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. Why $KMnO_4$ shows colour?

(1) Due to d-d transition

(2) Due to metal to ligand charge transfer

(3) Due to ligand to metal charge transfer

(4) Due to F-centre

Answer (3)

Sol. Colour of $KMnO_4$ is due to LMCT (Ligand to metal charge transfer.

2. C is added to solution of A and B, find mole fraction of C.

(1) $\dfrac{n_C}{n_A + n_B + n_C}$ (2) $\dfrac{n_C}{n_A \cdot n_B + n_C}$

(3) $\dfrac{n_C}{n_A \cdot n_C + n_B}$ (4) $\dfrac{n_C}{n_A + n_B}$

Answer (1)

Sol. In a mixture of A, B and C

Mole fraction = $\dfrac{n_C}{n_A + n_B + n_C}$

3. IUPAC name of compound $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - C \equiv CH$ is

(1) 2-Methylbutyne

(2) 3-Methylbut-1-yne

(3) 2-methylbutene

(4) 3-methylbutane

Answer (2)

Sol. $\overset{4}{CH_3} - \underset{\displaystyle CH_3}{\underset{|}{\overset{3}{CH}}} - \overset{2}{C} \equiv \overset{1}{CH}$

3-Methylbut-1-yne

4. Which of the following solution will have lowest freezing point?

(1) 180 g glucose in 1 L solution

(2) 180 g of benzoic acid in 1 L solution

(3) 180 g of CH_3COOH in 1 L solution

(4) 180 g sucrose in 1 L solution

Answer (3)

Sol. ΔT_f = (i) (k_f) (m)

Molality is highest for 180 gm of CH_3COOH in 1 litre solution.

5. Arrange the following according to their decreasing oxidising power.

BrO_4^-, IO_4^-, ClO_4^-

(1) $ClO_4^- > IO_4^- > BrO_4^-$

(2) $BrO_4^- > IO_4^- > ClO_4^-$

(3) $IO_4^- > BrO_4^- > ClO_4^-$

(4) $BrO_4^- > ClO_4^- > IO_4^-$

Answer (2)

Sol. The reduction potential of BrO_4^-, IO_4^- and ClO_4^- are 1.75 V, 1.65 V and 1.20 V respectively. Thus BrO_4^-, has the highest oxidising power and ClO_4^- has the lowest oxidising power among the given perhalates.

6. Salicylaldehyde forms from phenol by reacting with which reagent?

(1) CO_2, NaOH

(2) $CHCl_3$, NaOH

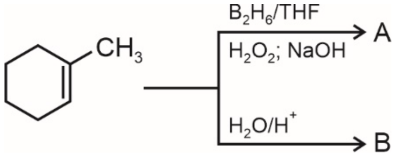
(3) CCl_4, NaOH

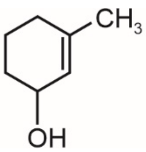
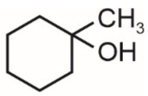
(4) H_2O, H^+

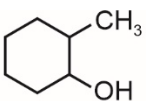
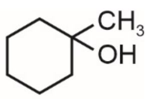
Answer (2)

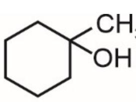
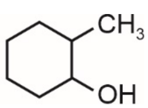
Sol. In Reimer Tiemann reaction phenol reacts with $CHCl_3$, NaOH to give salicylaldehyde.

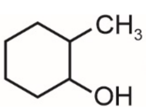
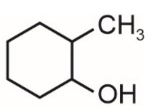
7. Complete the following reactions and find major products A and B



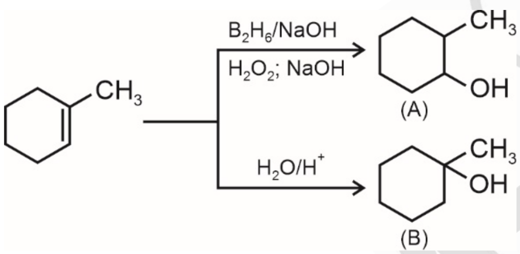
(1) A =  B = 

(2) A =  B = 

(3) A  ; 

(4) A =  ; B = 

Answer (2)

Sol. 

