

## FINAL JEE–MAIN EXAMINATION – JULY, 2022

(Held On Friday 29<sup>th</sup> July, 2022)

TIME : 9 : 00 AM to 12 : 00 NOON

### SECTION-A

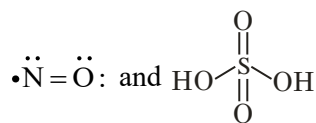
1. Which of the following pair of molecules contain odd electron molecule and an expanded octet molecule?

(A)  $\text{BCl}_3$  and  $\text{SF}_6$                       (B)  $\text{NO}$  and  $\text{H}_2\text{SO}_4$   
 (C)  $\text{SF}_6$  and  $\text{H}_2\text{SO}_4$                   (D)  $\text{BCl}_3$  and  $\text{NO}$

**Official Ans. by NTA (B)**

**Ans. (B)**

- Sol.** (A)  $\text{BCl}_3 \rightarrow$  Even Electron molecule  
 $\text{SF}_6 \rightarrow$  Expanded octet molecule  
 (B)  $\text{NO} \rightarrow$  Odd Electron molecule  
 $\text{H}_2\text{SO}_4 \rightarrow$  Expanded octet.  
 (C)  $\text{SF}_6 \rightarrow$  Even Electron molecule  
 $\text{H}_2\text{SO}_4 \rightarrow$  Expanded octet.  
 (D)  $\text{BCl}_3 \rightarrow$  Even Electron molecule  
 $\text{NO} \rightarrow$  Odd Electron molecule



$\text{S} \rightarrow 12e^-$  in outer orbit.

2.  $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$

20 g    5 g

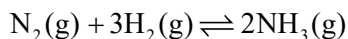
Consider the above reaction, the limiting reagent of the reaction and number of moles of  $\text{NH}_3$  formed respectively are:

(A)  $\text{H}_2$ , 1.42 moles                      (B)  $\text{H}_2$ , 0.71 moles  
 (C)  $\text{N}_2$ , 1.42 moles                      (D)  $\text{N}_2$ , 0.71 moles

**Official Ans. by NTA (C)**

**Ans. (C)**

**Sol.**



$W_2 = 20\text{g} \quad 5\text{g}$

$$n = \frac{20}{28} \quad \frac{5}{2}$$

Stoichiometric Amount:

$$\text{N}_2 \rightarrow \frac{20/28}{1} = \frac{20}{28} \quad \text{H}_2 \rightarrow \frac{5/2}{3} = \frac{5}{6}$$

$\therefore \text{N}_2$  is the Limiting Reagent.

$$\begin{aligned} \therefore n(\text{NH}_3) &= 2 \times n(\text{N}_2) = 2 \times \frac{20}{28} \\ &= 1.42 \end{aligned}$$

3. 100 mL of 5% (w/v) solution of  $\text{NaCl}$  in water was prepared in 250 mL beaker. Albumin from the egg was poured into  $\text{NaCl}$  solution and stirred well.

This resulted in a/an :

(A) Lyophilic sol                      (B) Lyophobic sol  
 (C) Emulsion                          (D) Precipitate

**Official Ans. by NTA (A)**

**Ans. (A)**

- Sol.** Standard method for the preparation of lyophilic sol. (Discussed in lab Manual)

4. The first ionization enthalpy of  $\text{Na}$ ,  $\text{Mg}$  and  $\text{Si}$ , respectively, are: 496, 737 and 786  $\text{kJ mol}^{-1}$ . The first ionization enthalpy ( $\text{kJ mol}^{-1}$ ) of  $\text{Al}$  is:

(A) 487                                      (B) 768  
 (C) 577                                      (D) 856

**Official Ans. by NTA (C)**

**Ans. (C)**

- Sol.** I. E :  $\text{Na} < \text{Al} < \text{Mg} < \text{Si}$

$$\therefore 496 < \text{IE}(\text{Al}) < 737$$

Option (C), matches the condition.

$$\text{i.e. IE}(\text{Al}) = 577 \text{ kJ mol}^{-1}$$

5. In metallurgy the term "gangue" is used for:

(A) Contamination of undesired earthy materials.  
 (B) Contamination of metals, other than desired metal  
 (C) Minerals which are naturally occurring in pure form  
 (D) Magnetic impurities in an ore.

