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. For complex ion $[NiCl_4]^{2-}$ what is the charge on metal and shape of complex respectively?

    (1) +2, Tetrahedral
    (2) +2, Square planar
    (3) +4, Tetrahedral
    (4) +4, Square Planar

Answer (1)

Sol. $[NiCl_4]^{2-} \Rightarrow Ni^{2+} \rightarrow 3d^8$

Cl⁻ ligand is weak field ligand and hybridisation is sp^3. Shape of complex is tetrahedral.

2. Compare boiling point of given solutions

    (i) 10^{-4} M NaCl
    (ii) 10^{-3} M NaCl
    (iii) 10^{-2} M NaCl
    (iv) 10^{-4} M urea

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

Answer (2)

Sol. Higher the elevation in boiling point, higher will be the boiling point

$\Delta Tb \propto i \times m$

For urea i = 1

For NaCl i = 2

Boiling point order III > II > I > IV

3. The correct decreasing order of electronegativity is

    (1) F > Cl > I > Br
    (2) Cl > F > Br > I
    (3) F > Cl > Br > I
    (4) Br > F > I > Cl

Answer (3)

Sol. The correct order is

F > Cl > Br > I

4. Which of the following has maximum size out of Al^{3+}, Mg^{2+}, F⁻, Na⁺?

    (1) Al^{3+}
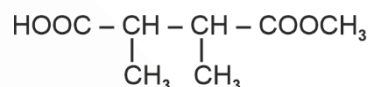   (2) Mg^{2+}
    (3) F⁻
    (4) Na⁺

Answer (3)

Sol. For isoelectronic species, more the negative charge more will be the size, also more the positive charge smaller will be the size.

The correct order of ionic size is :

$Al^{3+} < Mg^{2+} < Na^+ < F^-$

5. The IUPAC name of given specie is
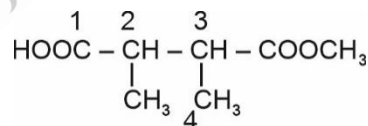
$$HOOC - \underset{\underset{CH_3}{|}}{CH} - \underset{\underset{CH_3}{|}}{CH} - COOCH_3$$

    (1) 2, 3-dimethyl methyl carboxy butanoic acid
    (2) 4-methoxy carbonyl-2, 3-dimethyl propanoic acid
    (3) 3-methoxycarbonyl-2-methyl butanoic acid
    (4) 1-carboxy-2, 3-dimethyl methyl butanoate

Answer (3)

Sol.

$$HOOC - \overset{1}{C}\underset{\underset{CH_3}{|}}{H} - \overset{2}{C}\underset{\underset{CH_3}{|}}{H} - \overset{3}{C}OOCH_3$$

3-methoxycarbonyl-2-methyl butanoic acid

6. Compare crystal field splitting energy(Δ) for given complexes

    (i) $K_4[Fe(CN)_6]$
    (ii) $[Cu(NH_3)_4]^{+2}$ s
    (iii) $K_4[Fe(SCN)_6]$
    (iv) $[Fe(en)_3]Cl_3$

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

Answer (2)

Sol. $K_4[Fe(CN)_6] \Rightarrow d^6 \Rightarrow$ SFL,

$K_2[Cu(NH_3)_4] \Rightarrow d^9 \Rightarrow dsp^2$

$K_4[Fe(SCN)_6] \Rightarrow d^6 \Rightarrow$ WFL

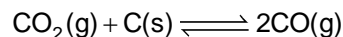$[Fe(en)_3]Cl_3 \Rightarrow d^5 \Rightarrow$ SFL
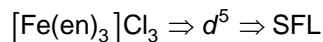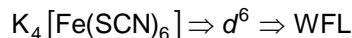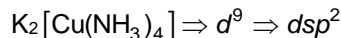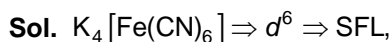
Splitting energy $\propto$ Strength of ligand $\propto$ Charge of CA.

$\Delta_{sp} > \Delta_o$

II > I > IV > III

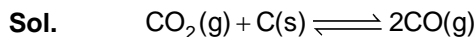7. Consider the given equilibrium reaction

$CO_2(g) + C(s) \rightleftharpoons 2CO(g)$

If initial pressure of CO_2 is 0.6 atm and after equilibrium is established, total pressure is 0.8 atm. Then, find K_p.

