PART : CHEMISTRY

1. Which of the following ions does not show disproportion reaction

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

Ans. (4)

Sol. $\underset{\substack{\text{Highest} \\ \text{oxidation} \\ \text{state}}}{\overset{+7}{ClO_4^-}} \longrightarrow$ It does not undergo disproportonation reaction

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

(1) 2.79   (2) 3   (3) 2.17   (4) 2.65

Ans. (4)

Sol. $m = \dfrac{1000 \times M}{1000d - M \times MM_{solute}} = \dfrac{1000 \times 3}{1000 \times 1.25 - 3 \times 40} = \dfrac{3000}{1130} \approx 2.65$

3. Arrange according to CFSE value

(i) $[Co(NH_3)_4]^{2+}$ (ii) $[Co(NH_3)_6]^{3+}$ (iii) $[Co(NH_3)_6]^{2+}$ (iv) $[Co(en)_3]^{3+}$

(1) (iv) > (ii) > (iii) > (i)   (2) (iv) > (iii) > (ii) > (i)   (3) (i) > (iii) > (ii) > (iv)   (4) (i) > (ii) > (iii) > (iv)

Ans. (1)

Sol. Co^{2+} : [Ar] $4s^0 3d^7$ | Co^{3+} : [Ar] $4d^6$

CFSE $\propto$ Strength of ligand

CFSE $\propto$ Charge on cation

4. 200 mL of 0.2 M solution of NaOH is mixed with 400 mL of 0.5 M NaOH solution. Molarity of mixture is $x \times 10^{-1}$. x is :

Ans. (4)

Sol. $M = \dfrac{200 \times 0.2 + 400 \times 0.5}{600} = \dfrac{40 + 200}{600} = \dfrac{240}{600} = \dfrac{12}{30} = 0.4M$

5. **S1 :** A spectral line is produced upon election transition from $2p_x \rightarrow 2p_y$

S2 : $2p_x$ & $2p_y$ are degenerate orbitals

(1) S1 True, S2 False   (2) S1 False, S2 True

(3) Both S1 & S2 True   (4) Both S1 & S2 False

Ans. (2)

Sol. Since orbitals are degenerate, no spectral line will be produced in transition.

6. Select the correct statement :

(1) T, P, d – They are intensive variables   (2) V, P, d – They are intensive variables

(3) m, V, P – They are extensive variables   (4) m, V, T – They are extensive variables

Ans. (1)

Sol. T, P, d - intensive

m, V - extensive

7. Compare dipole moment

i. NF_3 ii. $CHCl_3$ iii. H_2S iv. HBr

(1) i > ii > iii > iv   (2) ii > iii > i > iv   (3) ii > iii > iv > i   (4) iii > I > iv > ii

Ans. 3

Sol. NF_3 = 0.23 D $CHCl_3$ = 1.04 D

H_2S = 0.95 D   HBr = 0.79 D

8. Match the column

Column-I	Column-II
(i) $\left(\dfrac{\partial G}{\partial T}\right)_p$	(a) C_p
(ii) $\left(\dfrac{\partial H}{\partial T}\right)_p$	(b) C_v
(iii) $\left(\dfrac{\partial U}{\partial T}\right)_v$	(c) $-S$
(iv) $\left(\dfrac{\partial G}{\partial P}\right)_T$	(d) V

(1) i-c, ii-a, iii-b, iv-d (2) i-b, ii-d, iii-a, iv-c (3) i-d, ii-c, iii-b, iv-a (4) i-c, ii-a, iii-d, iv-b

Ans. (1)

Sol. $dG = Vdp - SdT$

At constant P, $\dfrac{\partial G}{\partial T} = -S$

At constant T, $\dfrac{\partial G}{\partial P} = V$

$\left(\dfrac{\partial H}{\partial T}\right) = C_p$; $\left(\dfrac{\partial U}{dT}\right)_v = C_v$

