

**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  $[\text{NiCl}_4]^{2-}$  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.**  $[\text{NiCl}_4]^{2-} \Rightarrow \text{Ni}^{2+} \rightarrow 3d^8$

$\text{Cl}^-$  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

$$\Delta T_b \propto i \times m$$

For urea  $i = 1$

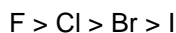
For NaCl  $i = 2$

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



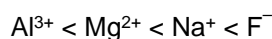
4. Which of the following has maximum size out of  $\text{Al}^{3+}$ ,  $\text{Mg}^{2+}$ ,  $\text{F}^-$ ,  $\text{Na}^+$ ?

- (1)  $\text{Al}^{3+}$       (2)  $\text{Mg}^{2+}$   
 (3)  $\text{F}^-$       (4)  $\text{Na}^+$

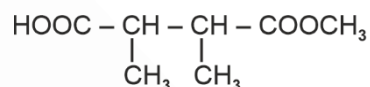
**Answer (3)**

**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 :



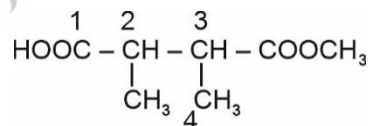
5. The IUPAC name of given specie is



- (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.**



3-methoxycarbonyl-2-methyl butanoic acid

6. Compare crystal field splitting energy ( $\Delta$ ) for given complexes

- (i)  $\text{K}_4[\text{Fe}(\text{CN})_6]$       (ii)  $[\text{Cu}(\text{NH}_3)_4]^{2+}$   
 (iii)  $\text{K}_4[\text{Fe}(\text{SCN})_6]$       (iv)  $[\text{Fe}(\text{en})_3]\text{Cl}_3$   
 (1) I > II > III > IV      (2) II > I > IV > III  
 (3) IV > I > III > II      (4) IV > III > I > II

**Answer (2)**

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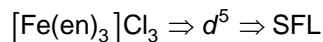
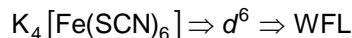
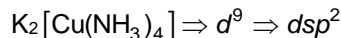
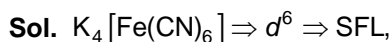
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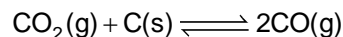


Splitting energy  $\propto$  Strength of ligand  $\propto$  Charge of CA.

$\Delta_{sp} > \Delta_o$

$II > I > IV > III$

7. Consider the given equilibrium reaction

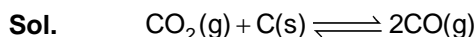


If initial pressure of  $CO_2$  is 0.6 atm and after equilibrium is established, total pressure is 0.8 atm. Then, find  $K_p$ .

(1) 0.4 (2) 0.2

(3) 0.6 (4) 0.8

Answer (1)



$t = 0$  0.6

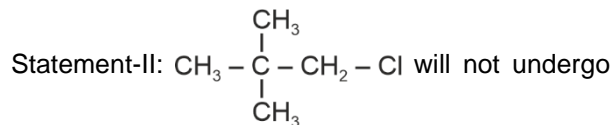
$t = t_{eq}$  0.6 - p 2p

$P_t$  at equilibrium = 0.8 = 0.6 + p

0.2 = p

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

8. Statement-I:  $CH_3 - O - CH_2 - Cl$  will show nucleophilic substitution by  $S_N1$  mechanism in protic medium.



nucleophilic substitution via  $S_N2$  mechanism easily.

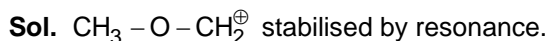
(1) Statement-I and statement-II both are correct

(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)



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)

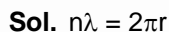
Sol. Ascorbic acid is also known as vitamin C.

10. An electron of  $He^+$  is present in  $3^{rd}$  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)



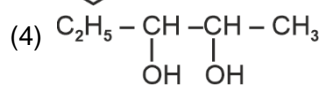
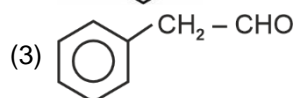
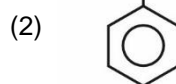
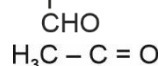
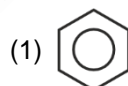
For  $3^{rd}$  excited state,  $n = 4$

$4\lambda = 2 \times \pi \times a_0 \frac{n^2}{Z}$

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

$\lambda = 2 \times 3.14 \times 0.529 \times 2 \text{ Å} = 6.64 \text{ Å}$

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



Answer (3)

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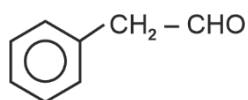
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**Sol.** Fehling test is given by Aldehydes except benzaldehyde

