

**FINAL JEE-MAIN EXAMINATION – APRIL, 2023**

**(Held On Saturday 15<sup>th</sup> April, 2023)**

**TIME : 9 : 00 AM to 12 : 00 NOON**

**SECTION-A**

61. Match List I with List II:

**List I-(Monomer)**                      **List II-(Polymer)**

- |                       |                     |
|-----------------------|---------------------|
| (A) Tetrafluoroethene | (i) Orlon           |
| (B) Acrylonitrile     | (ii) Natural rubber |
| (C) Caprolactam       | (iii) Teflon        |
| (D) Isoprene          | (IV) Nylon-6        |

Choose the correct answer from the options given

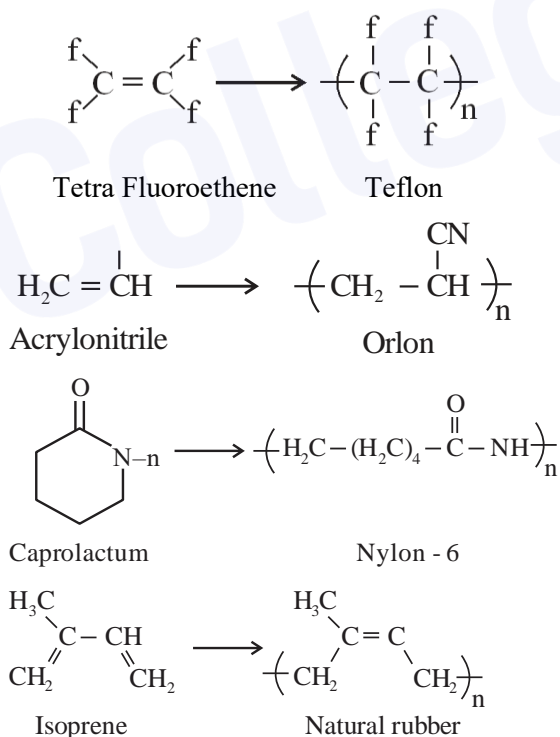
below :

- (1) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)  
 (2) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)  
 (3) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)  
 (4) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

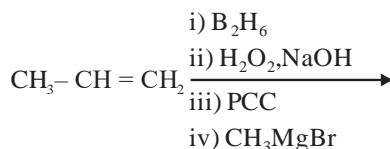
**Official Ans. by NTA (1)**

**Ans. (1)**

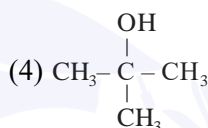
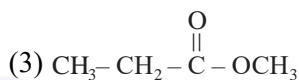
**Sol.**



62. The product formed in the following multistep reaction is:



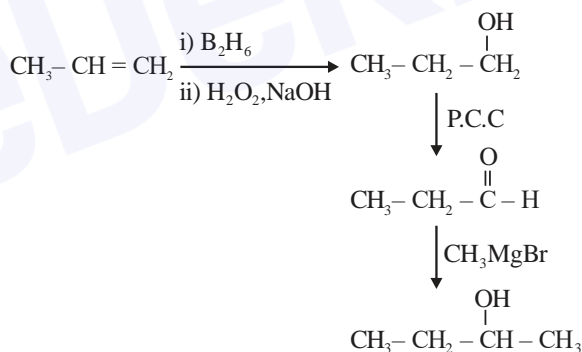
- (1)  $CH_3 - CH_2 - \overset{OH}{|}CH - CH_3$   
 (2)  $CH_3 - CH_2 - CH_2 - CH_2 - OH$



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

**Ans. (1)**

**Sol.**



63. The possibility of photochemical smog formation will be minimum at

- (1) Kolkata in October  
 (2) Mumbai in May  
 (3) New-Delhi in August (Summer)  
 (4) Srinagar, Jammu and Kashmir in January

**Official Ans. by NTA (4)**

**Ans. (4)**

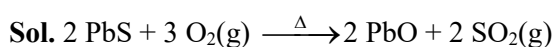
**Sol.** Photochemical smog occurs in warm, dry and sunny climate.