9. Solubility product of salt $Zr_3(PO_4)_4$ is K_{sp} then solubility of salt in term of K_{sp} is

(1) $\left(\dfrac{K_{sp}}{27 \times 256}\right)^{\frac{1}{7}}$ (2) $\left(\dfrac{K_{sp}}{27 \times 256}\right)^{\frac{1}{5}}$ (3) $\left(\dfrac{K_{sp}}{27 \times 256}\right)^{7}$ (4) $\left(\dfrac{K_{sp}}{27 \times 256}\right)^{5}$

Ans. (1)

Sol. $Zr_3(PO_4)_4 \rightleftharpoons \underset{3s}{3Zr^{4+}} + \underset{4s}{4PO_4^{3-}}$

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

$K_{sp} = 27(s)^3 \times 256(s)^4$

$S = \left(\dfrac{K_{sp}}{27 \times 256}\right)^{\frac{1}{7}}$

10. Sum of number of 4d electrons in Nb & Ru is

Ans. (11)

Sol. $Nb(5s^1 4d^4)$ & $Ru(5s^1 4d^7)$

11. **Statement-I :** Corrosion is an electrochemical process, in which pure metal is present at anode and impure is present at cathode.

Statement-II : Corrosion occur foster in alkaline medium than in acidic medium.

(1) Both Statement-I & Statement-II are true.
(2) Both Statement-I is true & Statement-II is false.
(3) Statement-I is false & Statement-II is true.
(4) Both Statement-I and Statement-II is false.

Ans. (4)
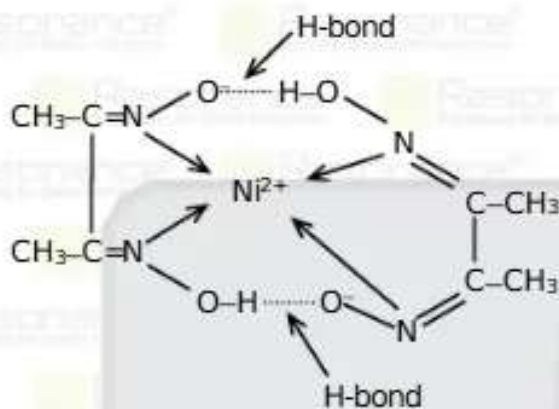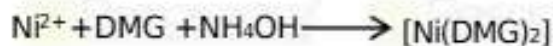
Sol. **Statement-I :** Corrosion is an electrochemical process which oxidation of metal take place at anode but impure metal is not present at cathode.

Statement-II : Corrosion occur foster in acidic medium.

12. Find number of hydrogen in $[Ni(DMG)_2]$

Ans. **(14)**

Sol.

$$Ni^{2+} + DMG + NH_4OH \longrightarrow [Ni(DMG)_2]$$
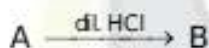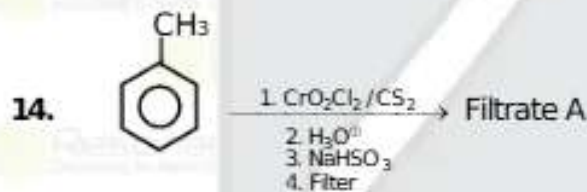

