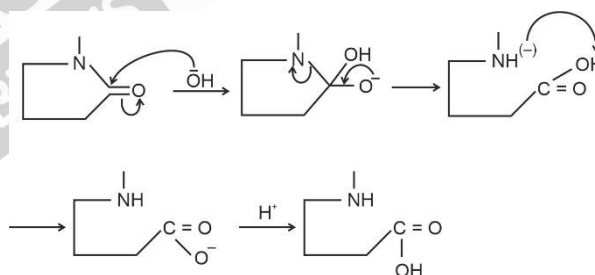
10. Identify the product formed in the following reaction



- (1) H₂N - (CH₂)₃ - CHO
- (2) CH₃ - NH - (CH₂)₃ - CH₂OH
- (3) CH₃ - NH - (CH₂)₃ - COOH
- (4) H₂N - CH(CH₃) - (CH₂)₂ - COOH

Answer (3)

Sol.

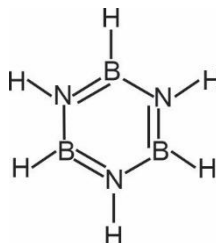


11. Incorrect statement about Borazine is

- (1) It has Banana shape bonds
- (2) It has electron delocalisation
- (3) It reacts with water
- (4) Cyclic in nature

Answer (1)

Sol. Borazine is B₃N₃H₆



Banana bonds are not present in B₃N₃H₆.

12. Match the Column-I and Column-II

Column-I		Column-II	
A	Nylon-6	1	Caprolactum
B	Natural rubber	2	Chloroprene
C	Vulcanized rubber	3	Isoprene
D	Neoprene	4	Sulfur containing rubber

- (1) A → 1; B → 3; C → 4; D → 2
 (2) A → 1; B → 2; C → 4; D → 3
 (3) A → 4; B → 3; C → 1; D → 2
 (4) A → 2; B → 3; C → 4; D → 1

Answer (1)**Sol.** Nylon-6 – Caprolactum

Natural rubber – Isoprene

Vulcanized rubber – Sulfur containing rubber

Neoprene – Chloroprene

13. Consider a reaction.



Incorrect statement regarding the product is

- (1) Be is tetrahedrally bonded in the product
 (2) Be forms cationic part
 (3) It is an acid-base reaction
 (4) $\text{Be}(\text{OH})_2$ acts as a Lewis acid

Answer (2)**Sol.** $\text{Be}(\text{OH})_2 + \text{Sr}(\text{OH})_2 \longrightarrow \text{Sr}^{2+}[\text{Be}(\text{OH})_4]^{2-}$

As Be is present in the anionic part, option (2) is incorrect.

14. Following two columns are given

Column I	Column II
(a) Troposphere	(p) From 10 to 50 km from sea level
(b) Stratosphere	(q) Upto 10 km from sea level
(c) Mesosphere	(R) From 85 km to 100 km from sea level
(d) Thermosphere	(s) From 50 km to 85 km from sea level

- (1) a(p); b(q); c(r); d(s)
 (2) a(r); b(s); c(p); d(q)
 (3) a(q); b(p); c(s); d(r)
 (4) a(s); b(r); c(p); d(q)

Answer (3)**Sol. Thermosphere :** From 85 to ~ 700 km from sea level**Mesosphere :** From 50 to 85 km from sea level**Stratosphere :** From 10 – 50 km from sea level**Troposphere :** Upto 10 km from sea level15. Energy of first Bohr orbit E_1 is -2.18×10^{-18} J, then find energy of third Bohr orbit for hydrogen

- (1) $3E_1$ (2) $9E_1$
 (3) $\frac{E_1}{9}$ (4) $\frac{E_1}{27}$

Answer (3)**Sol.** $E_3 = -2.18 \times 10^{-18} \times \frac{Z^2}{n^2}$

$$E_3 = \frac{E_1}{(3)^2} = \frac{E_1}{9}$$

16. Which one of the following is the best method for the removal of hardness of water?

- (1) Boiling
 (2) Treatment with washing soda
 (3) Permutit process
 (4) Synthetic resin method

