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. **Statement 1 :** S_8 disproportionate into $H_2S_2O_3$ and S^{2-} in alkaline medium

   Statement 2 : ClO_4^- undergoes disproportionation in acidic medium.

   (1) Statement 1 is correct but statement 2 is incorrect

   (2) Statement 1 is incorrect but statement 2 is correct

   (3) Both statement 1 and statement 2 are correct

   (4) Both statement 1 and statement 2 are incorrect

Answer (1)

Sol. (1) $\overset{0}{S_8} + NaOH \rightarrow \overset{-2}{Na_2S} + \overset{+2}{Na_2S_2O_3}$ (Oxidation and Reduction)

(2) Cl is in its highest oxidation state (+7). It cannot be further oxidised

Therefore, statement 1 is correct but statement 2 is incorrect.

2. Which of the following is correct?

   (1) $[NiCl_4]^{2-}$ – diamagnetic
   $[Ni(CO)_4]$ – diamagnetic

   (2) $[Ni(CO)_4]$ – diamagnetic
   $[NiCl_4]^{2-}$ – paramagnetic

   (3) $[NiCl_4]^{2-}$ – paramagnetic
   $[Ni(CO)_4]$ – paramagnetic

   (4) $[NiCl_4]^{2-}$ – paramagnetic
   $[Ni(CO)_4]$ – diamagnetic

Answer (2)

Sol. Ni^{2+} : $4s^0 3d^8$ (No pairing with Cl^-)

$[Ni(CO)_4]$: $4s^0 3d^{10}$ (diamagnetic)

3. **Statement-I :** Among 15th group hydrides reducing character decreases from NH_3 to BiH_3.

   Statement-II : E_2O_3 and E_2O_5 are always basic.

   [Where E is group 15 element]

   (1) Both statement-I and Statement-II are correct

   (2) Statement-I is correct and Statement-II is false

   (3) Statement-I is false and Statement-II is correct

   (4) Both Statement-I and Statement-II are false

Answer (4)

Sol. Reducing character increases from NH_3 to BiH_3.

Group 15 oxides of type E_2O_3 and E_2O_5 are not always basic.

4. Which of the following has maximum ionic character?

   (1) KCl (2) AgCl

   (3) $CoCl_2$ (4) $BaCl_2$

Answer (1)

Sol. Polarisation power $\propto \frac{\text{Charge}}{\text{Size}}$

for K^+, polarising power is least and ionic character is maximum.

5. Match the following :

   (a) $[Cr(H_2O)_6]^{+3}$ (i) $t_{2g}^2 eg^0$

   (b) $[Fe(H_2O)_6]^{+3}$ (ii) $t_{2g}^3 eg^0$

   (c) $[Ni(H_2O)_6]^{+2}$ (iii) $t_{2g}^3 eg^2$

   (d) $[V(H_2O)_6]^{+3}$ (iv) $t_{2g}^6 eg^2$

   (1) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

   (2) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

   (3) (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)

   (4) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

Answer (1)

Sol. (a) $[Cr(H_2O)_6]^{+3} \rightarrow Cr^{+3} \rightarrow t_{2g}^3 eg^0$

(b) $[Fe(H_2O)_6]^{+3} \rightarrow Fe^{3+} \rightarrow t_{2g}^3 eg^2$

(c) $[Ni(H_2O)_6]^{+2} \rightarrow Ni^{2+} \rightarrow t_{2g}^6 eg^2$

(d) $[V(H_2O)_6]^{+3} \rightarrow V^{3+} \rightarrow t_{2g}^2 eg^0$

6. Quantum number for outermost electron of K-atom are given by

(1) n = 4, l = 0, m = 0, $s = \frac{1}{2}$

(2) n = 4, l = 1, m = 0, $s = \frac{1}{2}$

(3) n = 3, l = 0, m = 0, $s = \frac{1}{2}$

(4) n = 4, l = 0, m = 1, $s = \frac{1}{2}$

Answer (1)