**Official Ans. by NTA (A)**

**Ans. (A)**

- Sol.** Earthy and undesired materials present in the ore, other than the desired metal, is known as gangue.

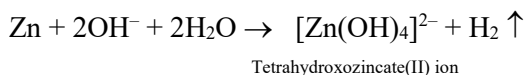
6. The reaction of zinc with excess of aqueous alkali, evolves hydrogen gas and gives :

- (A)  $Zn(OH)_2$  (B)  $ZnO$   
 (C)  $[Zn(OH)_4]^{2-}$  (D)  $[ZnO_2]^{2-}$

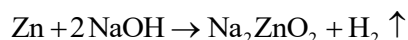
**Official Ans. by NTA (D)**

**Ans. (C or D)**

**Sol.** Zinc dissolves in excess of aqueous alkali



However, this reaction in NCERT is given as



$ZnO_2^{2-}$  is anhydrous form of  $[Zn(OH)_4]^{2-}$

So in aqueous medium best answer of this question is  $[Zn(OH)_4]^{2-}$

7. Lithium nitrate and sodium nitrate, when heated separately, respectively, give :

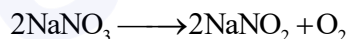
- (A)  $LiNO_2$  and  $NaNO_2$   
 (B)  $Li_2O$  and  $Na_2O$   
 (C)  $Li_2O$  and  $NaNO_2$   
 (D)  $LiNO_2$  and  $Na_2O$

**Official Ans. by NTA (C)**

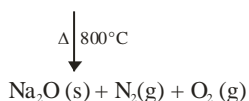
**Ans. (C)**

**Sol.**  $Li_2O$ ,  $NaNO_2$

As per NCERT Lithium nitrate when heated gives lithium oxide,  $Li_2O$ , whereas other alkali metal nitrates decompose to give the corresponding nitrite.



However, the decomposition product of  $NaNO_3$  are temperature dependent process as shown in the below reaction.



As temperature is not mentioned, we can go by

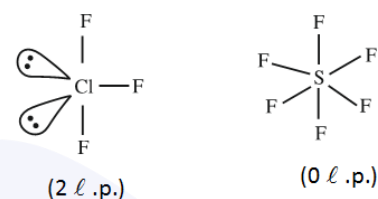
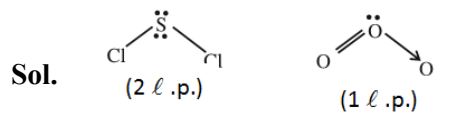
**Ans. (C)**

8. Number of lone pairs of electrons in the central atom of  $SCl_2$ ,  $O_3$ ,  $ClF_3$  and  $SF_6$ , respectively, are :

- (A) 0, 1, 2 and 2  
 (B) 2, 1, 2 and 0  
 (C) 1, 2, 2 and 0  
 (D) 2, 1, 2 and 0

**Official Ans. by NTA (B)**

**Ans. (B)**

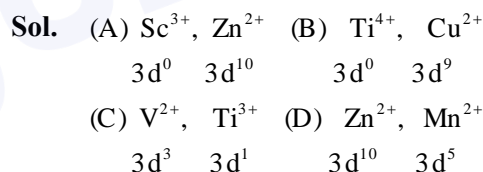


9. In following pairs, the one in which both transition metal ions are colourless is :

- (A)  $Sc^{3+}$ ,  $Zn^{2+}$   
 (B)  $Ti^{4+}$ ,  $Cu^{2+}$   
 (C)  $V^{2+}$ ,  $Ti^{3+}$   
 (D)  $Zn^{2+}$ ,  $Mn^{2+}$