Answer (4)

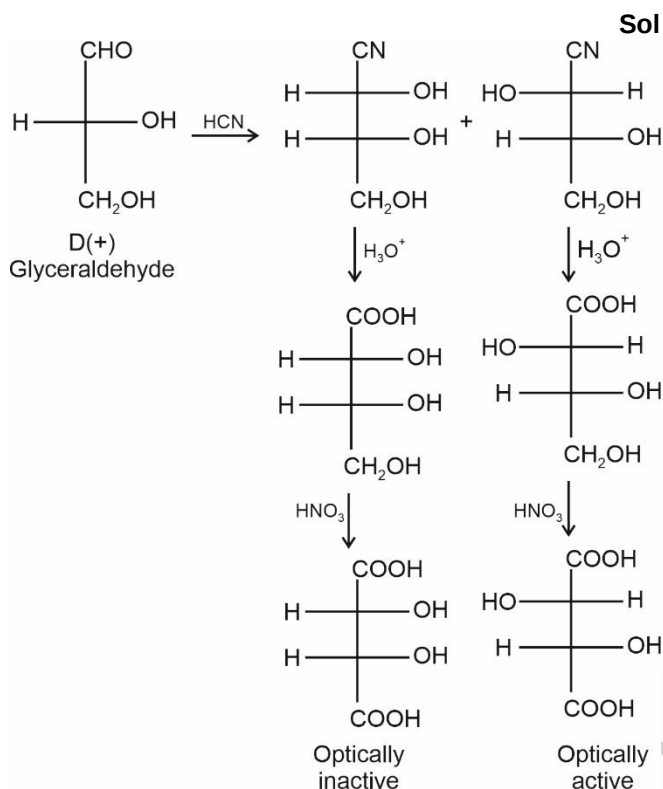
Sol. Boiling of hard water removes temporary hardness only. Treatment with washing soda as well as permutit process are useful in removing Ca^{2+} and Mg^{2+} ions from hard water but do not remove Cl^- and SO_4^{2-} ions. Synthetic resin method enables us to remove Ca^{2+} and Mg^{2+} ions as well as Cl^- and SO_4^{2-} ions. Therefore, synthetic resin method is the best method to remove hardness of water.

17. Glyceraldehyde $\xrightarrow[\text{ii. H}_3\text{O}^+]{\text{i. HCN}}$ A + B
 iii HNO_3

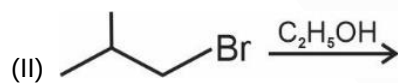
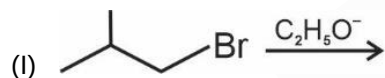
Then select the correct option about the product A and B

- (1) Both are optically active
 (2) Both are optically inactive
 (3) One is optically active and another is optically inactive
 (4) None of these

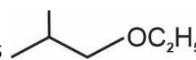
Answer (3)

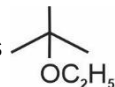


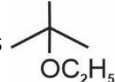
18. Consider the following reactions

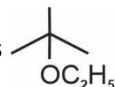


and identify the correct statement.

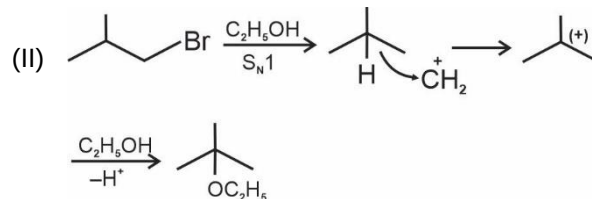
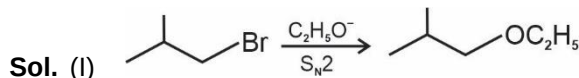
(1) In reaction (I), mechanism is $\text{S}_{\text{N}}1$ and the product is 