Correct answer is option (2)

8. What is the correct IUPAC name of the given compound?

$$CH_3-\underset{\underset{NH_2}{|}}{CH}-CH_2-CH_2-CN$$

(1) 4-Aminopentanenitile

(2) 2-Aminopentanenitile

(3) 3-Aminobutanenitile

(4) 2-Aminobutanenitrile

Answer (1)

Sol. $$\overset{5}{CH_3}-\underset{\underset{NH_2}{|}}{\overset{4}{CH}}-\overset{3}{CH_2}-\overset{2}{CH_2}-\overset{1}{CN}$$

4-Aminopentanenitile

9. In the given reactions A and B respectively are:

$$CrO_2Cl_2 + NaOH \longrightarrow A + NaCl + H_2O$$

$$H_2SO_4 + A + H_2O_2 \longrightarrow B$$

(1) Na_2CrO_4 and CrO_5

(2) CrO_5 and Na_2CrO_4

(3) Na_2CrO_4 and CrO_3

(4) $Na_2Cr_2O_7$ and Na_2CrO_4

Answer (1)

Sol. $CrO_2Cl_2 + NaOH \longrightarrow \underset{(A)}{\boxed{Na_2CrO_4}} + NaCl + H_2O$

$$Na_2CrO_4 + H_2O_2 + H_2SO_4 \longrightarrow \underset{(B)}{\boxed{CrO_5}} + Na_2SO_4 + H_2O$$

$\therefore$ A = Na_2CrO_4

B = CrO_5

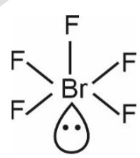
10. Which of the following has square pyramidal shape?

(1) PCl_5 (2) BrF_5

(3) PF_5 (4) $[Ni(CN)_4]^{2-}$

Answer (2)

Sol. BrF_5 has 1 lone pair and 5 bond pairs



So, geometry is octahedral, shape is square pyramidal.

11. Find out correct order of stability for given carbocations

(I)	(II)	(III)	(IV)
$(CH_3)_3C^+$	$(CH_3)_2\overset{\oplus}{CH}$	$CH_3-\overset{\oplus}{CH_2}$	$\overset{\oplus}{CH_3}$

(1) II > I > III > IV (2) I > II > III > I V

(3) IV > III > II > I (4) I > II > IV > III

Answer (2)

Sol. Stability of carbocation : 3° > 2° > 1° > methyl

12. **Statement I :** Halogen attached to bulky group undergo S_N2 reaction.

Statement I : Secondary alkyl halide react with excess C_2H_5OH undergo S_N1 reaction.

(1) Both statements are true

(2) Statement I is true, II is false

(3) Both statements are false

(4) Statement I is false, Statement II is true

Answer (4)

Sol. When halogen attached to bulky group back side attack is not possible so S_N2 reaction does not takes place.

Secondary alkyl halide reacts with excess of ethanol undergo S_N1 reaction.

13. Consider the following statements.

Statement I : Since electronegativity of F > H, so dipole moment of NF_3 > NH_3.

Statement II : Lone pair dipole in NH_3 is not in the direction of resultant bond dipole while in case of NF_3 the lone pair dipole is in the direction of resultant bond dipole.

(1) SI : True
SII : False

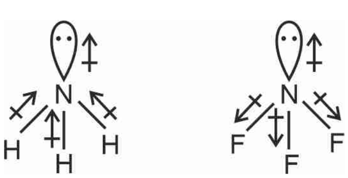
(2) SI : True
SII : True

(3) SI : False
SII : False

(4) SI : False
SII : True

Answer (3)

Sol. Dipole moment of NH_3 > NF_3 because in case of NH_3 the lone pair dipole is in the direction of resultant bond dipole.



