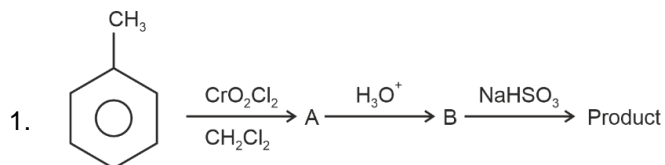


CHEMISTRY

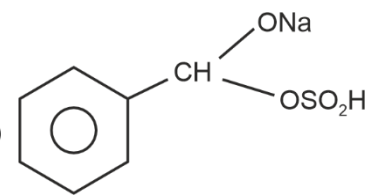
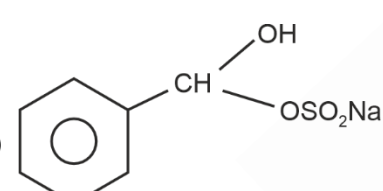
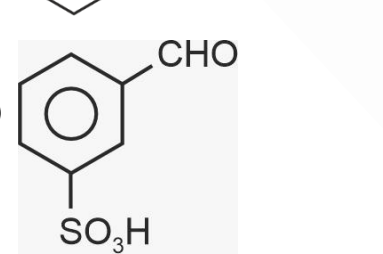
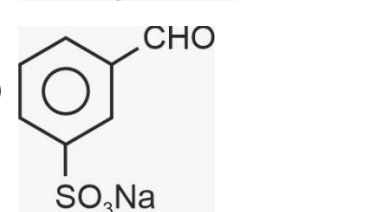
SECTION - A

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 :

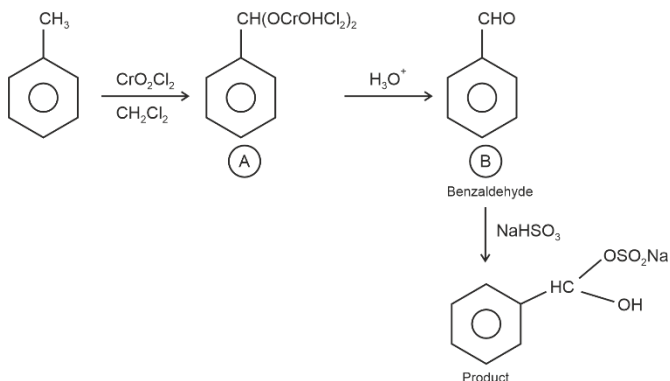


The product is

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

Answer (2)

Sol.



2. Density of 3 M NaOH is 1.25 g/ml. Molality of solution is

- (1) 2.65 (2) 2.5
(3) 2.8 (4) 3

Answer (1)

Sol.
$$M = \frac{1000 M}{1000 d - M \times M_0}$$

$$= \frac{3 \times 1000}{1250 - 3 \times 40}$$

$$= \frac{3 \times 1000}{1130} = 2.65$$

3. Arrange according to CFSE.

- (i) $[\text{Co}(\text{NH}_3)_4]^{2+}$
 (ii) $[\text{Co}(\text{NH}_3)_6]^{3+}$
 (iii) $[\text{Co}(\text{NH}_3)_6]^{2+}$
 (iv) $[\text{Co}(\text{en})_3]^{3+}$
 (1) (iv) > (ii) > (iii) > (i)
 (2) (iv) > (iii) > (ii) > (i)
 (3) (i) > (iii) > (ii) > (iv)
 (4) (i) > (ii) > (iii) > (iv)

Answer (1)

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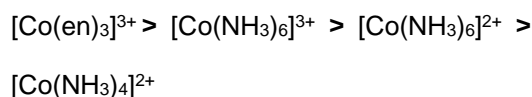
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Sol. Crystal Field Splitting Energy (CFSE)

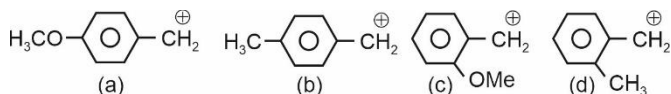
\propto Charge on central metal ion

\propto Ligand field strength

On this basis the correct decreasing order of CFSE



4. What is correct order of stability of carbocation.



- (1) $a > b > c > d$
- (2) $c > a > d > b$
- (3) $a > c > d > b$
- (4) $c > b > a > d$

Answer (3)

Sol. Solution stability of $\text{C}^{\oplus} \propto +M, \text{HC}, +I$

$$\propto \frac{1}{-M, -Z}$$

5. Which of the following anion will not undergo disproportionation?

- (1) ClO_4^-
- (2) ClO_3^-
- (3) ClO_2^-
- (4) ClO^-

Answer (1)

Sol. In $\text{ClO}_4^- \rightarrow$ chlorine is in its highest oxidation state i.e., +7.