**Official Ans. by NTA (A)**

**Ans. (A)**



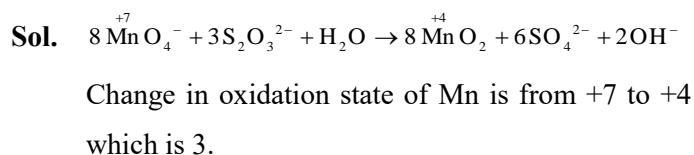
No d-d transitions in ions with  $d^0$  &  $d^{10}$  configuration. Therefore they are colourless.

10. In neutral or faintly alkaline medium,  $KMnO_4$  being a powerful oxidant can oxidize, thiosulphate almost quantitatively, to sulphate. In this reaction overall change in oxidation state of manganese will be :

- (A) 5 (B) 1 (C) 0 (D) 3

**Official Ans. by NTA (D)**

**Ans. (D)**



11. Which among the following pairs has only herbicides ?

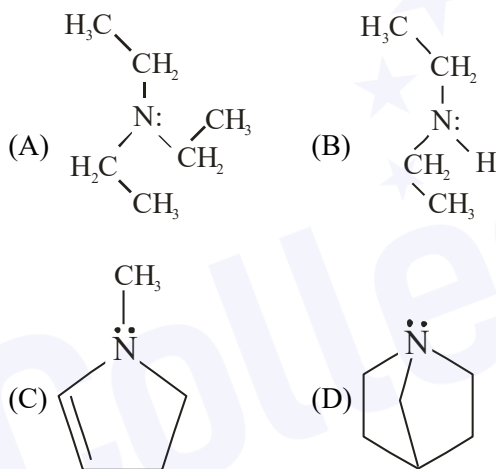
- (A) Aldrin and Dieldrin  
 (B) Sodium chlorate and Aldrin  
 (C) Sodium arsenate and Dieldrin  
 (D) Sodium chlorate and sodium arsenite.

Official Ans. by NTA (D)

Ans. (D)

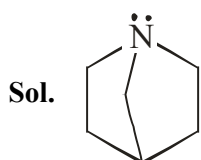
Sol. Both sodium chlorate and sodium arsenite behave as herbicide.

12. Which among the following is the strongest Bronsted base ?



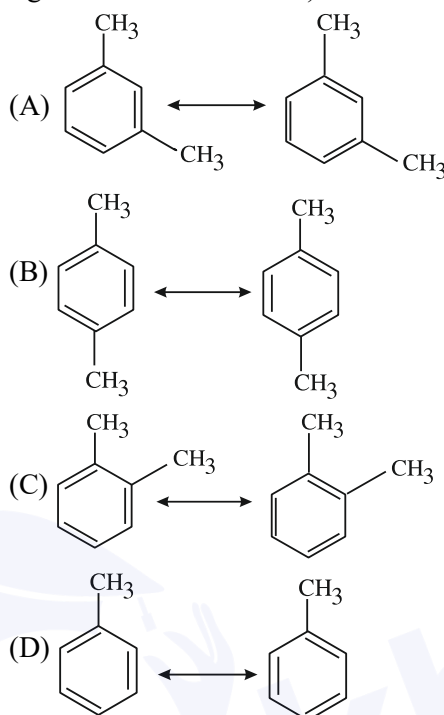
Official Ans. by NTA (D)

Ans. (D)



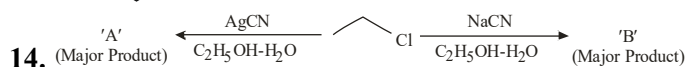
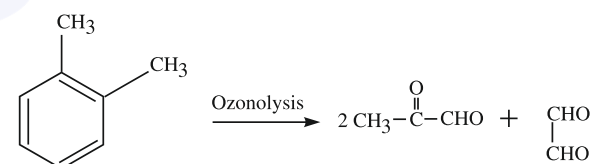
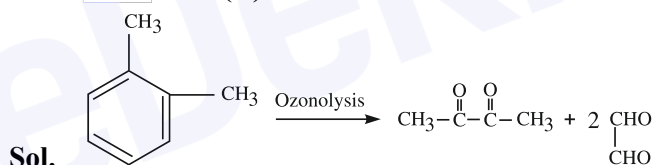
It is most basic because there is no amine inversion.

