

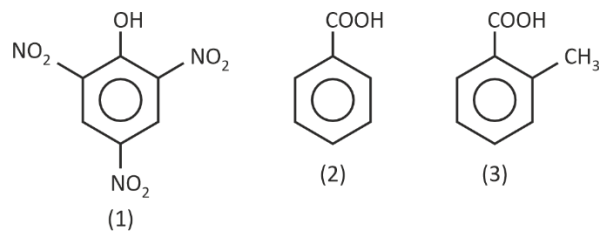
CHEMISTRY

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. What is the rate of reaction for releasing CO₂(g) with aq. NaHCO₃ among following?



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

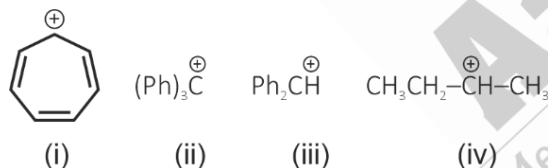
Answer (3)

Sol. pK_a (Benzoic acid) : 4.27

pK_a (o-Toluic acid) : 3.91 → due to ortho effect.

pK_a (Picric acid) : 0.3

2. Consider the following carbocations



The correct increasing order of stability of these carbocations is:

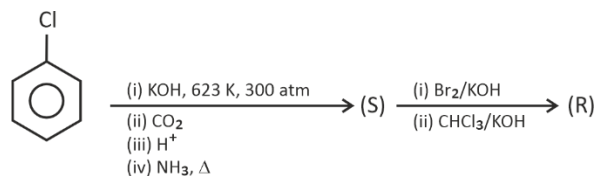
- (1) (i) < (ii) < (iii) < (iv) (2) (iv) < (iii) < (ii) < (i)
(3) (ii) < (iii) < (iv) < (i) (4) (iv) < (iii) < (i) < (ii)

Answer (2)

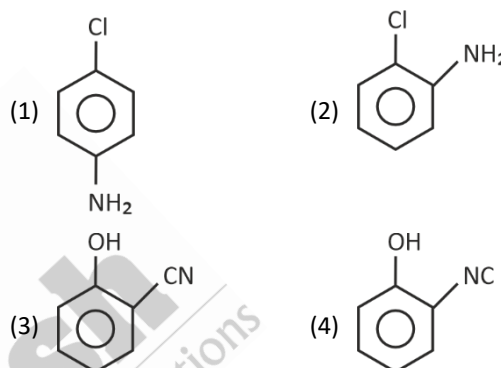
Sol. Tropylium carbocation is most stable due to presence of aromaticity.

∴ (i) > (ii) > (iii) > (iv) is the correct order of stability of carbocation.

3. In the given reaction sequence:

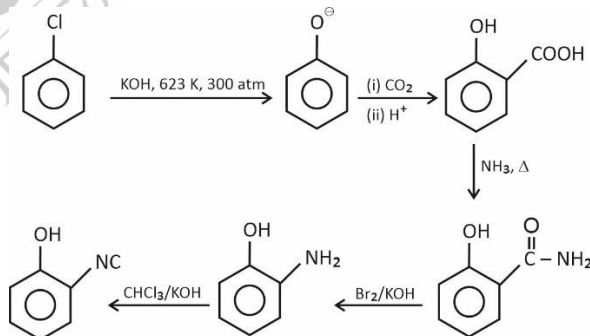


The compound R is



Answer (4)

Sol.



4. Which of the following pair have square pyramidal shape?

- (1) BrF₅, XeOF₄ (2) SbF₅, BrF₅
(3) PCl₅, XeOF₄ (4) PCl₅, SbF₅

Answer (1)

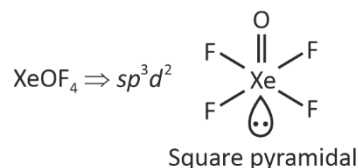
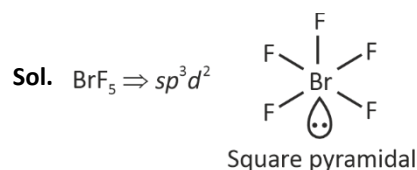
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5. Which of the following set of quantum numbers have same energy?

- (a) $n = 2, l = 2, m = +1$
- (b) $n = 2, l = 1, m = -1$
- (c) $n = 3, l = 2, m = 0$
- (d) $n = 3, l = 2, m = 1$

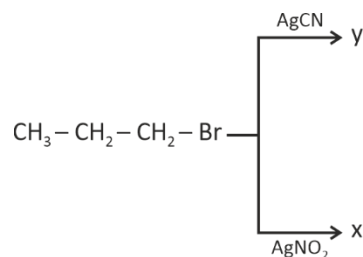
- (1) a, b
- (2) b, c
- (3) c, d
- (4) a, c

Answer (3)