(1) 0.4   (2) 0.2

(3) 0.6   (4) 0.8

Answer (1)

Sol. $CO_2(g) + C(s) \rightleftharpoons 2CO(g)$

t = 0   0.6

t = t_{eq} 0.6 – p   2p

P_t at equilibrium = 0.8 = 0.6 + p

0.2 = p

$K_p = \dfrac{(p_{CO})^2}{(p_{CO_2})} = \dfrac{(2p)^2}{0.6-p} = \dfrac{4 \times 0.04}{0.6 - 0.2} = \dfrac{4 \times 0.04}{0.4} = 0.4$

8. Statement-I: $CH_3 - O - CH_2 - Cl$ will show nucleophilic substitution by S_N1 mechanism in protic medium.
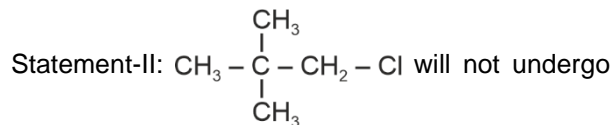
Statement-II: $CH_3 - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}} - CH_2 - Cl$ will not undergo nucleophilic substitution via S_N2 mechanism easily.
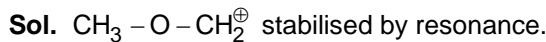
(1) Statement-I and statement-II both are correct

(2) Statement-I and statement-II both are incorrect

(3) Statement-I is correct but statement-II is incorrect

(4) Statement-I is incorrect but statement-II is correct

Answer (1)

Sol. $CH_3 - O - CH_2^{\oplus}$ stabilised by resonance.

9. Which of the following acids is also known as vitamin C?

(1) Adipic acid   (2) Ascorbic acid

(3) Saccharic acid   (4) Aspartic acid

Answer (2)

Sol. Ascorbic acid is also known as vitamin C.

10. An electron of He^+ is present in 3rd excited state. Find its de-Broglie wavelength.

(1) 6.64 Å   (2) 1.66 Å

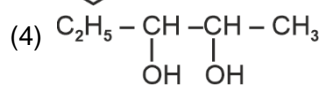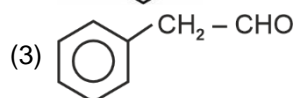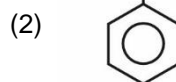(3) 3.32 Å   (4) 13.28 Å
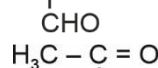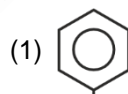
Answer (1)

Sol. $n\lambda = 2\pi r$

For 3rd excited state, n = 4

$4\lambda = 2 \times \pi \times a_\circ \dfrac{n^2}{z}$

$4\lambda = 2 \times \pi \times 0.529 \dfrac{16}{2}$ Å

$\lambda = 2 \times 3.14 \times 0.529 \times 2$ Å = 6.64 Å

11. Which of the following will show positive Fehling test?

(1)

(2)

(3)

(4) $C_2H_5 - \underset{\underset{\displaystyle OH}{|}}{CH} - \underset{\underset{\displaystyle OH}{|}}{CH} - CH_3$

Answer (3)

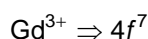**Sol.** Fehling test is given by Aldehydes except benzaldehyde
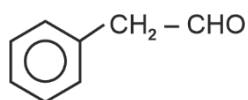
will give +ve Fehling test

12. $4f^7$ configuration is possible for

(a) Eu^{3+}, (b) Eu^{2+}, (c) Gd^{3+}, (d) Tb^{3+}, (e) Sm^{2+}

(1) (a) and (c)

(2) (b) and (c)

(3) (d) and (e)

(4) Only (c)

Answer (2)

Sol. Electronic configuration of:

$Eu^{3+} \Rightarrow 4f^6$ $Tb^{3+} \Rightarrow 4f^8$

$Eu^{2+} \Rightarrow 4f^7$ $Sn^{2+} \Rightarrow 4f^5$

$Gd^{3+} \Rightarrow 4f^7$

13. Given : $NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$

If the partial pressure of CO_2 gas at equilibrium is 0.4 atm and the total pressure is 1 atm, then the value of K_p at the same temperature is

(1) 0.027 atm^3

(2) 0.064 atm^3

(3) 0.144 atm^3

(4) 0.216 atm^3

Answer (3)