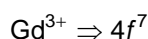


will give +ve Fehling test

12.  $4f^7$  configuration is possible for  
 (a)  $\text{Eu}^{3+}$ , (b)  $\text{Eu}^{2+}$ , (c)  $\text{Gd}^{3+}$ , (d)  $\text{Tb}^{3+}$ , (e)  $\text{Sm}^{2+}$   
 (1) (a) and (c)  
 (2) (b) and (c)  
 (3) (d) and (e)  
 (4) Only (c)

**Answer (2)**

**Sol.** Electronic configuration of:



13. Given :  $\text{NH}_2\text{COONH}_4(\text{s}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$   
 If the partial pressure of  $\text{CO}_2$  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<sup>3</sup>  
 (2) 0.064 atm<sup>3</sup>  
 (3) 0.144 atm<sup>3</sup>  
 (4) 0.216 atm<sup>3</sup>

**Answer (3)**

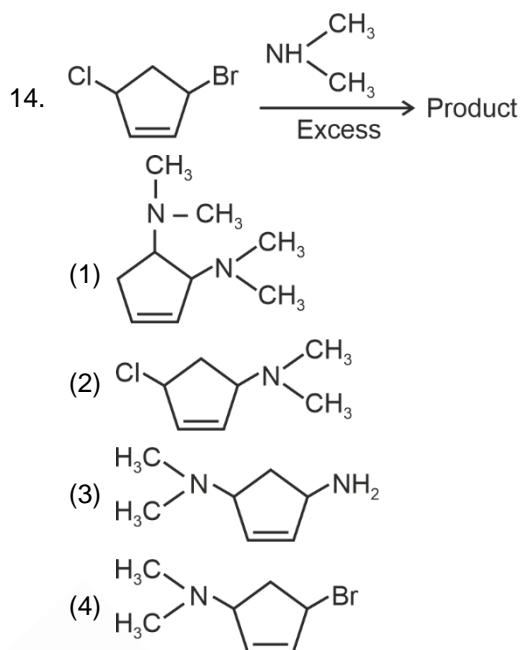
**Sol.**  $\text{NH}_2\text{COONH}_4(\text{s}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$

Total pressure at equilibrium = 1.0 atm

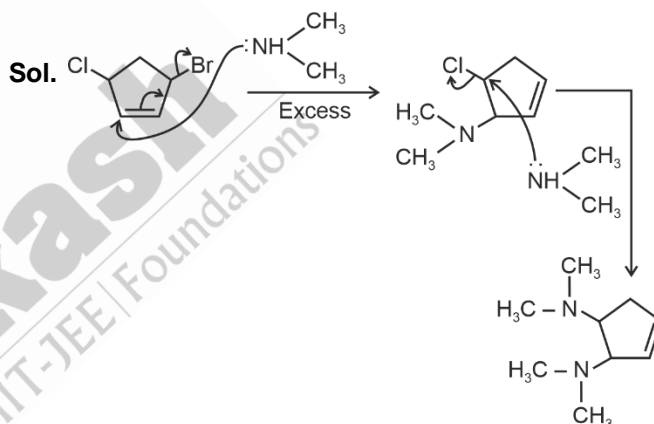
Partial pressure of  $\text{CO}_2$  at equilibrium = 0.4 atm

$\therefore$  Partial pressure of  $\text{NH}_3$  at equilibrium = 0.6 atm

$$\begin{aligned} K_p &= (p_{\text{NH}_3})^2 (p_{\text{CO}_2}) \\ &= (0.6)^2 (0.4) \\ &= 0.144 \text{ atm}^3 \end{aligned}$$



**Answer (1)**



15.  $\text{CO}_2$  gas is taken at 1 atm, 273K. Now it is allowed to pass through 0.1 M  $\text{Ca}(\text{OH})_2$  aq. solution. Excess amount of  $\text{Ca}(\text{OH})_2$  is neutralised with 40 mL of 0.1 M HCl. Then find volume of  $\text{Ca}(\text{OH})_2$  initially taken if 50%  $\text{Ca}(\text{OH})_2$  is react with  $\text{CO}_2$   
 (1) 40 mL  
 (2) 20 mL  
 (3) 80 mL  
 (4) 50 mL

**Answer (1)**

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Sol. g meq of  $\text{Ca}(\text{OH})_2 = 2 \times \text{gm eq of HCl}$

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

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

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

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

$$\Delta E = w \text{ (but not zero)}$$

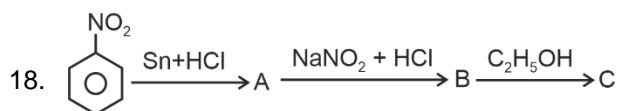
17. Match the column and choose the correct option