(2) In reaction (II), mechanism is $\text{S}_{\text{N}}1$ and the product is 

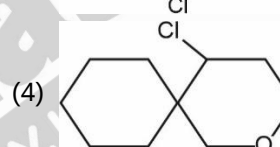
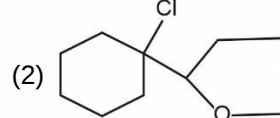
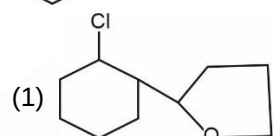
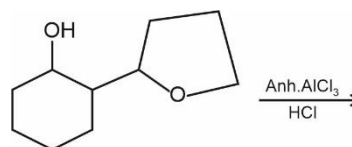
(3) In reaction (I), mechanism is $\text{S}_{\text{N}}2$ and the product is 

(4) In reaction (II), mechanism is $\text{S}_{\text{N}}2$ and the product is 

Answer (2)



19. Identify the major product formed in the following reaction



Answer (3)

Sol.

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. Radius of 2nd orbit of He^+ is r_0 . Radius of 4th orbit of Be^{+3} is xr_0 .

Find x .

Answer (02.00)

Sol. $r_0 = 0.529 \times \frac{(4)}{2}$

$$= 0.529 \times 2 \text{ \AA}$$

$$r_{\text{Be}}^{+3} = 0.529 \times \frac{(4)^2}{4}$$

$$= 0.529 \times 4$$

$$= 2r_0$$

$$\Rightarrow x = 2$$

22. An organic compound on combustion gives 0.22 g of CO_2 and 0.126 g H_2O . If the percentage of C in given organic compound is 40%, the % of H will be?

Answer (9.34)

$$\text{Sol. } C\% = \frac{12}{44} \times \frac{0.22}{\text{weight of sample}} \times 100$$

$$40 = \frac{12}{44} \times \frac{0.22}{\text{weight of sample}} \times 100$$

$$\therefore \text{weight of sample} = \frac{6}{40} = 0.15 \text{ g}$$

$$\therefore H\% = \frac{2}{18} \times \frac{0.126}{0.15} \times 100$$

$$= 9.33\%$$

23. For the 1st order reaction, the ratio of $t_{50\%}$ to $t_{87.5\%}$ will be:

Answer (3)

Sol. At 87.5% consumption, we have 3 half lives.

$$\therefore \frac{t_{87.5}}{t_{50\%}} = 3$$

24. If $\left(1 + \frac{1}{x}\right)^{1/2} v_{\text{av}} = v_{\text{rms}}$, then x is (Nearest integer)

Answer (6)

$$\text{Sol. } \left(1 + \frac{1}{x}\right)^{1/2} \sqrt{\frac{8RT}{\pi M}} = \sqrt{\frac{3RT}{M}}$$

$$\left(1 + \frac{1}{x}\right) \times \frac{8}{\pi} = 3$$

$$8x + 8 = 3\pi x$$

$$x = \frac{8}{(3\pi - 8)} = \frac{8}{1.42} \approx 5.63$$

25. A solution is isotonic with glucose having concentration 0.05 M at a certain temperature. If the volume of the solution is 1 L, find the molar mass of the solution if 12 g of the (in g/mol) solute is mixed to form the solution.

Answer (240)

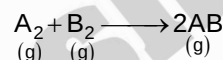
$$\text{Sol. } \frac{12}{x} = 0.05$$

$$\therefore x = \frac{12}{0.05}$$

$$= \frac{1200}{5}$$

$$= 240 \text{ g}$$

26. Consider a reaction



If ΔH_f° of A_2 , AB and B_2 are in the ratio $1 : \frac{1}{2} : 1$ and ΔH of the reaction is -200 kJ/mol . Find $\Delta H_f^\circ (\text{A}_2)$. (kJ mol^{-1})

Answer (200)

$$\text{Sol. } \Delta H_{\text{reaction}} = 2\Delta H_f^\circ (\text{AB}) - \Delta H_f^\circ (\text{A}_2) - \Delta H_f^\circ (\text{B}_2)$$

$$-200 = 2k - 2k - 2k \Rightarrow k = 100$$

$$\therefore \Delta H_f^\circ (\text{A}_2) = 200 \text{ kJ mol}^{-1}$$

27.

28.

29.

30.