64. Which one of the following is not an example of calcination ?

- (1)  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O} \xrightarrow{\Delta} \text{Fe}_2\text{O}_3 + x\text{H}_2\text{O}$
- (2)  $\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2$
- (3)  $\text{CaCO}_3 \cdot \text{MgCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{MgO} + 2\text{CO}_2$
- (4)  $2\text{PbS} + 3\text{O}_2 \xrightarrow{\Delta} 2\text{PbO} + 2\text{SO}_2$

Official Ans. by NTA (4)

Ans. (4)



It is a roasting reaction.

65. Consider the following statements:

- (A)  $\text{NF}_3$  molecule has a trigonal planar structure.
- (B) Bond length of  $\text{N}_2$  is shorter than  $\text{O}_2$ .
- (C) Isoelectronic molecules or ions have identical bond order.
- (D) Dipole moment of  $\text{H}_2\text{S}$  is higher than that of water molecule.

Choose the correct answer from the option below:

- (1) (A) and (D) are correct
- (2) (C) and (D) are correct
- (3) (A) and (B) are correct
- (4) (B) and (C) are correct

Official Ans. by NTA (4)

Ans. (4)

Sol. (A)  $\text{NF}_3$  has trigonal pyramidal shape.

(B) Bond order  $\Rightarrow \text{N}_2 > \text{O}_2$

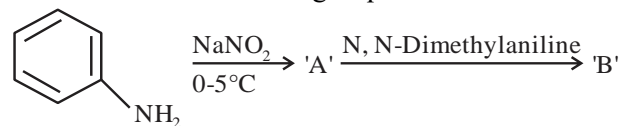
Bond length  $\Rightarrow \text{N}_2 < \text{O}_2$

$\Rightarrow$  (C)

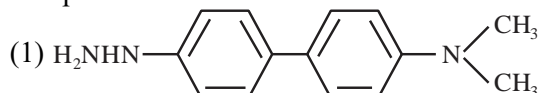
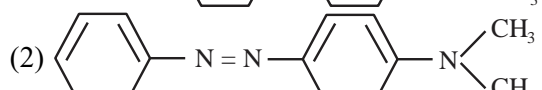
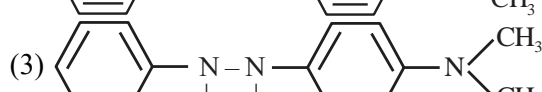
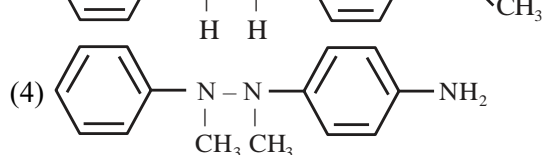
(D) Dipole moment  $\text{H}_2\text{O} > \text{H}_2\text{S}$

Due to Electronegativity difference.

66. Consider the following sequence of reactions:



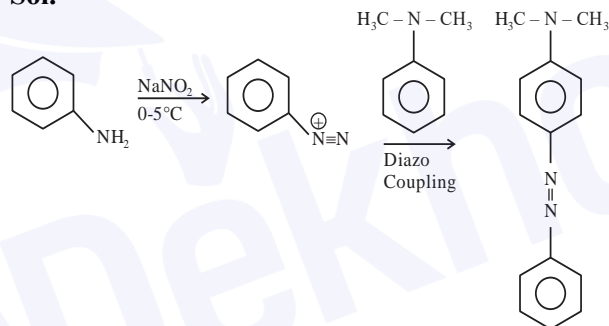
The product 'B' is

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

Official Ans. by NTA (2)

Ans. (2)

Sol.



