

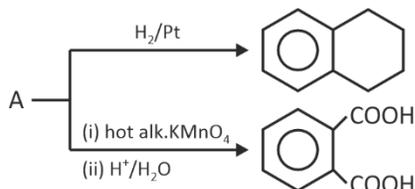
CHEMISTRY

SECTION - A

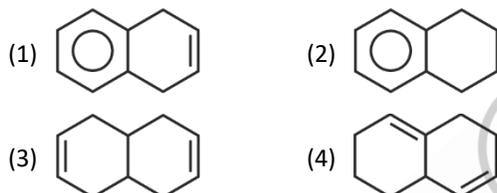
Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

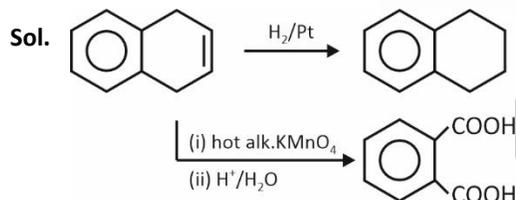
1. Consider the following reaction :



Then 'A' will be



Answer (1)



2. In Sulphur estimation, 0.7 g of an organic compound gives 1 g of BaSO₄ by Carius method. What is the % of 'S' in compound?

- (1) 19.61
(2) 23.85
(3) 27.93
(4) 14.57

Answer (1)

Sol. % of S = $\frac{1}{233} \times 32 \times 100 = 19.61\%$

3. Which of the following is the correct order with respect to the property indicated?

- (1) Cl > F (Ionisation energy)
(2) K₂O > Na₂O > Al₂O₃ (Basic nature)
(3) K > Na > Al > Mg (Metallic character)
(4) None of these

Answer (2)

Sol. F > Cl : First ionisation energy (due to small size of F)

K > Na > Mg > Al : Metallic character (It decreases from Left to Right across the period and increases from Top to Bottom.

4. Given below are two statements.

Statement I : Arginine and Tryptophan are essential amino acids.

Statement II : Glycine does not have any chiral carbon.

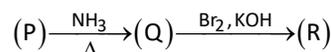
In the light of the above statements, which is the correct option.

- (1) Both statement-I and statement-II are correct
(2) Both statement-I and statement-II are incorrect
(3) Statement-I is correct and statement-II is incorrect
(4) Statement-I is incorrect and statement-II is correct

Answer (1)

Sol. Arginine and Tryptophan both are essential amino acids. Glycine does not contain any chiral centre.

5. Observe the following reaction sequence:



Which of the following is the correct structure for P, Q and R?

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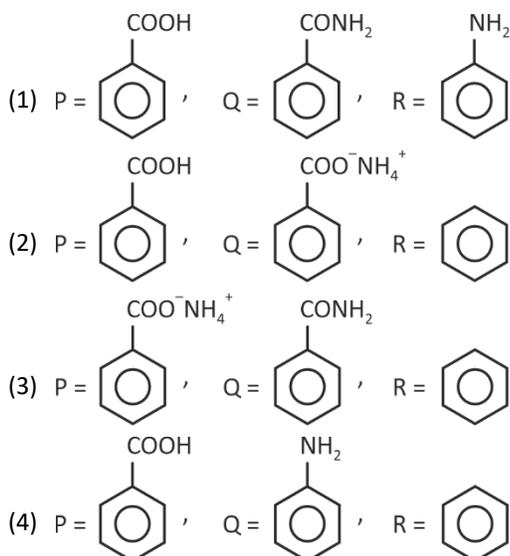


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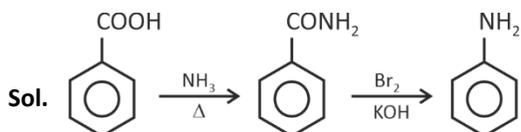


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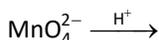




Answer (1)



6. In the following reaction,



Manganate ion undergoes disproportionation in acidic medium to form

- (1) $\text{MnO}_2, \text{MnO}_4^-$ (2) MnO, MnO_2
 (3) $\text{MnO}_2, \text{Mn}_2\text{O}_3$ (4) $\text{MnO}_4^-, \text{MnO}$

Answer (1)

Sol. MnO_4^{2-} disproportionates in acidic solution to gives

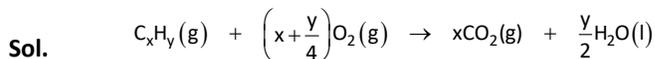
MnO_4^- and MnO_2



7. 80 mL of an organic compound is mixed with 264 mL O_2 and ignited. It gives 224 mL of gaseous mixture at NTP. After passing through KOH 64 mL of gas remains. The organic compound is