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


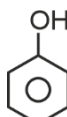
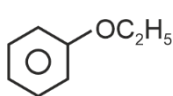
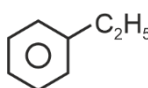
- (1) A-1, B-2, C-3, D-4  
 (2) A-4, B-3, C-2, D-1  
 (3) A-2, B-3, C-4, D-1  
 (4) A-3, B-2, C-4, D-1

**Answer (1)**

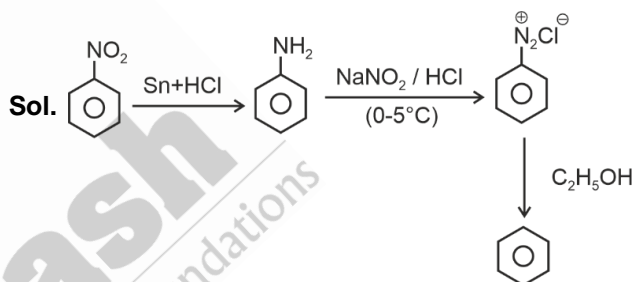
Sol.  $\text{Li}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$   
           76 pm    72 pm    31 pm



Identify C.

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

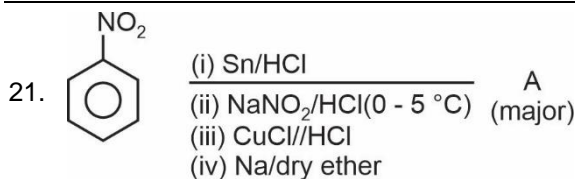
**Answer (1)**



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.



Find molecular weight of (A) in  $\text{g mol}^{-1}$

**Answer (154)**

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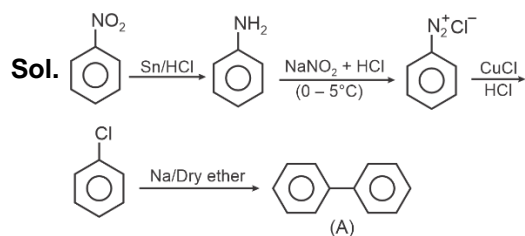
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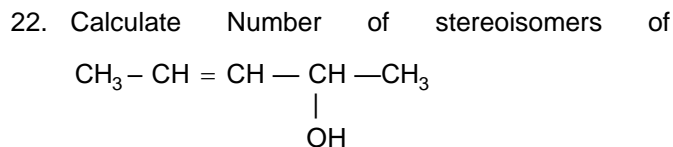
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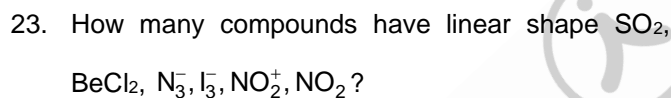
Molecular weight of (A) =  $154 \text{ g mol}^{-1}$



**Answer (4)**

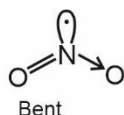
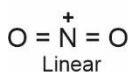
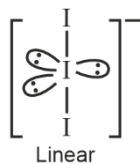
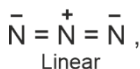
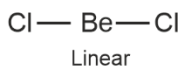
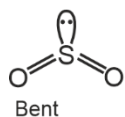
**Sol.** Number of centres which can show stereoisomerism in molecule = 2

Number of isomers =  $2^2 = 4$



**Answer (4)**

**Sol.**



24. In Carius method 180 mg of organic compound gives 143.5 mg of  $\text{AgCl}$ . Find the percentage of Cl in the organic compound. (Nearest integer)

**Answer (20)**

**Sol.** Mass of organic compound = 180 mg

Mass of  $\text{AgCl}$  = 143.5 mg

$$\begin{aligned} \text{Mass of Cl} &= \frac{143.5}{143.5} \times 35.5 \text{ mg} \\ &= 35.5 \text{ mg} \end{aligned}$$

Percentage of Cl in the organic compound

$$\begin{aligned} &= \frac{35.5 \times 100}{180} \\ &= 19.72\% \approx 20\% \end{aligned}$$

25. Two ampere current is allowed to pass through molten  $\text{AlCl}_3$  for 30 min. Find the mass (in mg) of aluminium deposited at cathode. (Nearest integer)

**Answer (336)**

**Sol.** Total charge passed =  $2 \times 30 \times 60 \text{ C}$

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

$$\text{Equivalents of Al deposited} = \frac{36}{965}$$

$$\begin{aligned} \text{Mass of Al deposited} &= \frac{36 \times 9}{965} \text{ g} \\ &= \frac{36 \times 9 \times 1000}{965} \text{ mg} \\ &= 335.75 \text{ mg} \\ &\approx 336 \text{ mg} \end{aligned}$$

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