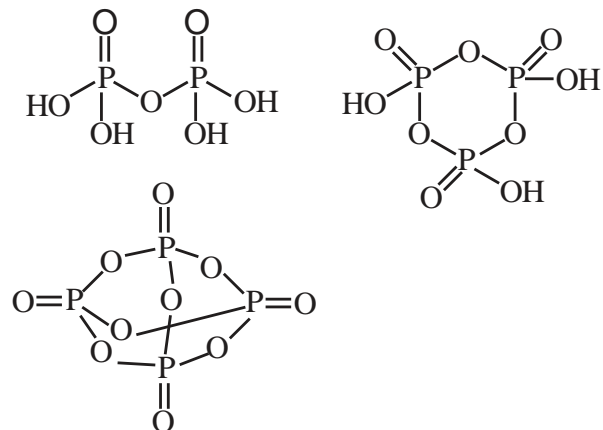
67. The number of P - O - P bonds in  $\text{H}_4\text{P}_2\text{O}_7$ ,  $(\text{HPO}_3)_3$  and  $\text{P}_4\text{O}_{10}$  are respectively.

- (1) 1, 3, 6
- (2) 0, 3, 6
- (3) 0, 3, 4
- (4) 1, 2, 4

Official Ans. by NTA (1)

Ans. (1)

Sol.



Molecule	Number of P-O-P Bond
$\text{H}_4\text{P}_2\text{O}_7$	1
$(\text{HPO}_3)_3$	3
$\text{P}_4\text{O}_{10}$	6

68. Given below are two statements:

**Statement I:** According to Bohr's model of hydrogen atom, the angular momentum of an electron in a given stationary state is quantised.

**Statement II :** The concept of electron in Bohr's orbit, violates the Heisenberg uncertainty principle.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are correct.
- (2) Statement I is correct but Statement II is incorrect.
- (3) Statement I is incorrect but Statement II is correct
- (4) Both Statement I and Statement II are incorrect.

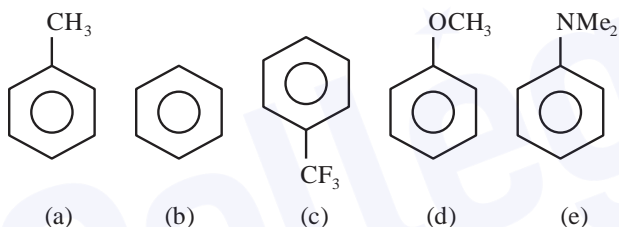
**Official Ans. by NTA (1)**

**Ans. (1)**

**Sol.** According to Bohr's model the angular momentum is quantised and equal to  $\frac{nh}{2\pi}$ .

Heisenberg uncertainty principle explains orbital concept, which is based on probability of finding electron.

69. Decreasing order of reactivity towards electrophilic substitution for the following compounds is :

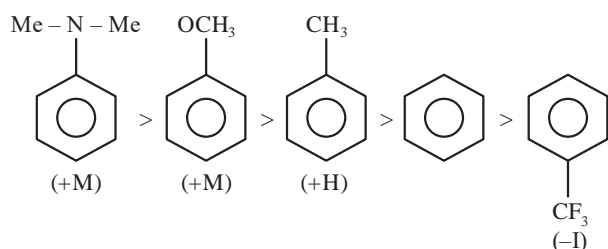


- (1)  $c > b > a > d > e$
- (2)  $e > d > a > b > c$
- (3)  $a > d > e > b > c$
- (4)  $d > a > e > c > b$

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

**Ans. (2)**

**Sol.** Higher the electron density on Benzene Ring, Higher its Reactivity towards electrophilic substitution Reaction



70. Which of the following statement(s) is/are correct?

- (A) The pH of  $1 \times 10^{-8}$  M HCl solution is 8.
- (B) The conjugate base  $\text{H}_2\text{PO}_4^-$  is  $\text{HPO}_4^{2-}$ .
- (C)  $K_w$  increases with increase in temperature.
- (D) When a solution of weak monoprotic acid is titrated against a strong base at half neutralisation point,  $\text{pH} = \frac{1}{2} \text{p}K_a$

Choose the correct answer from the option given below.