Sol. $NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$

Total pressure at equilibrium = 1.0 atm
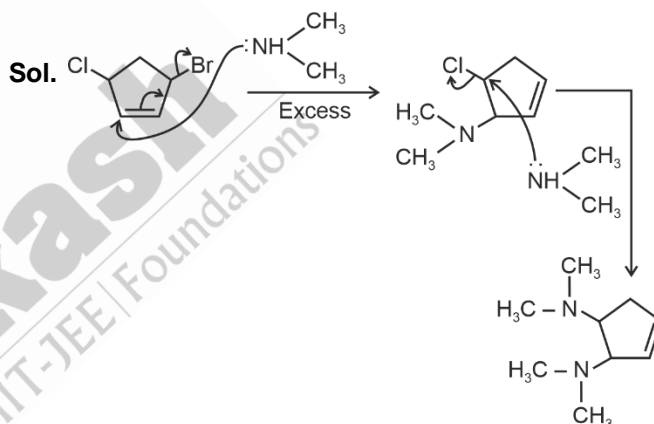
Partial pressure of CO_2 at equilibrium = 0.4 atm

∴ Partial pressure of NH_3 at equilibrium = 0.6 atm

$K_p = (p_{NH_3})^2(p_{CO_2})$

$= (0.6)^2(0.4)$

$= 0.144$ atm^3

14.

Answer (1)

Sol.
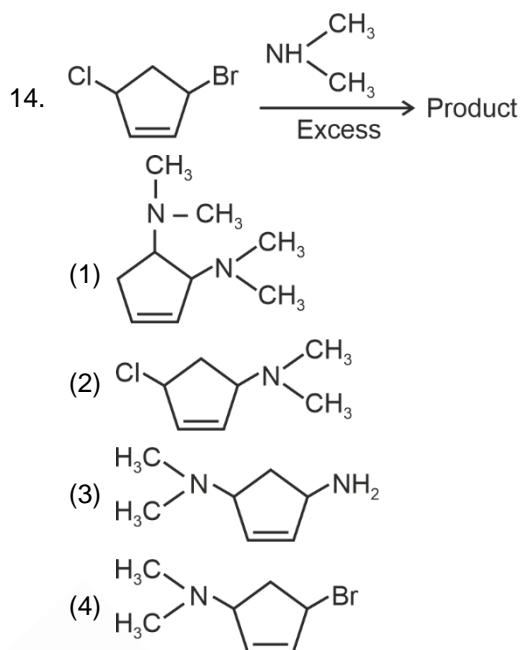
15. CO_2 gas is taken at 1 atm, 273K. Now it is allowed to pass through 0.1 M $Ca(OH)_2$ aq. solution. Excess amount of $Ca(OH)_2$ is neutralised with 40 mL of 0.1 M HCl. Then find volume of $Ca(OH)_2$ initially taken if 50% $Ca(OH)_2$ is react with CO_2

(1) 40 mL

(2) 20 mL

(3) 80 mL

(4) 50 mL

Answer (1)

Sol. g meq of $Ca(OH)_2$ = 2 × gm eq of HCl

$$0.1 \times \frac{V_{mL}}{1000} \times 2 = 2 \times 0.1 \times \frac{40}{1000} \times 1$$

$$V_{mL} = 40 \text{ mL}$$

16. In a closed insulated container, a liquid is stirred with a paddle to increase the temperature, which of the following is true?

    (1) w = 0, $\Delta E = q \neq 0$ (2) $\Delta E = w \neq 0$, q = 0

    (3) $\Delta E = w = 0$, $q \neq 0$ (4) $\Delta E = 0$, $w = q \neq 0$

Answer (2)

Sol. In closed insulated container a liquid stirred with a paddle to increase the temperature, it behaves as an adiabatic container, q = 0

From FLOT

$\Delta U = q + w$; q = 0

$\Delta E = w$ (but not zero)

17. Match the column and choose the correct option

	Column-I (Properties)		Column-II (Order)
(A)	Electronegativity	(1)	B < C < N < O
(B)	Cationic size	(2)	Li > Mg > Be
(C)	Metallic Character	(3)	K > Mg > Al
(D)	Electron affinity	(4)	Cl > F > Br > I

    (1) A–1, B–2, C–3, D–4

    (2) A–4, B–3, C–2, D–1

    (3) A–2, B–3, C–4, D–1

    (4) A–3, B–2, C–4, D–1

Answer (1)

Sol. $\underset{76\,pm}{Li^+} > \underset{72\,pm}{Mg^{2+}} > \underset{31\,pm}{Be^{2+}}$

18.

    Identify C.