14. Magnetic moment due to the motion of the electron in n^{th} orbit of Bohr atom is proportional to n^x. The value of x is

(1) 0

(2) 1

(3) 2

(4) 3

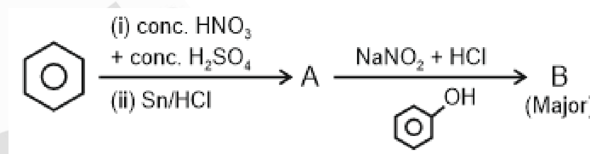
Answer (2)

Sol. Magnetic moment $\mu = \frac{e}{2m} \times L$

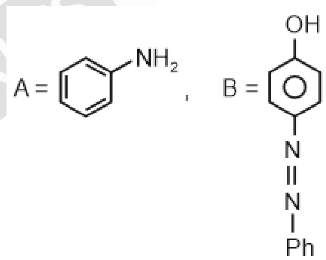
Where L is the angular momentum

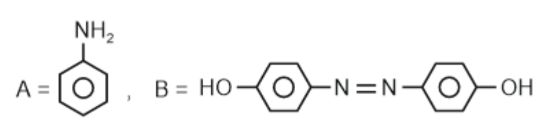
$L = \frac{nh}{2\pi}$

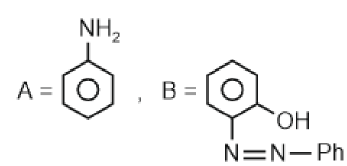
$\therefore \quad \boxed{\mu \propto n}$

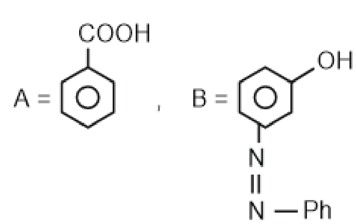
15. 

A and B respectively are :

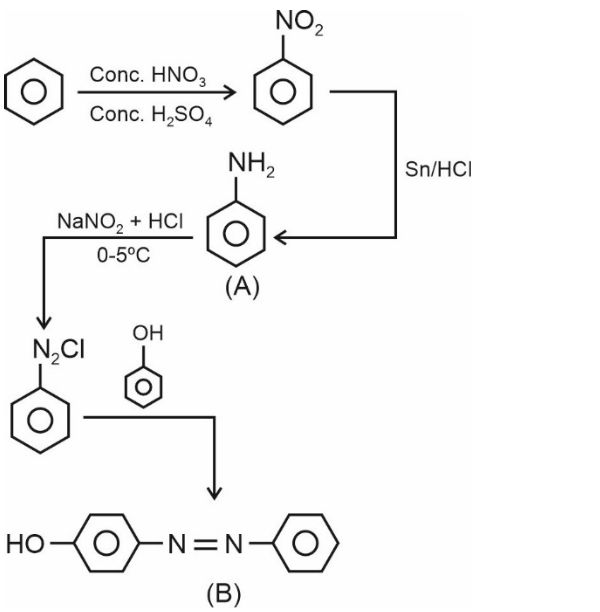
(1) 

(2) 

(3) 

(4) 

Answer (1)

Sol. 

16. Which of the following is a purification method which is based on solubility of compound.

(1) Distillation

(2) Sublimation

(3) Crystallization

(4) Column Chromatography

Answer (3)

Sol. Insoluble impurities can be separated by filtration followed by crystallization where soluble compound crystallizes in pure form.

17. Statement 1 : H_2Te is more acidic than H_2S

Statement 2 : H_2Te has more B.D.E than H_2S

(1) Statement 1 and 2 both are correct

(2) Statement 1 and 2 both are incorrect

(3) Statement 1 is incorrect and statement 2 is correct

(4) Statement 1 is correct and statement 2 is incorrect

Answer (4)

Sol. H_2Te has less bond dissociation energy than H_2S, that's why H_2Te is more acidic than H_2S

18. What is the structure of $Mn_2(CO)_{10}$?

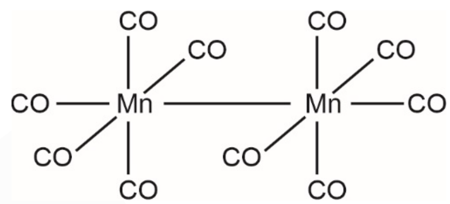
(1) Two square pyramidal units joined by bridging CO ligands

(2) Two square pyramidal units joined by Mn-Mn bond

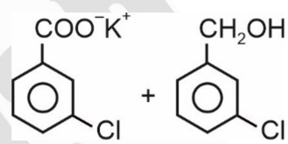
(3) Two tetrahedral units joined by Mn-Mn bond

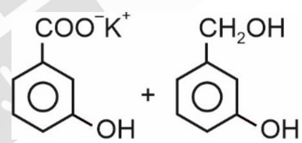
(4) Two square planar units joined by Mn-Mn bond

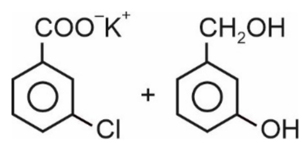
Answer (2)

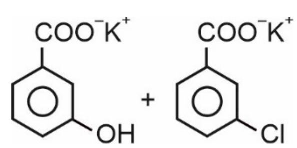
Sol. 