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

**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol.** (A) pH of  $10^{-8}$  M HCl is in acidic range (6.98).

(B) Conjugate Base of  $\text{H}_2\text{PO}_4^-$  is  $\text{HPO}_4^{2-}$

(C)  $K_w$  increases with increasing Temperature, as the temperature increases, the dissociation of water increases.

(D) At half neutralisation point, half of the acid is present in the form of salt.

$$\text{pH} = \text{p}K_a + \log \frac{1}{1} = \text{p}K_a$$

71. Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R :

**Assertion (A) :**  $\text{BeCl}_2$  and  $\text{MgCl}_2$  produce characteristic flame.

**Reason (R) :** The excitation energy is high in  $\text{BeCl}_2$  and  $\text{MgCl}_2$

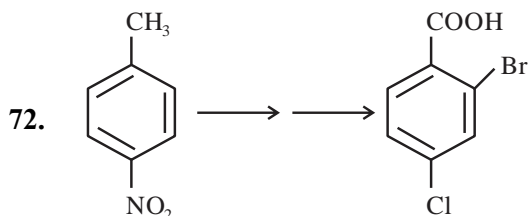
In the light of the above statements, choose the correct answer from the option given below :

- (1) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
- (2) (A) is false but (R) is true
- (3) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (4) (A) is true but (R) is false.

Official Ans. by NTA (2)

Ans. (2)

Sol. Be, Mg do not give colour to flame due to high excitation energy.



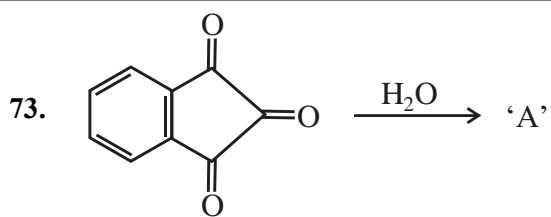
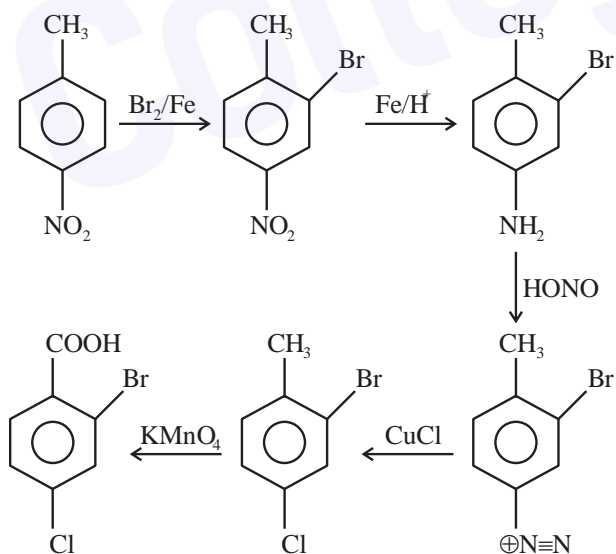
In the above conversion the correct sequence of reagents to be added is

- (1) (i)  $\text{Fe}/\text{H}^+$ , (ii) HONO, (iii)  $\text{CuCl}$ , (iv)  $\text{KMnO}_4$ , (v)  $\text{Br}_2$
- (2) (i)  $\text{KMnO}_4$ , (ii)  $\text{Br}_2/\text{Fe}$ , (iii)  $\text{Fe}/\text{H}^+$ , (iv)  $\text{Cl}_2$
- (3) (i)  $\text{Br}_2/\text{Fe}$ , (ii)  $\text{Fe}/\text{H}^+$ , (iii) HONO, (iv)  $\text{CuCl}$ , (v)  $\text{KMnO}_4$
- (4)  $\text{Br}_2/\text{Fe}$ , (ii)  $\text{Fe}/\text{H}^+$ , (iii)  $\text{KMnO}_4$ , (iv)  $\text{Cl}_2$

Official Ans. by NTA (3)

Ans. (3)

Sol.