13. Which among the following pairs of the structures will give different products on ozonolysis? (Consider the double bonds in the structures are rigid and not delocalized.)

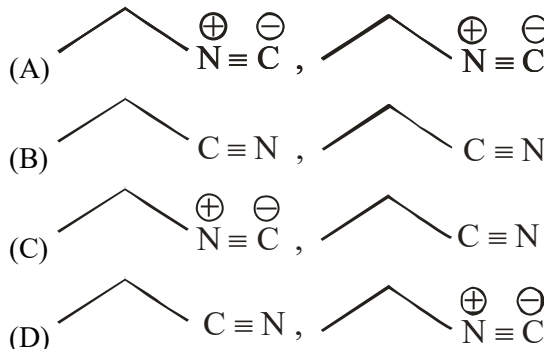


Official Ans. by NTA (C)

Ans. (C)

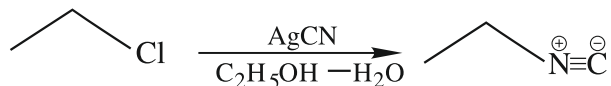
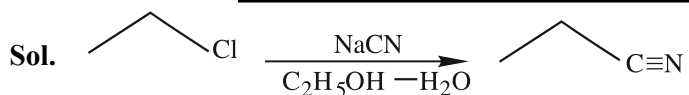


Considering the above reactions, the compound 'A' and compound 'B' respectively are :



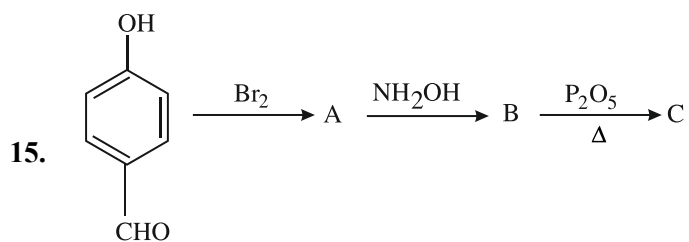
Official Ans. by NTA (C)

Ans. (C)



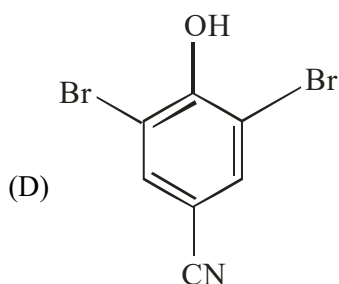
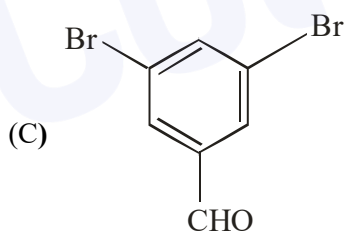
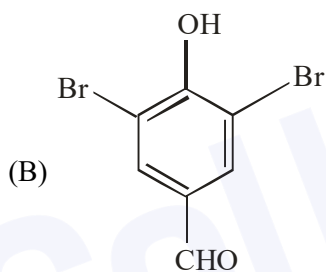
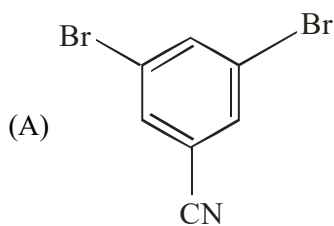
In NaCN; carbon is more nucleophilic atom.

Whereas in AgCN; Ag - C has covalent bond.