- (1) C_2H_4 (2) C_2H_2
 (3) C_4H_{10} (4) C_3H_6

Answer (2)



$t=0$ 80 mL 264 mL

$(V_{\text{CO}_2} + V_{\text{O}_2})_{\text{after reaction}} = 224 \text{ mL}$

After passing through KOH, 64 mL gas left

$(V_{\text{O}_2})_{\text{left}} = 64 \text{ mL}$

$(V_{\text{O}_2})_{\text{used}} = 200 \text{ mL}$

$(V_{\text{CO}_2})_{\text{formed}} = 224 - 64 = 160 \text{ mL}$

1 mL $\text{C}_x\text{H}_y \rightarrow x \text{ mL CO}_2$

80 mL $\rightarrow 160 \text{ mL CO}_2$

$x = 2$

$$\frac{V_{\text{C}_x\text{H}_y}}{1} = \frac{(V_{\text{O}_2})_{\text{used}}}{x + \frac{y}{4}}$$

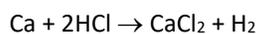
$$80 = \frac{200}{\left(2 + \frac{y}{4}\right)}$$

$160 + 20y = 200$

$20y = 40$

$y = 2$ formula C_2H_2

8. Consider the following reaction



We have 14 g Ca reacts with excess of HCl. Choose the incorrect option.

- (1) Mass of CaCl_2 produced is 38.85 g
 (2) Mole of H_2 produced is 0.35 mol
 (3) Volume of H_2 produced at STP is 7.84 L
 (4) Mass of CaCl_2 produced is 3.885 g

Answer (4)

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Sol. $\text{Ca} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$

$$\frac{14}{40} = 0.35 \text{ mol}$$

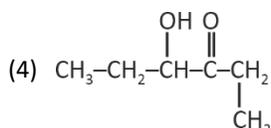
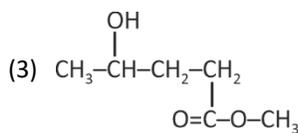
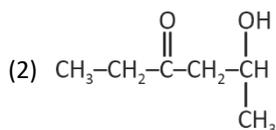
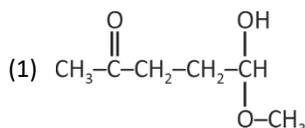
$$n_{\text{CaCl}_2} = 0.35$$

$$W_{\text{CaCl}_2} = 38.85 \text{ g}$$

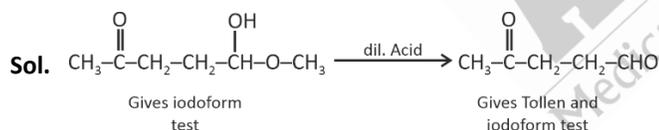
$$n_{\text{H}_2} = 0.35$$

$$V_{\text{H}_2} \text{ at STP} = 0.35 \times 22.4 = 7.84 \text{ L}$$

9. $\text{C}_6\text{H}_{12}\text{O}_3$ gives positive iodoform test on hydrolysis with dil. Acid. The hydrolysis product formed gives Tollens' and iodoform test both. Find structure of $\text{C}_6\text{H}_{12}\text{O}_3$.



Answer (1)



10. Given below are two statements :

Statement I : All the pairs of molecules (PbO , PbO_2); (SnO , SnO_2) and (GeO , GeO_2) contain amphoteric oxides.

Statement II : AlCl_3 , BH_3 , BeH_2 and NO_2 all have incomplete octet.

In the light of the above statements, choose the correct option.

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

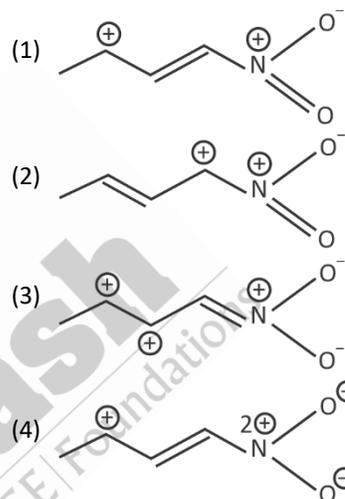
Answer (4)

Sol. • SnO , SnO_2 , PbO , PbO_2 are amphoteric oxides.

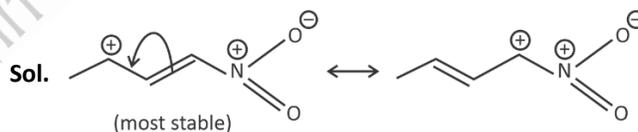
• GeO_2 is acidic.

• GeO is distinctly acidic.