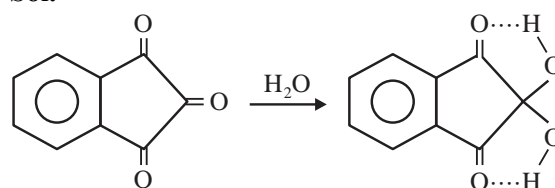
major product 'A' formed in the above reaction is

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

Official Ans. by NTA (4)

Ans. (4)

Sol.

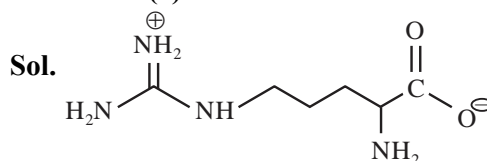


74. Which is not true for arginine?

- (1) It is a crystalline solid.
- (2) It is associated with more than one  $\text{pK}_a$  values.
- (3) It has a fairly high melting point.
- (4) It has high solubility in benzene.

Official Ans. by NTA (4)

Ans. (4)



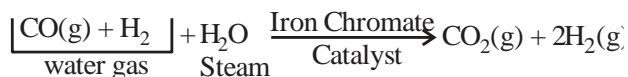
Arginine exist is zwitterion, so solid in nature and soluble in polar solvent.

75. During water-gas shift reaction
- (1) carbon monoxide is oxidized to carbon dioxide.
  - (2) carbon is oxidized to carbon monoxide.
  - (3) carbon dioxide is reduced to carbon monoxide.
  - (4) water is evaporated in presence of catalyst.

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

**Ans. (1)**

**Sol.** Water gas shift reaction



76. For a good quality cement, the ratio of silica to alumina is found to be

- (1) 3
- (2) 4.5
- (3) 2
- (4) 1.5

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

**Ans. (1)**

**Sol.** For good quality cement, the ratio of silica (SiO<sub>2</sub>) to Alumina (Al<sub>2</sub>O<sub>3</sub>) should be between 2.5 to 4.

77. Which of the following statement is correct for paper chromatography ?

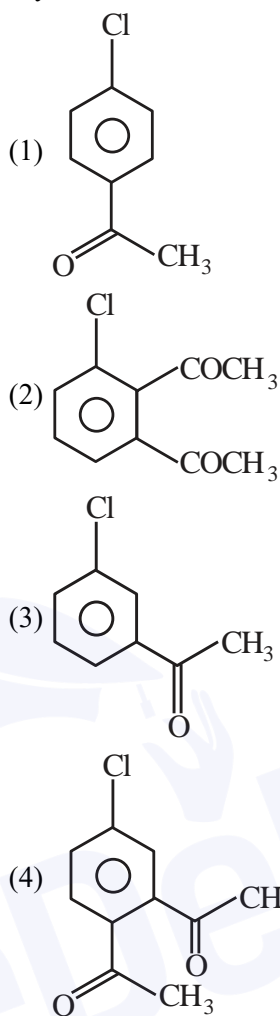
- (1) Water present in the mobile phase gets absorbed by the paper which then forms the stationary phase.
- (2) Water present in the pores of the paper forms the stationary phase.
- (3) Paper sheet forms the stationary phase.
- (4) Paper and water present in its pores together form the stationary phase.

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

**Ans. (2)**

**Sol.** In paper chromatography, a special quality paper known as chromatography paper is used. Paper contains water trapped in it, which acts as the stationary phase.

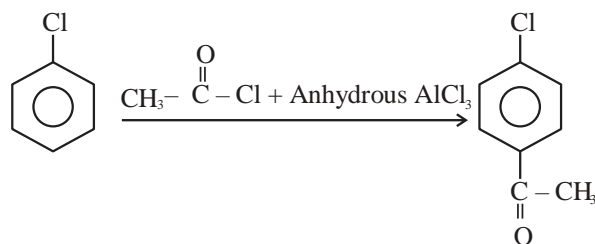
78. The major product formed in the Friedel-Craft acylation of chlorobenzene is .