Chlorine can exhibit -1 to $+7$ oxidation state.

The oxidation states of chlorine which can undergo disproportionation are : $0, +1, +3$ and $+5$.

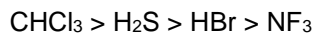
6. Compare dipole moment of

- | | |
|---|---|
| (I) NF_3 | (II) CHCl_3 |
| (III) H_2S | (IV) HBr |
| (1) $\text{I} > \text{II} > \text{III} > \text{IV}$ | (2) $\text{II} > \text{III} > \text{I} > \text{IV}$ |
| (3) $\text{II} > \text{III} > \text{IV} > \text{I}$ | (4) $\text{III} > \text{I} > \text{IV} > \text{II}$ |

Answer (3)

Sol. NH_3 CHCl_3 H_2S HBr
 $\Rightarrow 0.230$ 1.04 0.95 0.79

So, order is



7. Given below are two statements

S-I: Lassaigne test is used for detection of Nitrogen, phosphorous, sulphur and Halogens.

S-II: Lassaigne extract is made with magnesium metal.

- (1) Both S-I and S-II are correct.
- (2) Both S-I and S-II are incorrect.
- (3) S-I is correct but S-II is incorrect.
- (4) S-I is incorrect but S-II is correct

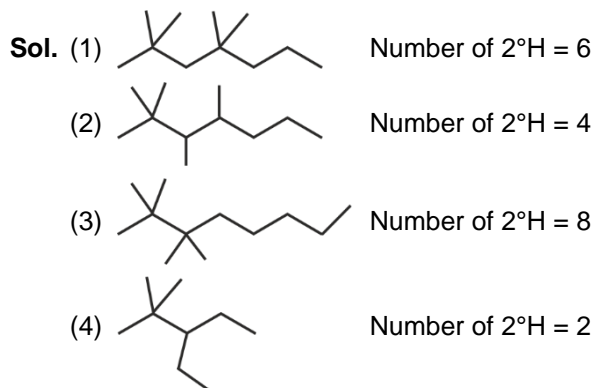
Answer (3)

Sol. Lassaigne extract is made with sodium metal, and not with magnesium metal.

8. Which one has two secondary Hydrogen atoms?

- (1) 2, 2, 4, 4-tetramethylheptane
- (2) 2, 2, 3, 4-tetramethylheptane
- (3) 2, 2, 3, 3-tetramethyloctane
- (4) 3-ethyl-2, 2-dimethylpentane

Answer (4)



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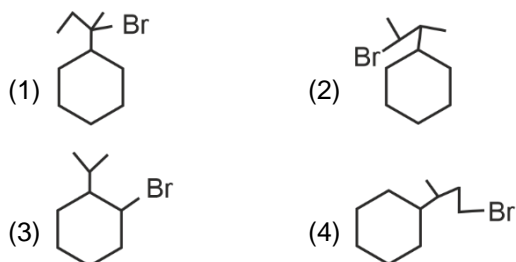
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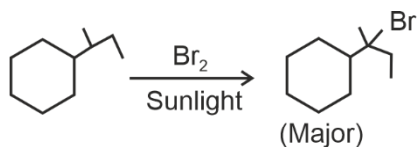
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9. Secondary butyl cyclohexane when reacts with Br₂ in presence of sunlight produce



Answer (1)

Sol.



10. 200 mL of 0.2 M solution of NaOH is mixed with 400 mL of 0.5 M NaOH solution. Molarity of mixture is

- (1) 0.4 (2) 0.6
(3) 4 M (4) 0.8 M

Answer (1)