Sol. $K_{19} = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

For 4*s* electron

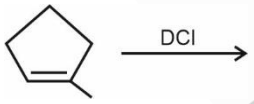
n = 4

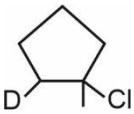
l = 0

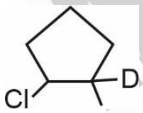
m = 0

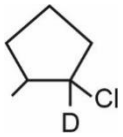
$s = \frac{1}{2}$

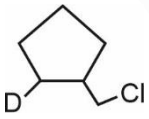
7. What is the product formed in the below given reaction?



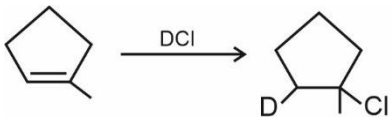
(1) 

(2) 

(3) 

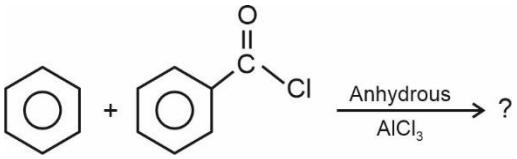
(4) 

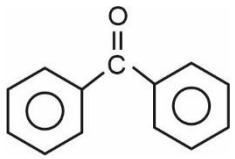
Answer (1)

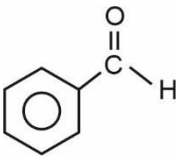
Sol. 

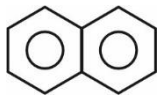
Markovnikov addition

8. What is the major product formed in the following reaction?



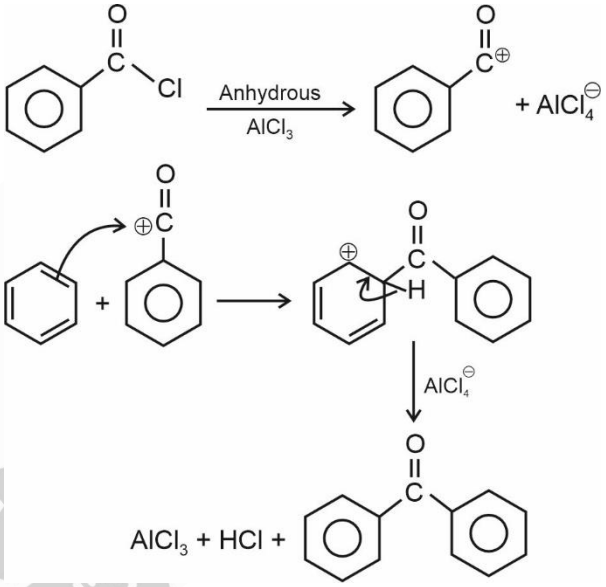
(1) 

(2) 

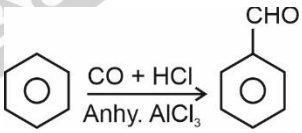
(3) 

(4) 

Answer (1)

Sol. 

9. Identify the given rection



(1) Rosenmund reaction

(2) Stephen reaction

(3) Gattemann Koch reaction

(4) Etard reaction

Answer (3)

Sol. The given reaction is Gattemann Koch reaction.

10. Choose the correct answers.

(A) Mn_2O_7 is a oil at room temperature.

(B) V_2O_4 react with acid to give VO^{2+}

(C) CrO is a basic oxide

(D) V_2O_5 does not react with acids.

(1) A, B and C only (2) B, C and D only

(3) A only (4) B and C only

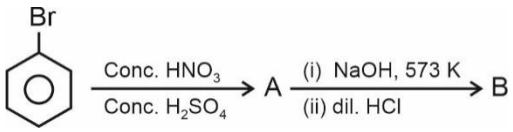
Answer (1)

Sol. A, B and C are correct.