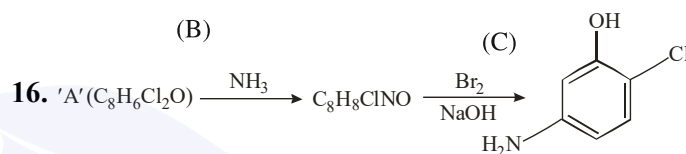
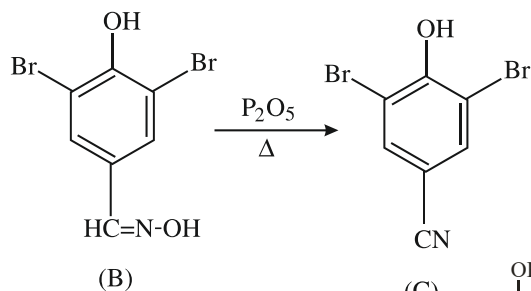
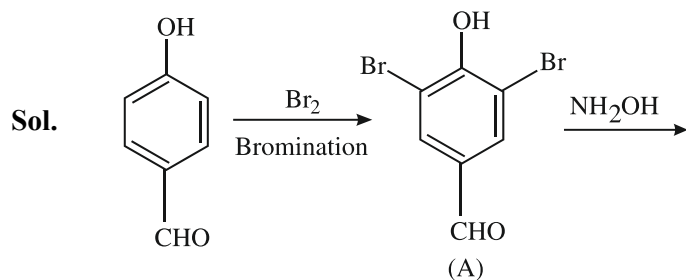


Consider the above reaction sequence, the Product

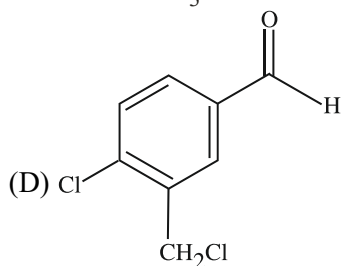
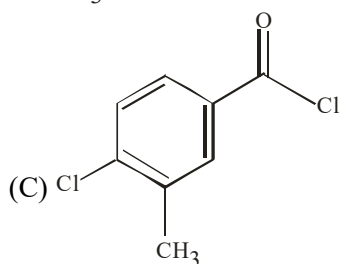
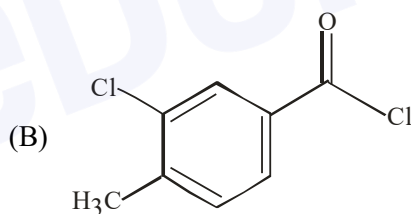
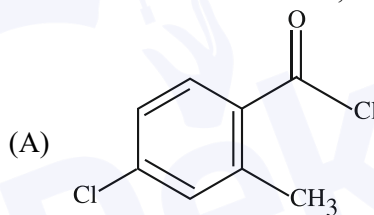
'C' is :



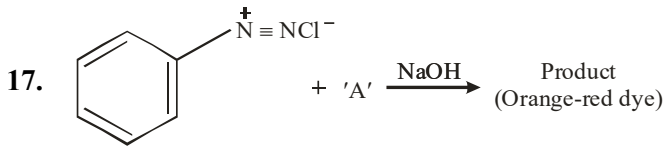
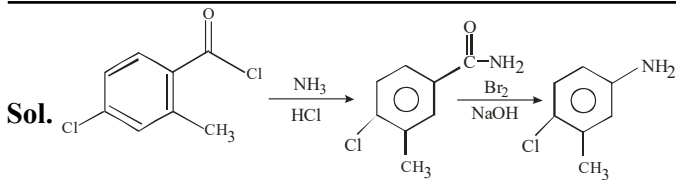
Official Ans. by NTA (D)  
Ans. (D)