11. Which of the following resonating structure is the most stable?



Answer (1)



12. Consider the following statements.

- (A) Propanal and Propanone are functional isomers
- (B) Ethoxyethane and methoxypropane are metamers
- (C) But-2-ene shows optical isomerism
- (D) But-1-ene and But-2-ene are functional isomers
- (E) Pentane and 2, 2-dimethylpropane are chain isomers

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The correct statements are

- (1) A, B, D only
- (2) B, C, D only
- (3) A, B, E only
- (4) A, B, D, E only

Answer (3)

Sol. • But-2-ene doesn't show optical isomerism as it contains plane of symmetry and has no chiral centre also.

- But-1-ene and But-2-ene are position isomers.

13. Given below are two statements

Statement I: When electric discharge is put on hydrogen, it emits discrete frequency in electromagnetic spectrum.

Statement II: Frequency of He^+ ion of 2nd line of Balmer series is equal to first line of Lyman series.

- (1) Both statement I and statement II are correct
- (2) Both statement I and statement II are incorrect
- (3) Statement I is correct and statement II is incorrect
- (4) Statement I is incorrect and statement II is correct

Answer (1)

Sol. For He^+ ion

$$v \propto z^2 \left(\frac{1}{2^2} - \frac{1}{4^2} \right) \propto 2^2 \left(\frac{1}{2^2} - \frac{1}{4^2} \right)$$

$$\propto \frac{3}{4}$$

For H atom

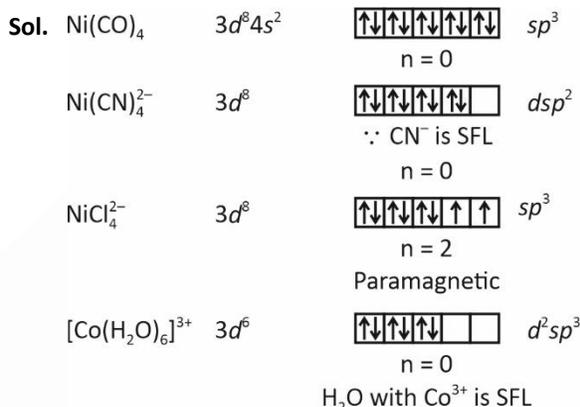
$$v \propto 1^2 \left(\frac{1}{1^2} - \frac{1}{2^2} \right) \propto \frac{3}{4}$$

∴ frequency is same.

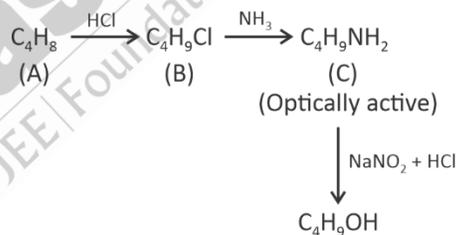
14. Which of the following compound is paramagnetic in nature?

- (1) $[\text{Ni}(\text{CO})_4]$
- (2) $[\text{Ni}(\text{CN})_4]^{2-}$
- (3) $[\text{NiCl}_4]^{2-}$
- (4) $[\text{Co}(\text{H}_2\text{O})]^{3+}$

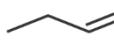
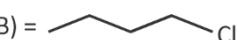
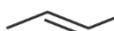
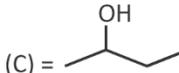
Answer (3)



15. Observe the following reaction sequence :



Which of the following is correct structure of A, B and C?

- (1) (A) =  , (B) = 
(C) = 
- (2) (A) =  , (B) = 
(C) = 

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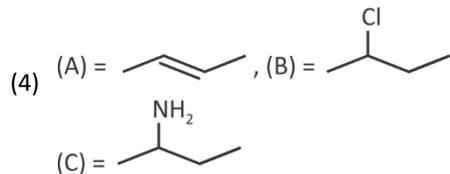
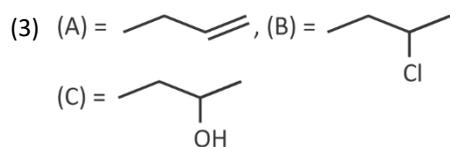
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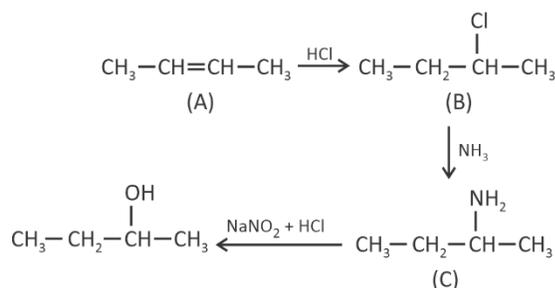
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Answer (4)

Sol.



16.
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. For two chemical reactions A and B, if the difference between their activation energy is 20 kJ at 300 K ($R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$). Determine $\ln \frac{k_2}{k_1}$.