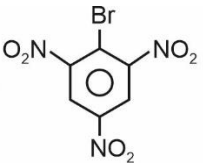
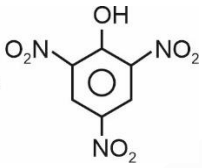
- Mn_2O_7 is a green oil at room temperature.
- V_2O_4 react with acids to give VO^{2+}.
- CrO is Basic and CrO_3 is acidic.
- V_2O_5 react with acids as well as alkali.

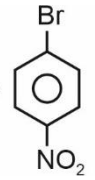
(Ref. NCERT Pg 224)

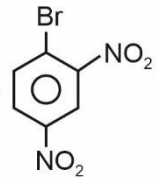
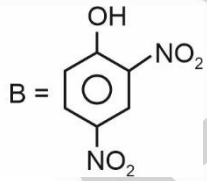
11. Consider the following reaction :

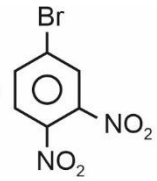


A and B respectively are

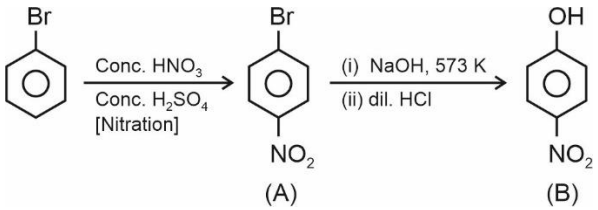
(1) A =  , B = 

(2) A =  , B = 

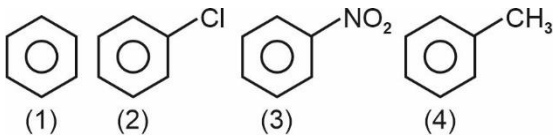
(3) A =  , B = 

(4) A =  , B = 

Answer (2)

Sol. 

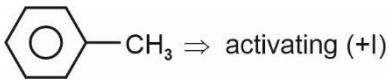
12. What will be the reactivity order of following compounds towards electrophilic substitution reaction?



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

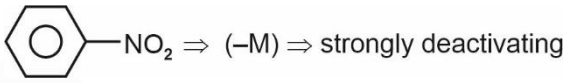
(3) 3 > 2 > 1 > 4 (4) 4 > 3 > 1 > 2

Answer (2)

Sol.  CH_3 ⇒ activating (+I)

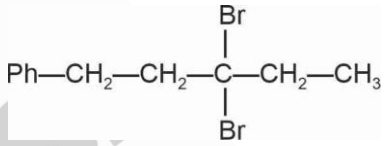
 H ⇒ Neutral (No effect)

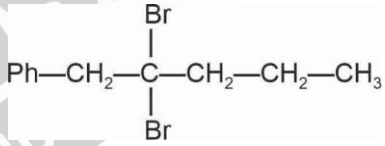
 Cl ⇒ Weakly deactivating (–I dominates over +M)

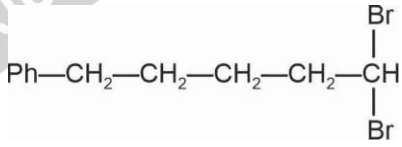
 NO_2 ⇒ (–M) ⇒ strongly deactivating

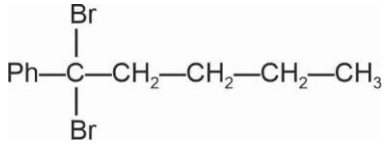
13. Correct IUPAC structure for the given organic compound is

2,2-Dibromo-1-phenylpentane

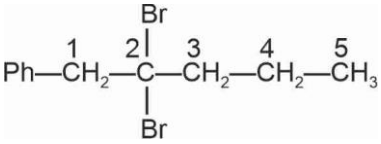
(1) 

(2) 

(3) 

(4) 

Answer (2)

Sol. 

14. **Statement-I :** Aniline on reaction with concentrated H_2SO_4 at 475 K gives p-amino benzene sulphonic acid. This gives blood red colour with Lassaigne's test.