- Sol.: (a) $\Rightarrow 2d =$ does not exist
 (b) $\Rightarrow 2p$
 (c) $\Rightarrow 3d$ same energy
 (d) $\Rightarrow 3d$ same energy

The value of $n + l$ is same for (c) and (d) both represents $3d$ orbital

6. Consider the following reaction



The major product x and y respectively are

- (1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{ONO}$ & $\text{CH}_3\text{CH}_2\text{CH}_2\text{CN}$
- (2) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2$ & $\text{CH}_3\text{CH}_2\text{CH}_2\text{CN}$
- (3) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2$ & $\text{CH}_3\text{CH}_2\text{CH}_2\text{NC}$
- (4) $\text{CH}_3\text{CH}_2\text{CH}_2\text{ONO}$ & $\text{CH}_3\text{CH}_2\text{CH}_2\text{CN}$

Answer (3)

Sol. CN^- and NO_2^- are ambidentate nucleophile but since AgCN and AgNO_2 are covalent compound, so only the nitrogen can donate electrons.

7. Match the following column and choose the correct option.

	Column-I		Column-II
(A)	$\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2$	(P)	Combustion reaction
(B)	$\text{NaH} \rightarrow \text{Na} + \text{H}_2$	(Q)	Disproportionation reaction
(C)	$\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$	(R)	Decomposition reaction
(D)	$\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$	(S)	Displacement reaction

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

Answer (3)

- Sol. $\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2$: Disproportionation reaction
 $\text{NaH} \rightarrow \text{Na} + \text{H}_2$: Decomposition reaction
 $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$: Combustion reaction
 $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$: Displacement reaction

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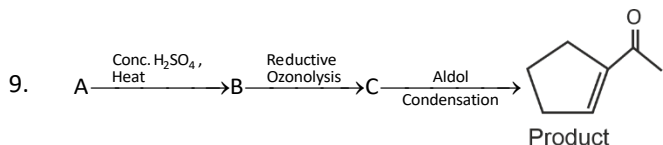
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8. Among the following the incorrect order of atomic radius is

- (1) $B > Al > Mg > F$ (2) $Al > B > N > F$
 (3) $Mg > Al > Be > O$ (4) $Mg > Be > N > F$

Answer (1)

Sol. As we move down the group size increases whereas on moving left to right in a period size decreases

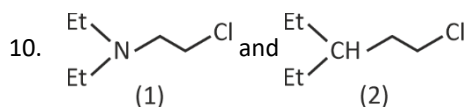
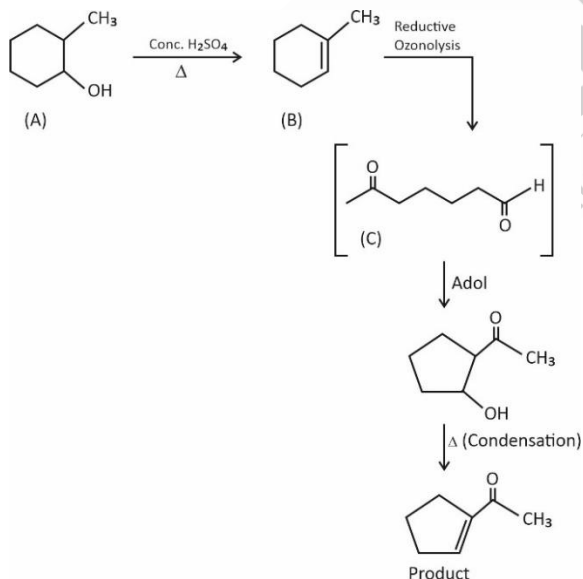


Identify the Compound A

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

Answer (1)

Sol.

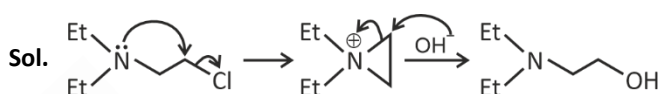


Statement-I: Compound (2) shows faster alkaline hydrolysis compared to (1).

Statement-II: Compound (1) shows substitution via neighbouring group participation.

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

Answer (2)



11. Which of the following has same energy in absence of electric and magnetic field for hydrogen atom?

- (1) 2s, 3p (2) 3s, 2p
 (3) 2s, 2p (4) 3s, 4f

Answer (3)

Sol. For hydrogen atom in absence of electric and magnetic field, energy only depends on principal quantum number (n). For same the value of n, energy will be same. Hence 2s and 2p have same energy.

12. Which of the following reaction(s)/test(s) can be used to distinguish acetaldehyde and acetone?

- (A) Iodoform Test (B) Cannizzaro
 (C) Aldol Condensation (D) Fehling's Test
 (E) Tollen's Test (F) Clemmensen's Reduction

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

Answer (1)

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Sol. CH_3CHO will react with Fehling's solution and Tollen's reagent while CH_3COCH_3 will not. Iodoform, Aldol and Clemmensen's reduction will be shown by both

13. Which of the following give violet colour in Borax bead test?

- (1) Cr^{3+}
- (2) Mn^{2+}
- (3) Co^{3+}
- (4) Fe^{2+}

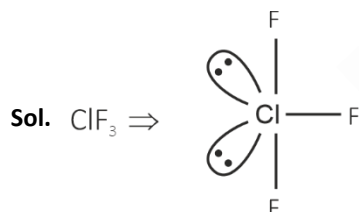
Answer (2)

Sol. Colour of Borax bead in oxidising flame is violet for Mn^{2+} .