Answer (8)

Sol. For reaction A,

$$k_1 = Ae^{-\frac{E_{a1}}{RT}}$$

For reaction B,

$$k_2 = Ae^{-\frac{E_{a2}}{RT}}$$

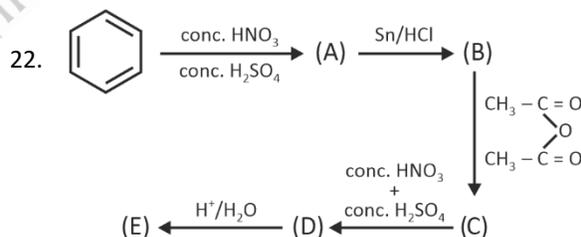
$$\frac{k_2}{k_1} = \frac{e^{-\frac{E_{a2}}{RT}}}{e^{-\frac{E_{a1}}{RT}}}$$

$$\frac{k_2}{k_1} = e^{-\frac{E_{a2} - E_{a1}}{RT}}$$

$$\ln \frac{k_2}{k_1} = \frac{-E_{a2} + E_{a1}}{RT}$$

$$\ln \frac{k_2}{k_1} = \frac{20000}{8.3 \times 300}$$

$$\ln \frac{k_2}{k_1} \approx 8$$



% of N in compound E is _____

Answer (20)

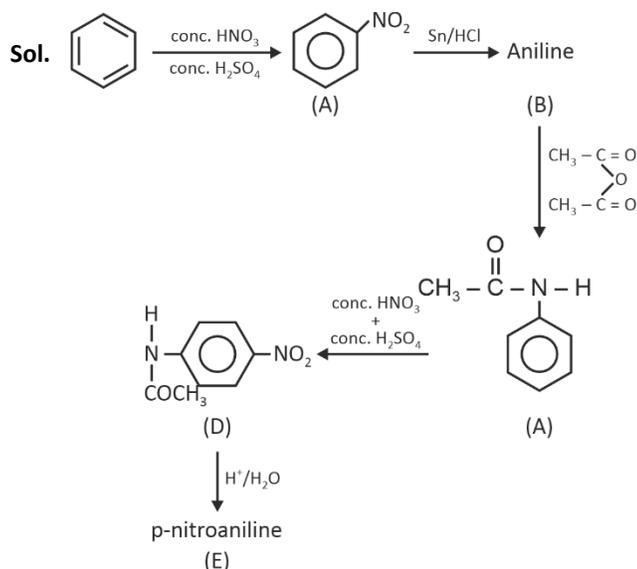
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$$\% \text{ of N} = \frac{14 \times 2 \times 100}{138} = 20.28 \approx 20$$

23. 1 g of AB_2 is dissolved in 50 g solvent such that $\Delta T_f = 0.689$. When 1 g AB is dissolved in 50 g of same solvent, ΔT_f is 1.176. Find molar mass of AB_2 . $K_f = 5 \text{ K kg/mol}$.

AB_2 and AB are non electrolyte. (Report to nearest integer)

Answer (145 g)

Sol. Let 'a' and 'b' are atomic weight of 'A' and 'B' respectively

$$0.689 = 5 \left[\frac{1}{a+2b} \times \frac{1000}{50} \right] \quad \dots(1)$$

$$1.176 = 5 \left[\frac{1}{a+b} \times \frac{1000}{50} \right] \quad \dots(2)$$

$$\frac{0.689}{1.176} = \frac{a+b}{a+2b} = \frac{1}{1.7}$$

$$\Rightarrow 1.7a + 1.7b = a + 2b$$

$$0.7a = 0.3b$$

$$b = \frac{7}{3}a$$

$$\text{Now, } 1.176 = \left[\frac{1}{a + \frac{7}{3}a} \times 20 \right] \times 5 = \frac{300}{10a}$$

$$\Rightarrow a = \frac{30}{1.176} = 25.51$$

$$b = \frac{7}{3}a = 59.52 \text{ g}$$

$$M_{AB_2} = 25.51 + 2 \times 59.52 = 144.55 \text{ g}$$

24. Out of the following, how many compounds have tetrahedral geometry?

NH_4^+ , XeF_4 , $[NiCl_4]^{2-}$, $[PtCl_4]^{2-}$, $[Cu(NH_3)_4]^{2+}$, BF_3 and $[Ni(CO)_4]$

Answer (3)

Sol.

Species		Geometry
NH_4^+	\Rightarrow	Tetrahedral
XeF_4	\Rightarrow	Octahedral
$[NiCl_4]^{2-}$	\Rightarrow	Tetrahedral
$[PtCl_4]^{2-}$	\Rightarrow	Square planar
$[Cu(NH_3)_4]^{2+}$	\Rightarrow	Square planar
BF_3	\Rightarrow	Triangular Planar
$[Ni(CO)_4]$	\Rightarrow	Tetrahedral

25.

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