Statement-II : Aniline forms a salt with anhydrus $AlCl_3$ in Friedel Craft's reaction.

(1) Both Statement-I and Statement-II are correct

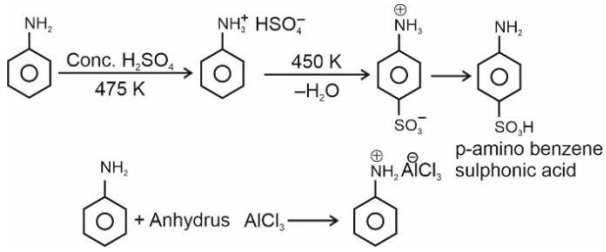
(2) Both Statement-I and Statement-II are incorrect

(3) Statement-I is correct and Statement-II incorrect

(4) Statement-I is incorrect and Statement-II correct

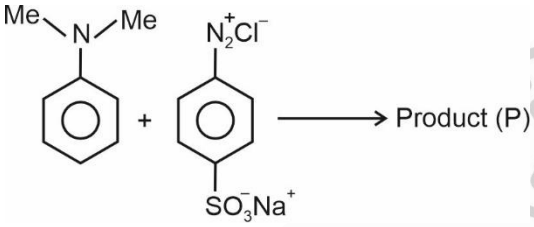
Answer (1)

Sol.



p-amino benzene sulphonic acid contains both N and S, so it gives blood red colour with Lassaigne's test.

15. Consider the following reaction.

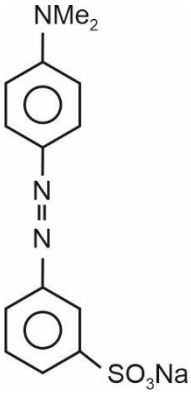


Select P

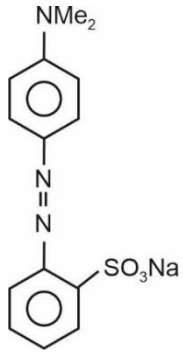
(Where Me is CH_3)

(1)

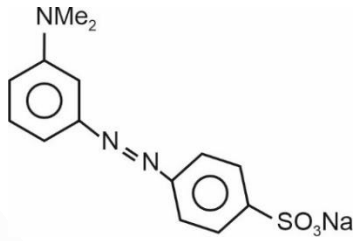
(2)



(3)

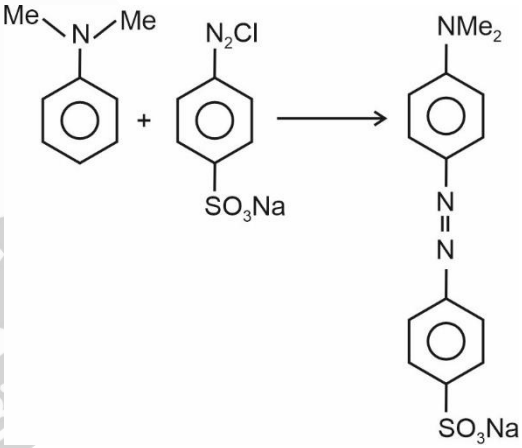


(4)



Answer (1)

Sol.



is an example of azo coupling reaction and final product is methyl orange.

16. $A(g) \rightleftharpoons B(g) + \frac{1}{2}C(g)$

In the about reaction, the correct relation between K_p, α and equilibrium pressure (p) is

(1) $K_p = \frac{\alpha^{1/2}\, 2p^{1/2}}{(2+\alpha)^{1/2}}$

(2) $K_p = \frac{\alpha^{1/2}\, p^{3/2}}{(2+\alpha)^{3/2}}$

(3) $K_p = \frac{\alpha^{1/2}\, 2p^{1/2}}{(2+\alpha)^{3/2}}$

(4) $K_p = \frac{\alpha^{3/2}\, p^{1/2}}{(2+\alpha)^{1/2}(1-\alpha)}$

Answer (4)