Sol. M₁ = 0.2 M

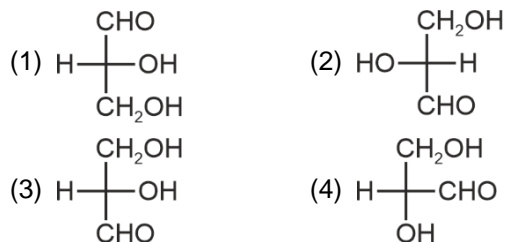
M₂ = 0.5 M

V₁ = 200 mL

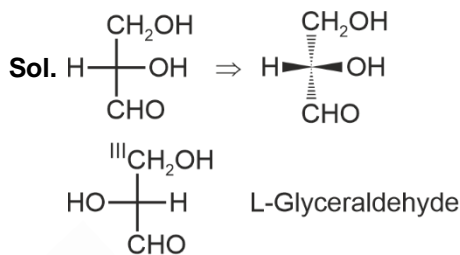
V₂ = 400 mL

$$\begin{aligned} \text{Molarity of mixture} &= \frac{M_1 V_1 + M_2 V_2}{V_1 + V_2} \\ &= \frac{0.2 \times 200 + 0.5 \times 400}{600} \text{ M} \\ &= \frac{40 + 200}{600} \\ &= \frac{240}{600} = 0.4 \text{ M} \end{aligned}$$

11. Correct structure of L-Glyceraldehyde is



Answer (3)



12. Identify the extensive and intensive property?

- (1) Mass, volume, conductivity – Intensive property
(2) Mass, temperature, heat, volume – Extensive property
(3) Mass, volume, internal energy – Extensive property
(4) Density, temperature, moles, internal energy – Intensive property

Answer (3)

Sol. The properties which do not depend upon amount of substance is known as intensive property and the properties which depend upon amount of substance are extensive properties of matter.

Mass, volume and internal energy depend on amount of substance.


13. Among Group-15 elements, what is the maximum covalency of an element having weakest E-E bond (E = element)

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

Answer (3)

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Sol. The E – E bond energies of the elements of group-15 are

N – N	167 kJ mol ⁻¹
P – P	201 kJ mol ⁻¹
As – As	146 kJ mol ⁻¹
Sb – Sb	121 kJ mol ⁻¹

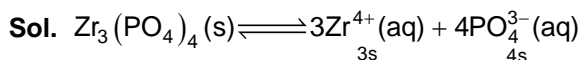
Antimony (Sb) has the weakest E – E bond and its maximum covalency is 5.

14. What is the relation between K_{sp} and S of $Zr_3(PO_4)_4$

$$(1) S = \left(\frac{K_{sp}}{6912}\right)^{\frac{1}{7}} \quad (2) S = \left(\frac{K_{sp}}{144}\right)^{\frac{1}{7}}$$

$$(3) S = \frac{K_{sp}}{6912} \quad (4) \text{None}$$

Answer (1)



$$K_{sp} = (3s)^3(4s)^4$$

$$= 27 \times 256 S^7$$

$$K_{sp} = 6912 S^7$$

$$S = \left(\frac{K_{sp}}{6912}\right)^{\frac{1}{7}}$$

15. Match the column and choose the correct option

(A)	$\left(\frac{\partial H}{\partial T}\right)_P$	(P)	C_P
(B)	$\left(\frac{\partial G}{\partial P}\right)_T$	(Q)	C_V
(C)	$\left(\frac{\partial U}{\partial T}\right)_V$	(R)	$-S$
(D)	$\left(\frac{\partial G}{\partial T}\right)_P$	(S)	V

- (1) (A) – (P), (B) – (S), (C) – (Q), (D) – (R)
 (2) (A) – (P), (B) – (S), (C) – (R), (D) – (Q)
 (3) (A) – (P), (B) – (R), (C) – (Q), (D) – (S)
 (4) (A) – (Q), (B) – (S), (C) – (P), (D) – (R)

Answer (1)

Sol. Heat exchanged at constant pressure is ΔH

Heat exchanged at constant volume is ΔU

16. Consider the following statements S-1 and S-2 and choose the correct option.

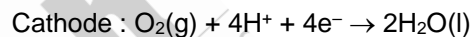
S-1 : During corrosion pure metal acts as anode and impure metal acts as cathode.

S-2 : Rate of corrosion is more in alkaline medium than in acidic medium.

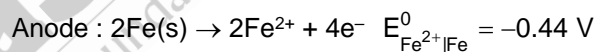
- (1) Both S-1 and S-2 are correct
 (2) Both S-1 and S-2 are incorrect
 (3) S-1 is correct but S-2 is incorrect
 (4) S-1 is incorrect but S-2 is correct

Answer (2)

Sol. In corrosion, a metal is oxidised by loss of electrons to oxygen. Electron released at anodic spot move through the same metal and go to another spot on the metal and reduce oxygen in the presence of H^+ (which is believed to be available from H_2CO_3 formed due to dissolution of CO_2 from air into water.



$$E^0_{H^+|O_2|H_2O} = 1.23 V$$



\therefore Both the statements S-1 and S-2 are incorrect.