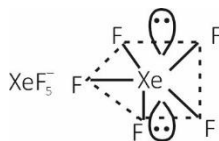
14. Which of the following compounds have the same number of lone pair on central atom as ClF_3 .

- (1) XeF_5^-
- (2) XeF_2
- (3) BrF_5
- (4) I_3^-

Answer (1)



No. of lone pairs on central atom = 2



No. of lone pairs on central atom = 2

$\text{XeF}_2 \Rightarrow$ no. of lone pairs on central atom = 3

$\text{I}_3^- \Rightarrow$ no. of lone pairs on central atom = 3

$\text{BrF}_5 \Rightarrow$ no. of lone pair on central atom = 1

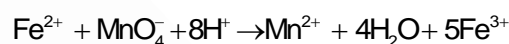
15. **Statement 1:** For titration of oxalic acid using KMnO_4 , warming of acid solution is required whereas in case of Ferrous Ammonium Sulphate, it is done at room temperature.

Statement 2: Fe^{2+} converts to Fe^{3+} during titration.

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

Answer (1)

Sol. In case of oxalic acid warming of solution (50°C - 60°C) is done as rate of reaction is very slow at room temperature.



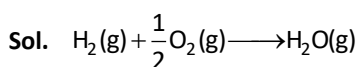
- 16.
- 17.
- 18.
- 19.
- 20.

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. $\Delta_f H$ of $\text{H}(\text{g})$ is 222 kJ/mol, $\Delta_f H$ of $\text{O}(\text{g})$ is 250 kJ/mol, $\Delta_f H$ of $\text{H}_2\text{O}(\text{g})$ is -248 kJ/mol. What is the value of Bond Energy of O - H bond in H_2O in kJ/mol?

Answer (471)



$$\Delta_f H = \sum (\text{B.E. of reactant}) - \sum (\text{B.E. of product})$$

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$$-248 = 444 + 250 - (2 \times B.E._{O-H})$$

$$2B.E._{O-H} = 942$$

$$2B.E._{O-H} = 471 \text{ kJ/mole}$$

22. 70% by mass solution of HNO_3 is taken having density 1.41 g/mL. Calculate the molarity of solution

Answer (16)

$$\begin{aligned} \text{Sol. } M &= \frac{10 \times d}{M_0} \\ &= \frac{10 \times 70 \times 1.41}{63} \\ &= 15.66 \text{ M} \end{aligned}$$

23. 1g of a non-electrolyte solute (MW = 256 g/mol) is dissolved in 50g of solvent, freezing point of solution is lowered by 0.40 K. Calculate the Molal depression constant of solvent.

Answer (5)

$$\text{Sol. } \Delta T_f = i k_f \times m$$

$$\Delta T_f = i x k_f \times \frac{W_{\text{solute}}}{MW_{\text{solute}} \times W_{\text{solvent}}} \times 1000$$

$$0.4 = k_f \times \frac{1 \times 1000}{256 \times 50}$$

$$k_f = \frac{0.4 \times 256 \times 50}{1000}$$

$$k_f = 5.12 \text{ K kg mol}^{-1}$$

24. A compound contains 14.4% carbon, 1.2% hydrogen and 84.4% chlorine, calculate empirical formula mass of compound.

(Molar mass of C = 12, H = 1, Cl = 35.5)

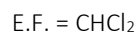
Answer (84)

$$\text{Sol. Let mass of compound} = 100\text{g}$$

	Mole	Molar ratio
C = 14.4g	$\Rightarrow \frac{14.4}{12} = 1.2$	1

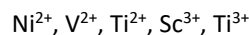
$$\text{H} = 1.2\text{g} \Rightarrow \frac{1.2}{1} = 1.2 \quad 1$$

$$\text{Cl} = 84.4\text{g} \Rightarrow \frac{84.4}{35.5} = 2.4 \quad 2$$



$$\text{E.F. mass} = 84$$

25. How many of the following ions have same value of spin only magnetic moment?



Answer (2)

- Sol.** The ions having same number of unpaired electrons having same value of spin only magnetic moment.

$$\mu = \sqrt{n(n+2)} \text{ BM} \quad (n = \text{Number of unpaired electron})$$



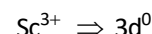
$$n = 2$$



$$n = 3$$



$$n = 2$$



$$n = 0$$



$$n = 1$$

Ni^{2+} and Ti^{2+} have same value of spin only magnetic moment.

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