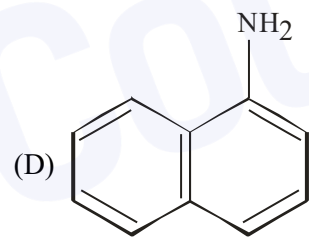
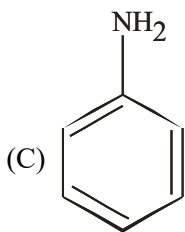
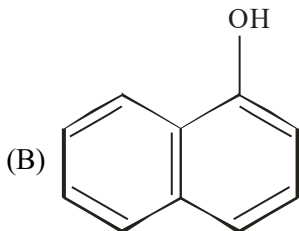
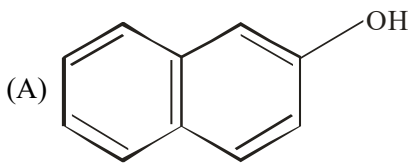
Consider the above reaction, the compound 'A' is :



Official Ans. by NTA (C)  
Ans. (C)



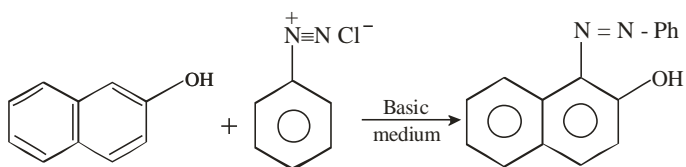
Which among the following represent reagent 'A'?



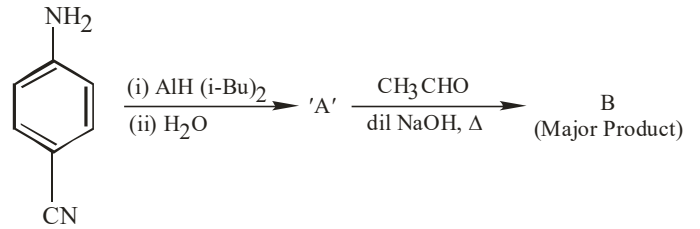
Official Ans. by NTA (A)

Ans. (A)

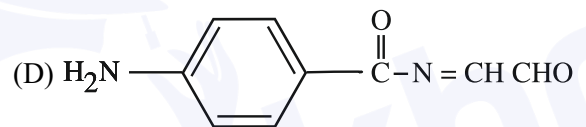
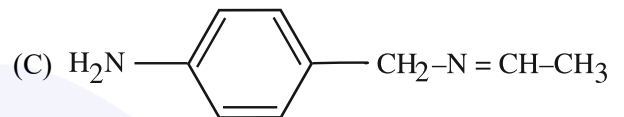
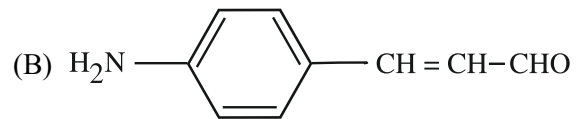
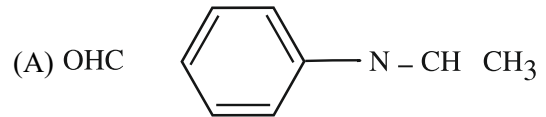
**Sol.**



18. Consider the following reaction sequence :



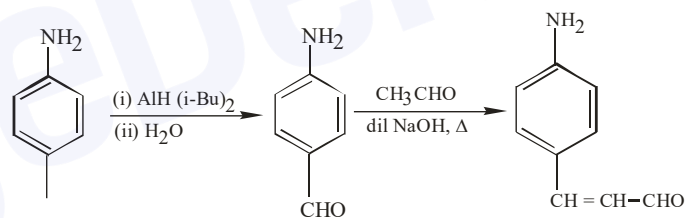
The product 'B' is :



Official Ans. by NTA (B)

Ans. (B)

**Sol.**



Cross aldol condensation

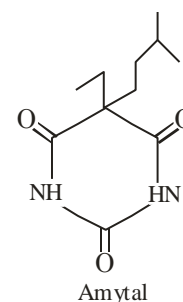
19. Which of the following compounds is an example of hypnotic drug ?