No. of H-atom = 14

13. Given below are two statements

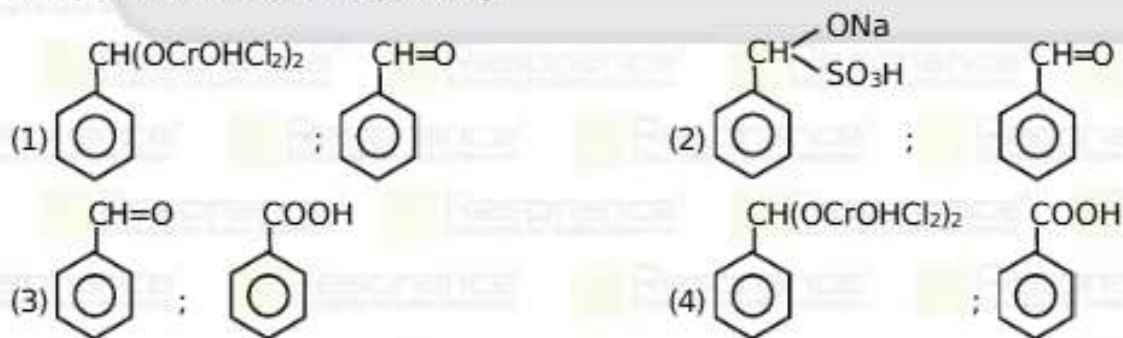**S-I :** Lassaigne test is used for detection of nitrogen, phosphorous, sulphur and halogen.

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

(1) Both Statement I and statement II are true

(2) Both statement I and statement II are false

(3) Statement I is true but statement II is false

(4) Statement I is false but statement II is true

Ans. **(3)**

14.

$$\xrightarrow[\substack{2.\ H_3O^{\oplus} \\ 3.\ NaHSO_3 \\ 4.\ Filter}]{1.\ CrO_2Cl_2/CS_2} \text{Filtrate A}$$

$$A \xrightarrow{dil.\ HCl} B$$

Compound A and B are respectively

(1)

(2)

(3)

(4)

Ans. **(2)**

Sol.

$$CH_3 \text{ (toluene)} \xrightarrow{CrO_2Cl_2} CH(OCrOHCl_2)_2 \xrightarrow{H_2O} CH=O \xrightarrow{NaHSO_3} CH\langle {ONa \atop SO_3H} \text{ (A)}$$

$$CH=O \xleftarrow{dl. HCl}$$
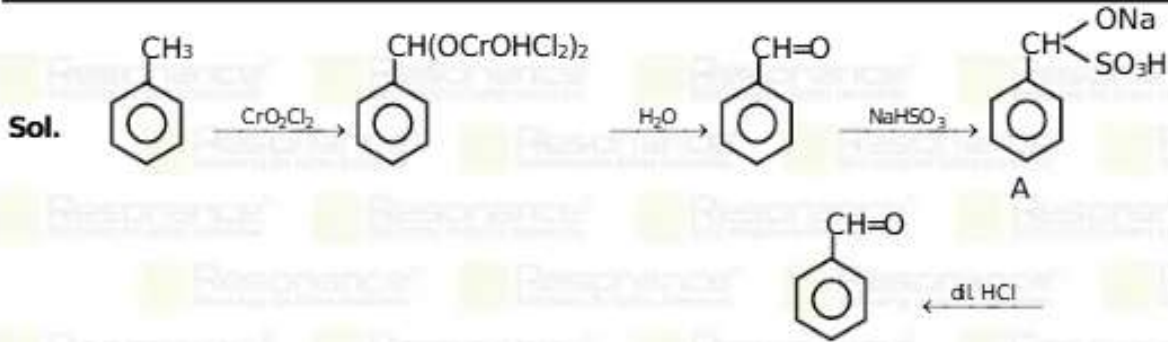
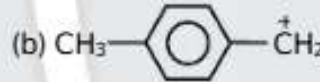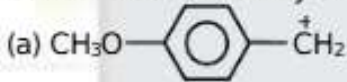**15.** Which of the following has 'two secondary' hydrogens.
   (1) 2,2, 3, 3-dimethyl pentane
   (2) 2,2,3,4-dimethyl heptane
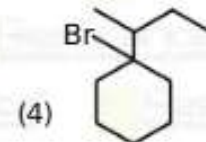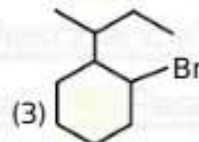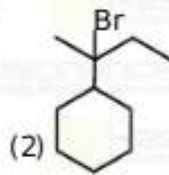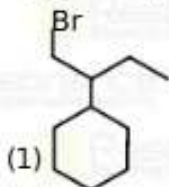   (3) 4-ethyl-2,2-dimethyl benzene
   (4) NOT