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

**Ans. (1)**

**Sol.**



Chlorine is ortho/para directing, para is major.

79. The complex with highest magnitude of crystal field splitting energy ( $\Delta_0$ ) is

- (1) [Cr(OH<sub>2</sub>)<sub>6</sub>]<sup>3+</sup>
- (2) [Ti(OH<sub>2</sub>)<sub>6</sub>]<sup>3+</sup>
- (3) [Fe(OH<sub>2</sub>)<sub>6</sub>]<sup>3+</sup>
- (4) [Mn(OH<sub>2</sub>)<sub>6</sub>]<sup>3+</sup>

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

**Ans. (4)**

**Sol.** Data based

80. Which of the following expressions is correct in case of a CsCl unit cell (edge length 'a')?

(1)  $r_{\text{Cs}^+} + r_{\text{Cl}^-} = \frac{a}{\sqrt{2}}$

(2)  $r_{\text{Cs}^+} + r_{\text{Cl}^-} = a$

(3)  $r_{\text{Cs}^+} + r_{\text{Cl}^-} = \frac{\sqrt{3}}{2} a$

(4)  $r_{\text{Cs}^+} + r_{\text{Cl}^-} = \frac{a}{2}$

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

**Ans. (3)**

**Sol.** For CsCl,  $\text{Cs}^{\oplus}$  is present at Body centre and

$\text{Cl}^{\ominus}$  at all corner.  $\frac{\sqrt{3}a}{2} = r_{\text{Cs}^{\oplus}} + r_{\text{Cl}^{\ominus}}$

### SECTION-B

81. The homoleptic and octahedral complex of  $\text{Co}^{2+}$  and  $\text{H}_2\text{O}$  has \_\_\_\_\_ unpaired electron(s) in the  $t_{2g}$  set of orbitals.

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

**Ans. (1)**

**Sol.**  $\text{Co}^{2+} : 3d^7$  configuration



82. The volume (in mL) of 0.1 M  $\text{AgNO}_3$  required for complete precipitation of chloride ions present in 20 mL of 0.01 M solution of  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$  as silver chloride is \_\_\_\_\_

**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol.**  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 + 2 \text{AgNO}_3 \rightarrow$

0.01M, 20mL

0.1M

For 0.2 milimole

$\text{AgNO}_3$  required

= 0.4 milimole

$$0.4 = 0.1 \times V(\text{ml})$$

$$V = 4\text{mL}$$

83. The total change in the oxidation state of manganese involved in the reaction of  $\text{KMnO}_4$  and potassium iodide in the acidic medium is \_\_\_\_\_

**Official Ans. by NTA (5)**

**Ans. (5)**

**Sol.**  $\text{KMnO}_4 \rightarrow \text{Mn}^{2+}$



+7      +2

Change in oxidation state of Mn = 5

84. In Chromyl chloride, the oxidation state of chromium is (+) \_\_\_\_\_

**Official Ans. by NTA (6)**

**Ans. (6)**

**Sol.**  $\text{CrO}_2\text{Cl}_2 \times -4 - 2 = 0$

Oxidation State = +6

85. The total number of isoelectronic species from the given set is \_\_\_\_\_

$\text{O}^{2-}, \text{F}^-, \text{Al}, \text{Mg}^{2+}, \text{Na}^+, \text{O}^+, \text{Mg}, \text{Al}^{3+}, \text{F}$

**Official Ans. by NTA (5)**

**Ans. (5)**

**Sol.** Isoelectronic species  $\text{O}^{2\ominus}, \text{F}^{\ominus}, \text{Mg}^{2+}, \text{Na}^{\oplus}, \text{Al}^{3+}$

86. The vapour pressure of 30% (w/v) aqueous solution of glucose is \_\_\_\_\_ mm Hg at 25°C.

[Given : The density of 30% (w/v), aqueous solution of glucose is  $1.2 \text{ g cm}^{-3}$  and vapour pressure of pure water is 24 mm Hg.]