- (A) Seldane (B) Amytal  
(C) Aspartame (D) Prontosil

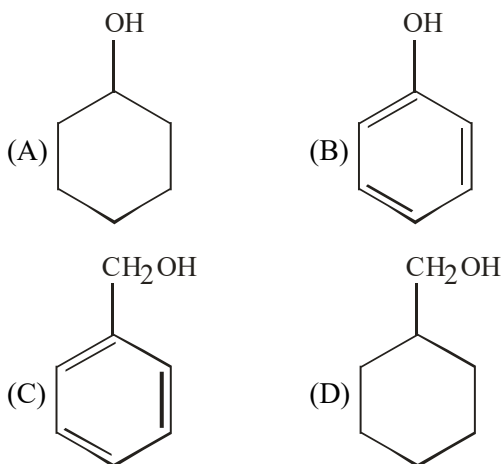
Official Ans. by NTA (B)

Ans. (B)

**Sol.** Amytal is hypnotic drug used to treat sleeping disorder.

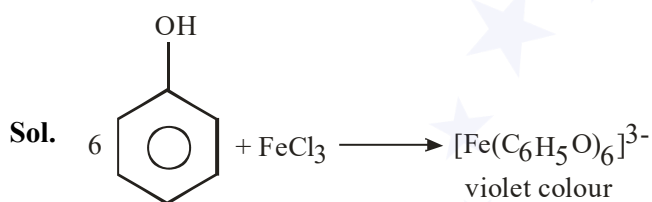


20. A compound 'X' is acidic and it is soluble in NaOH solution, but insoluble in NaHCO<sub>3</sub> solution. Compound 'X' also gives violet colour with neutral FeCl<sub>3</sub> solution. The compound 'X' is :



Official Ans. by NTA (B)

Ans. (B)



### SECTION-B

1. Resistance of a conductivity cell (cell constant 129 m<sup>-1</sup>) filled with 74.5 ppm solution of KCl is 100 Ω (labelled as solution 1). When the same cell is filled with KCl solution of 149 ppm, the resistance is 50 Ω (labelled as solution 2). The ratio of molar conductivity of solution 1 and solution 2 is i.e.

$$\frac{\Lambda_1}{\Lambda_2} = x \times 10^{-3}. \text{ The value of } x \text{ is } \underline{\hspace{2cm}}.$$

(Nearest integer)

Given, molar mass of KCl is 74.5 g mol<sup>-1</sup>

Official Ans. by NTA (1000)

Ans. (1000)

Sol.  $\frac{\ell}{A} = 129 \text{ m}^{-1}$

KCl solution 1 :

74.5 ppm, R<sub>1</sub> = 100 Ω

KCl solution 2 :

149 ppm, R<sub>2</sub> = 50 Ω

149 ppm, R<sub>2</sub> = 50 Ω

$$\text{Here, } \frac{\text{ppm}_1}{\text{ppm}_2} = \frac{M_1}{M_2} \left( = \frac{W_1/M_0}{V} \times \frac{V}{W_2/M_0} \right)$$

$$\frac{\Lambda_1}{\Lambda_2} = \frac{\kappa_1 \times \frac{1000}{M_1}}{\kappa_2 \times \frac{1000}{M_2}}$$

$$= \frac{\kappa_1}{\kappa_2} \times \frac{M_2}{M_1}$$

$$= \frac{50}{100} \times 2$$

$$= \frac{\Lambda_1}{\Lambda_2} = 1,000 \times 10^{-3}$$

Ans. 1,000

2. Ionic radii of cation A<sup>+</sup> and anion B<sup>-</sup> are 102 and 181 pm respectively. These ions are allowed to crystallize into an ionic solid. This crystal has cubic close packing for B<sup>-</sup>. A<sup>+</sup> is present in all octahedral voids. The edge length of the unit cell of the crystal AB is \_\_\_\_\_ pm. (Nearest Integer)

Official Ans. by NTA (512)

Ans. (566)