Sol.

$$A(g) \rightleftharpoons B(g) + \frac{1}{2}(g)$$

Initial moles	n	0	0
Eqb. moles	$n(1-\alpha)$	$n\alpha$	$\frac{n\alpha}{2}$

total moles $= n\left(1+\frac{\alpha}{2}\right)$

Eqb. pressure	$\frac{(1-\alpha)p}{1+\frac{\alpha}{2}}$	$\frac{\alpha p}{1+\frac{\alpha}{2}}$	$\frac{\left(\frac{\alpha}{2}\right)p}{1+\frac{\alpha}{2}}$

$$K_p = \frac{\frac{\alpha p}{\left(1+\frac{\alpha}{2}\right)} \times \left[\frac{\alpha p}{(2+\alpha)}\right]^{\frac{1}{2}}}{\frac{(1-\alpha)p}{1+\frac{\alpha}{2}}}$$

$$K_p = \frac{\alpha^{3/2}\, p^{1/2}}{(2+\alpha)^{1/2}(1-\alpha)}$$

17.

18.

19.

20.

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. Half life of a first order reaction is 36 hr. Find out time (in hr) required for concentration of reactant to get reduced by 90%.

Answer (120)

Sol. $t_{90} = \frac{2.303}{k}\log\left(\frac{100}{100-90}\right)$

$$= \frac{2.303\times 36}{2.303\times \log 2}\times \log 10 = \frac{36}{0.3} = 120$$

22. A 1 mol ideal gas expands from 10 L to 100 L at 300 k, if above expansion takes place reversibly and isothermally then magnitude of work done is _____ (in KJ)

Answer (06)

Sol. $w = -nRT\ln\frac{V_2}{V_1}$

$$|w| = 2.303\, nRT\log\frac{V_2}{V_1}$$

$$|w| = 1\times 2.303\times 8.314\times 300\log\frac{100}{10}$$

$|w| = 5744$ J

$|w| = 5.744$ kJ ≈ 6 kJ

23. How many of the following vitamins are stored in Human Body?

A, B, C, D, E, K?

Answer (4)

Sol. A, D, E, K vitamins are fat soluble vitamins, are stored in liver and adipose tissue.

While vitamin B and vitamin C are water soluble and must be supplied regularly in diet (not stored) (except vitamin B_{12}) (NCERT, Pg : 426)

24. Number of moles of H^+ required by 1 mole MnO_4^- to oxidize oxalate ion to CO_2 is____.

Answer (8)

Sol. The balanced reaction is as follows

$$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$$

2 mole MnO_4^- react with 16 mole H^+

1 mole MnO_4^- will react with 8 mole H^+

25. The potassium chloride is heated with potassium dichromate and conc. sulphuric acid to give products. The oxidation state of chromium in product is (+)_____.

Answer (06.00)

Sol. This is an example of chromyl chloride test

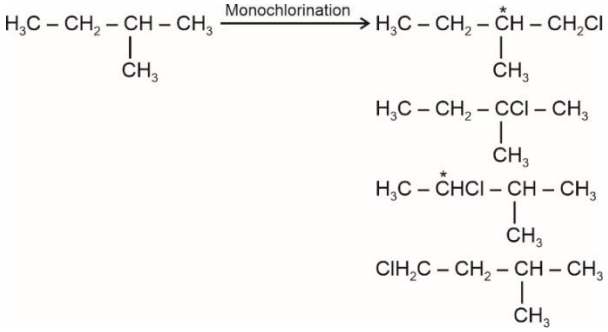
$$K_2Cr_2O_7 + 4KCl + 6H_2SO_4 \rightarrow 6KHSO_4 + 2CrO_2Cl_2 + 3H_2O$$

Oxidation state of Cr is +6.

26. Number of structural isomeric products formed by monochlorination of 2-methylbutane in presence of sunlight is_____.

Answer (4)

Sol



27.

28.

29.

30.