17.
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. In Ru and Nb, if in Ru, $4d$ electrons are x and in Nb, $4d$ electrons are y then find the sum of x and y .

Answer (11)

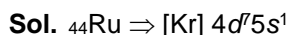
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$$x = 7$$



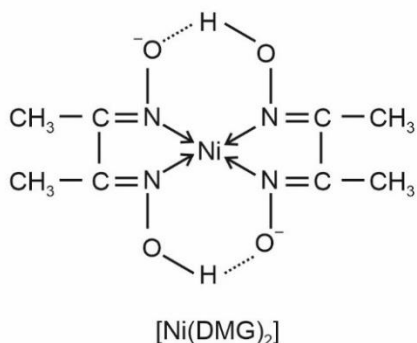
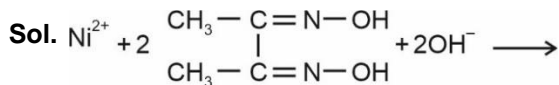
$$y = 4$$

$$x + y = 11$$

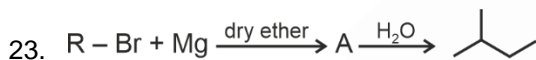


How many hydrogen bonds are present in a molecule of the complex?

Answer (2)



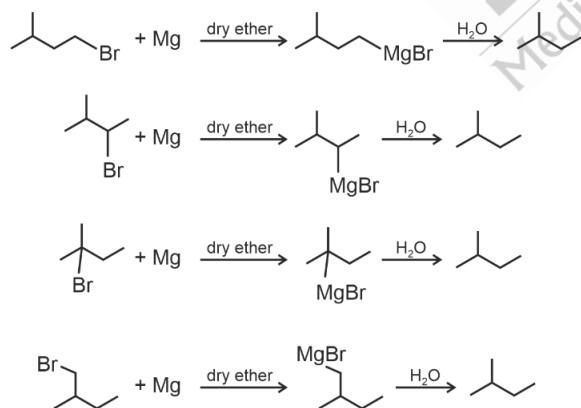
Number of H-bonds in a molecule of [Ni(DMG)₂] = 2



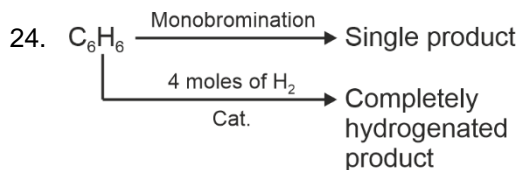
How many R - Br can form isopentane?

Answer (4)

Sol.



\therefore Total 4 R-Br can form isopentane in this reaction.

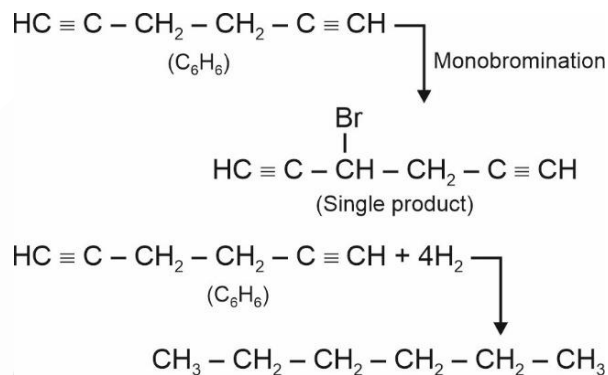


Find the number of π -electrons in C_6H_6 .

Answer (8)

Sol. Degree of unsaturation of $\text{C}_6\text{H}_6 = 4$

C_6H_6 is a symmetrical dialkyne.



Number of π -electrons in $\text{C}_6\text{H}_6 = 8$

25. Calculate the radius of first excited state of He^+ ion (in Å)

Answer (1)

Sol. $r = a_0 \frac{n^2}{z}$

$$n = 2$$

$$z = 2$$

$$r = a_0 \frac{4}{2}$$

$$= 2a_0$$

$$= 2 \times 0.529$$

$$= 1.058$$

$$\approx 1$$

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