Sol.  $a = 2(r_+ + r_-)$

$a = 2(102 + 181)$

$a = 2(283)$

$a = 566 \text{ pm}$



6. If the solubility product of PbS is  $8 \times 10^{-28}$ , then the solubility of PbS in pure water at 298 K is  $x \times 10^{-16} \text{ mol L}^{-1}$ . The value of x is \_\_\_\_\_ .  
(Nearest Integer)

[Given  $\sqrt{2} = 1.41$ ]

**Official Ans. by NTA (282)**

**Ans. (282)**

**Sol.**  $K_{sp} = S^2$

$$S = \sqrt{K_{sp}} = \sqrt{8 \times 10^{-28}} = 2\sqrt{2} \times 10^{-14}$$

$$= 2.82 \times 10^{-14}$$

$$= 282 \times 10^{-16}$$

Ans. = 282

7. The reaction between X and Y is first order with respect to X and zero order with respect to Y.

Experiment	[X] molL <sup>-1</sup>	[Y] molL <sup>-1</sup>	Initial rate molL <sup>-1</sup> min <sup>-1</sup>
I.	0.1	0.1	$2 \times 10^{-3}$
II.	L	0.2	$4 \times 10^{-3}$
III.	0.4	0.4	$M \times 10^{-3}$
IV.	0.1	0.2	$2 \times 10^{-3}$

Examine the data of table and calculate ratio of numerical values of M and L. (Nearest Integer)

**Official Ans. by NTA (40)**

**Ans. (40)**

**Sol.**  $r = k [X] [Y]^0 = k [X]$

Using I & II

$$\frac{4 \times 10^{-3}}{2 \times 10^{-3}} = \left(\frac{L}{0.1}\right) \Rightarrow L = 0.2$$

Using I & III

$$\frac{M \times 10^{-3}}{2 \times 10^{-3}} = \frac{0.4}{0.1} \Rightarrow M = 8$$

$$\frac{M}{L} = \frac{8}{0.2} = 40$$

Ans. 40

8. In a linear tetrapeptide (Constituted with different amino acids), (number of amino acids) - (number of peptide bonds) is \_\_\_\_\_.

**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** In Tetrapeptide,

No. of Amino Acids = 4

No. of Peptide bonds = 3

Hence

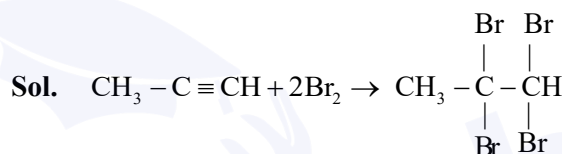
Ans. = 1

9. In bromination of Propyne, with Bromine 1, 1, 2, 2-tetrabromopropane is obtained in 27% yield. The amount of 1, 1, 2, 2 tetrabromopropane obtained from 1 g of Bromine in this reaction is \_\_\_\_\_  $\times 10^{-1}$  g. (Nearest integer)

(Molar Mass : Bromine = 80 g/mol)

**Official Ans. by NTA (3)**

**Ans. (3)**



$$= \frac{1}{160} \times \frac{1}{2} \times 360 \times 0.27$$

$$= 0.30375$$

$$= 3.0375 \times 10^{-1}$$

**Ans. = 3**

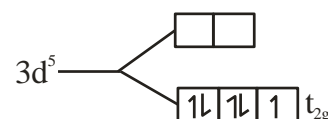
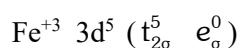
10.  $[\text{Fe}(\text{CN})_6]^{3-}$  should be an inner orbital complex. Ignoring the pairing energy, the value of crystal field stabilization energy for this complex is (–) \_\_\_\_\_  $\Delta_0$ . (Nearest integer)

**Official Ans. by NTA (2)**

**Ans. (2)**

**Sol.**  $[\text{Fe}(\text{CN})_6]^{3-}$

$\text{CN}^-$  is strong field ligand



$\text{CFSE} = 5 (-0.4 \Delta_0) = -2.0 \Delta_0$

**Ans. (2)**