    (1)

    (2)
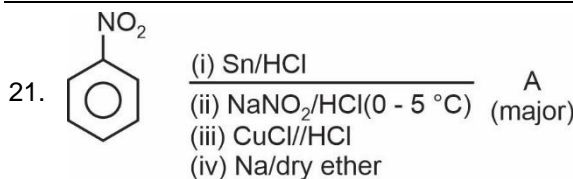
    (3)

    (4)

Answer (1)

Sol.
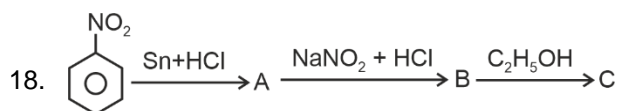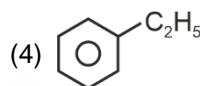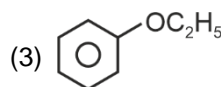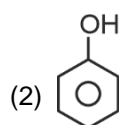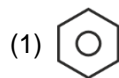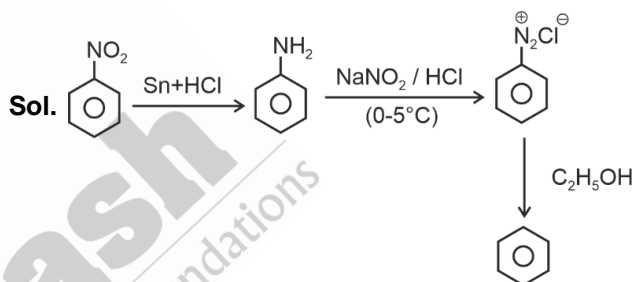
19.

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.

    (i) Sn/HCl
    (ii) NaNO₂/HCl(0 - 5 °C)   A (major)
    (iii) CuCl//HCl
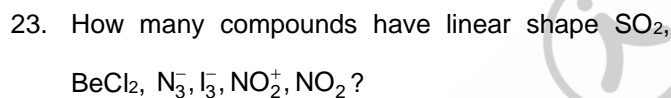   (iv) Na/dry ether

    Find molecular weight of (A) in g mol⁻¹

Answer (154)

Sol.
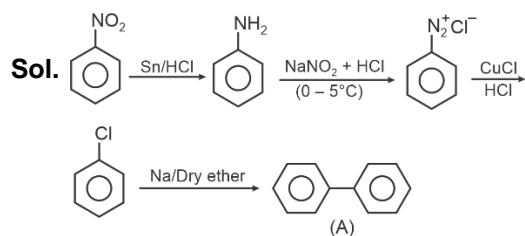
Molecular weight of (A) = 154 g mol^{-1}

22. Calculate Number of stereoisomers of

$$CH_3 - CH = CH - CH - CH_3$$
$$ |$$
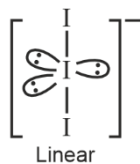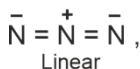$$ OH$$
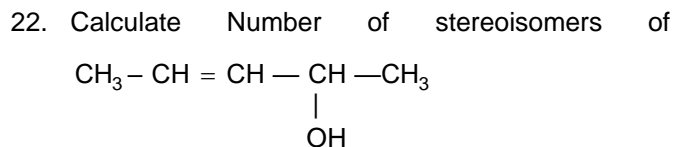
Answer (4)

Sol. Number of centres which can show stereoisomerism in molecule = 2

Number of isomers = 2^2 = 4

23. How many compounds have linear shape SO_2, $BeCl_2$, N_3^-, I_3^-, NO_2^+, NO_2 ?

Answer (4)

Sol.
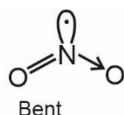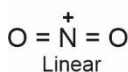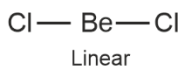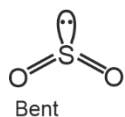
24. In Carius method 180 mg of organic compound gives 143.5 mg of AgCl. Find the percentage of Cl in the organic compound. (Nearest integer)

Answer (20)

Sol. Mass of organic compound = 180 mg

Mass of AgCl = 143.5 mg

Mass of Cl = $\dfrac{143.5}{143.5} \times 35.5$ mg

= 35.5 mg

Percentage of Cl in the organic compound

$$= \dfrac{35.5 \times 100}{180}$$

$$= 19.72\% \simeq 20\%$$

25. Two ampere current is allowed to pass through molten $AlCl_3$ for 30 min. Find the mass (in mg) of aluminium deposited at cathode. (Nearest integer)

Answer (336)

Sol. Total charge passed = 2 × 30 × 60 C

Number of Faradays passed = $\dfrac{2 \times 30 \times 60}{96500}$ F

Equivalents of Al deposited = $\dfrac{36}{965}$

Mass of Al deposited = $\dfrac{36 \times 9}{965}$ g

$$= \dfrac{36 \times 9 \times 1000}{965}$$ mg

= 335.75 mg

$\simeq$ 336 mg