19. What are the products of the reaction of m-chlorobenzaldehyde with 50% KOH?

(1) 

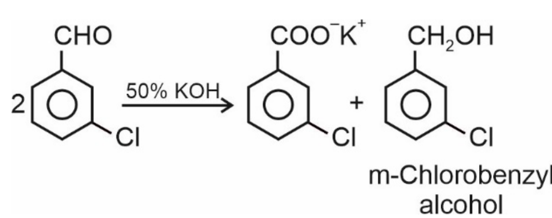
(2) 

(3) 

(4) 

Answer (1)

Sol. The reaction follows the Cannizzaro reaction mechanism.



20. **Statement-I:** There is regular increase in chemical reactivity from group 1 to group 18.

Statement-II: Oxides of group-1 elements are basic and oxide of group 17 are acidic

(1) Both statement-I and statement-II are true

(2) Statement-I is true and statement-II is false

(3) Statement-I is false and statement-II is true

(4) Statement-I and statement-II both are false

Answer (3)

Sol. The chemical reactivity of elements decreases and then increases from group 1 to 18 generally metal oxides are basic and nonmetal oxides are acidic.

SECTION - B

Numerical Value Type Questions: This section contains 10 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. How many spectral lines are obtained when an electron in He^+ ion Jumps from n = 5 to n = 1.

Answer (10)

Sol. Number of spectral lines

$$= \frac{(\Delta n)(\Delta n+1)}{2}$$

$$= \frac{(4)(5)}{2} = 10$$

22. What is the value of enthalpy change (ΔH) (in kJ/mole) for given reaction-

$$3C(s) + Fe_2O_3(s) \rightarrow 2Fe(s) + 3CO(g)$$

Given :

$$2Fe(s) + \frac{3}{2}O_2(g) \rightarrow Fe_2O_3(s) \quad \Delta H^\circ = -824 \text{ kJ/mol}$$

$$C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g) \quad \Delta H^\circ = -110 \text{ kJ/mol}$$

Answer (494)

Sol. $\Delta H^\circ = 3(-110) - (-824)$

$= -330 + 824 = 494$(kJ/mole)

23. Number of elements which give flame test from following

Sr, Cu, Co, Ca, Ni, Fe

Answer (4)

Sol. Cu : Green with blue centre

Ca : Brick red

Sr : Crimson red

Fe : Gold, when very hot such as an electric arc bright blue, or green turning to orange-brown

24. Consider the given reaction

$N_2O_4 \rightarrow 2NO_2$

Initial conc. of N_2O_4 = 3M

Concentration of N_2O_4 is 2.75 M

after 30 sec., find out rate of formation of NO_2 during this interval (in mol lit^{-1} min^{-1}) (Nearest integer)

Answer (1)

Sol. Rate of consumption of $N_2O_4 = \frac{3-2.75}{30}$

Rate of formation of $NO_2 = \frac{0.25}{30} \times 2 \times 60$

= 1 mol lit^{-1} min^{-1}

25. How many of the following shows disproportionation reactions?

H_2O_2, Ag, Cu^+, K^+, F_2, Cl_2, ClO_3^-

Answer (4)

Sol. Atom in its highest or lowest oxidation state does not disproportionate.

H_2O_2, Cu^+, Cl_2, ClO_3^-

$H_2O_2 \rightarrow O^{-1}$ can go to O^{2-} and O_2

$Cu^+ \rightarrow Cu$ = +1 to +2 and 0

$^0Cl_2 \rightarrow$ to Cl^{-1} and +1, +3, +5, +7

$\overset{+5}{Cl}O_3^- \rightarrow Cl^{-1}$ and Cl^{+7}

26.

27.

28.

29.

30.