(Molar mass of glucose is  $180 \text{ g mol}^{-1}$ .)

**Official Ans. by NTA (23)**

**Ans. (23)**

**Sol.**  $\frac{24 - P_s}{P_s} = \frac{m \times 18}{1000}$

wt of solute = 30 gm

Volume of solution = 100 mL

wt. of solution =  $1.2 \times 100 = 120$  gm

wt. of solvent =  $120 - 30 = 90$  gm

$$m = \frac{30 \times 1000}{180 \times 90} = 1.85$$

$$\frac{24 - P_s}{P_s} = \frac{1.85 \times 18}{1000}$$

$$24 - P_s = 0.0333 P_s$$

$$P_s(1.033) = 24$$

$$P_s = 23.22$$

87. 20 mL of 0.5 M NaCl is required to coagulate 200 mL of  $As_2S_3$  solution in 2 hours. The coagulating value of NaCl is \_\_\_\_\_

**Official Ans. by NTA (50)**

**Ans. (50)**

**Sol.** Coagulating value is required milimole of electrolyte needed to coagulate 1 L sol in 2 hours.

$$\text{Coagulating value} = \frac{20 \times 0.5}{200} \times 1000 = 50$$

88. For a reversible reaction  $A \rightleftharpoons B$ , the  $\Delta H_{\text{forward reaction}} = 20 \text{ kJ mol}^{-1}$ . The activation energy of the uncatalysed forward reaction is  $300 \text{ kJ mol}^{-1}$ . When the reaction is catalysed keeping the reactant concentration same, the rate of the catalysed forward reaction at  $27^\circ\text{C}$  is found to be same as that of the uncatalysed reaction at  $327^\circ\text{C}$ . The activation energy of the catalysed backward reaction is \_\_\_\_\_  $\text{kJ mol}^{-1}$ .

**Official Ans. by NTA (130)**

**Ans. (130)**

**Sol.**  $E_a = 300 \text{ kJ mol}^{-1}$

$$\frac{E_a}{T} = \frac{E'_a}{T'}$$

(Since rate of catalysed and uncatalysed reaction is same)

$$\frac{300}{600} = \frac{E'_{a,f}}{300}$$

$$E'_{a,f} = 150$$

$$20 = 150 - E'_{a,b}$$

$$E'_{a,b} = 130$$

89. The number of correct statements from the following is \_\_\_\_\_

- (A) Conductivity always decreases with decrease in concentration for both strong and weak electrolytes.  
 (B) The number of ions per unit volume that carry current in a solution increases on dilution.  
 (C) Molar conductivity increases with decrease in concentration.  
 (D) The variation in molar conductivity is different for strong and weak electrolytes.  
 (E) For weak electrolytes, the change in molar conductivity with dilution is due to decrease in degree of dissociation.

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

**Ans. (3)**

**Sol.**

- (A) Conductivity decreases with dilution for strong electrolyte as well as weak electrolyte.  
 (B) On dilution, The number of ions per unit volume that carry current in a solution decreases.  
 (C) Molar conductivity increases with dilution.  
 (D) Molar conductivity of strong electrolyte follows DHO equation but it is not applicable for weak electrolyte.  
 (E) On dilution degree of dissociation of weak electrolyte increases.

So answer is (A), (C) & (D).

90. 30.4 kJ of heat is required to melt one mole of sodium chloride and the entropy change at the melting point is  $28.4 \text{ J K}^{-1} \text{ mol}^{-1}$  at 1 atm. The melting point of sodium chloride is \_\_\_\_\_ K (Nearest Integer)

**Official Ans. by NTA (1070)**

**Ans. (1070)**

$$\text{Sol. } \Delta S = \frac{\Delta H}{T_{\text{mp}}}$$

$$28.4 = \frac{30.4 \times 1000}{T_{\text{mp}}}$$

$$T_{\text{mp}} = 1070.422 \text{ K.}$$