Ans. **(1)**

16. Correct order of stability of cation.

(a) $CH_3O-\bigcirc-\overset{+}{C}H_2$

(b) $CH_3-\bigcirc-\overset{+}{C}H_2$

(c) $\bigcirc\overset{-\overset{+}{C}H_2}{\underset{OMe}{}}$
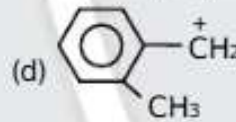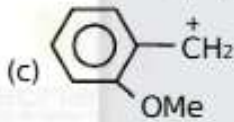
(d) $\bigcirc\overset{-\overset{+}{C}H_2}{\underset{CH_3}{}}$

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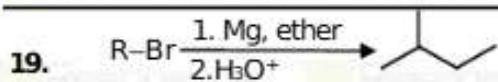   (3) a > c > d > b
   (4) c > b > a > d

Ans. **(3)**

17. Total number of π-electron in a compound with molecular formula C_6H_6, which adds four moles of H_2 and gives one single product on mono bromination.
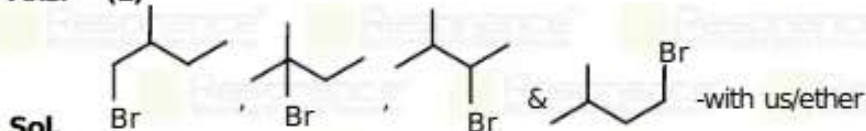
Ans. **(8)**

Sol.

18.

$\xrightarrow[hv]{Br_2}$ Major product

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

Ans. **(2)**

Sol.

Radical is most stable

19.

$$R-Br \xrightarrow[\text{2.H}_3O^+]{\text{1. Mg, ether}}$$
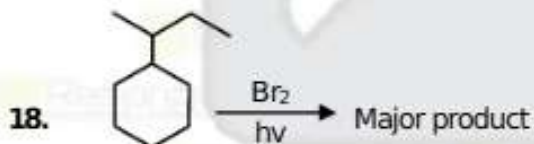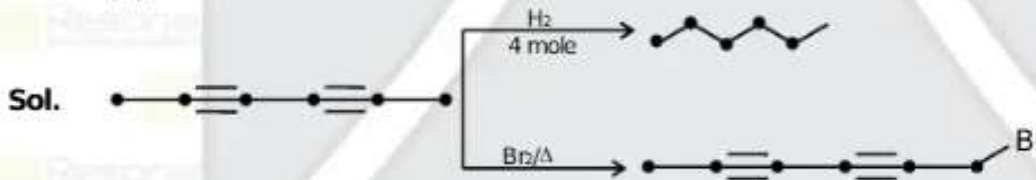
Possible number of position isomers of R–Br, which gives the above product is

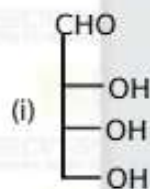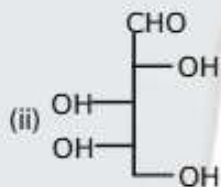(1) 4   (2) 3   (3) 5   (4) 6

Ans. (1)

Sol.

& -with us/ether

Followed by hydrolysis gives the required product.

20. Which of the following compound can be derived from (D) Glyceraldehyde.

(i) CHO, OH, OH, OH

(ii) CHO, OH, OH, OH, OH

(iii) CHO, OH, OH, OH, OH
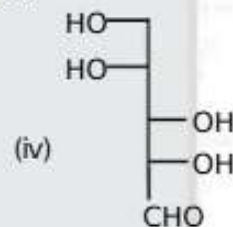
(iv) HO, HO, OH, OH, CHO

(1) I & II   (2) I, III & IV   (3) I, II, III   (4) II, III & Iv

Ans. (2)