# FINAL JEE–MAIN EXAMINATION – JUNE, 2022

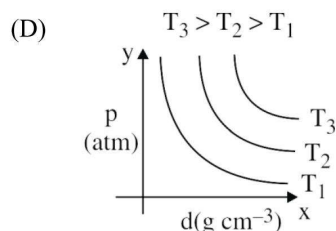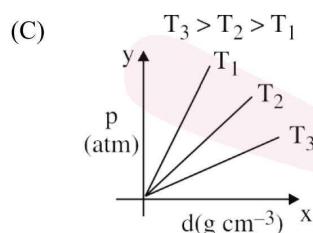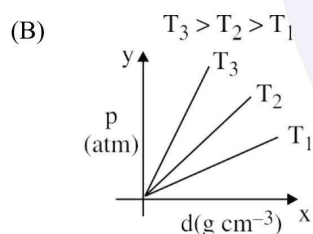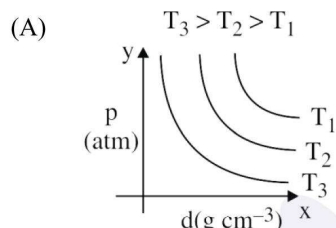**(Held On Monday 27th June, 2022)**　　　　**TIME : 3 : 00 PM to 6 : 00 PM**

| CHEMISTRY | TEST PAPER WITH SOLUTIONS |
|---|---|

## SECTION-A

**1.** Which amongst the given plots is the correct plot for pressure (p) vs density (d) for an ideal gas ?

(A)


$T_3 > T_2 > T_1$

(B)


$T_3 > T_2 > T_1$

(C)


$T_3 > T_2 > T_1$
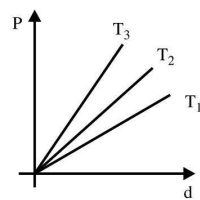
(D)


$T_3 > T_2 > T_1$

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

　　**Ans. (B)**

**Sol.** P vs d :

$$P = \left( \frac{RT}{M} \right) d$$



$T_3 > T_2 > T_1$

**2.** Identify the **incorrect** statement for $PCl_5$ from the following.

(A) In this molecule, orbitals of phosphorous are assumed to undergo $sp^3d$ hybridization.

(B) The geometry of $PCl_5$ is trigonal bipyramidal.

(C) $PCl_5$ has two axial bonds stronger than three equatorial bonds.

(D) The three equatorial bonds of $PCl_5$ lie in a plane.

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

　　**Ans. (C)**

**Sol.** In $PCl_5$, axial bonds are weaker than equatorial.

**3.** **Statement I : Leaching of gold** with cyanide ion in absence of air / $O_2$ leads to cyano complex of Au(III).

**Statement II :** Zinc is oxidized during the displacement reaction carried out for gold extraction.

In the light of the above statements, choose the correct answer from the options given below.

(A) Both Statement I and Statement II are correct

(B) Both Statement I and Statement II are incorrect

(C) Statement I is correct but Statement II is incorrect

(D) Statement I is incorrect but Statement II is correct

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

　　**Ans. (D)**

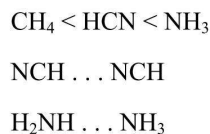**Sol.** Statement-1 : wrong, $Au^+$ is correct, not $Au^{+3}$

Statement-2 : correct

**4.** The correct order of increasing intermolecular hydrogen bond strength is

(A) $HCN < H_2O < NH_3$

(B) $HCN < CH_4 < NH_3$

(C) $CH_4 < HCN < NH_3$

(D) $CH_4 < NH_3 < HCN$

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

**Ans. (C)**

**Sol.** Order of H-Bonding

$CH_4 < HCN < NH_3$

$NCH \ldots NCH$

$H_2NH \ldots NH_3$

**5.** The correct order of increasing ionic radii is

(A) $Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$

(B) $N^{3-} < O^{2-} < F^- < Na^+ < Mg^{2+}$

(C) $F^- < Na^+ < O^{2-} < Mg^{2+} < N^{3-}$

(D) $Na^+ < F^- < Mg^{2+} < O^{2-} < N^{3-}$

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

**Ans. (A)**

**Sol.** $N^{-3} > O^{-2} > F^- > Na^+ > Mg^{+2}$ (Radii)
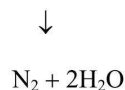
(Isoelectronic species)

**6.** The gas produced by treating an aqueous solution of ammonium chloride with sodium nitrite is

(A) $NH_3$           (B) $N_2$

(C) $N_2O$           (D) $Cl_2$

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

**Ans. (B)**

**Sol.** $NH_4Cl + NaNO_2 \rightarrow NH_4NO_2 + NaCl$

$\downarrow$

$N_2 + 2H_2O$

**7.** Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

**Assertion A :** Flourine forms one oxoacid.

**Reason R :** Flourine has smallest size amongst all halogens and is highly electronegative

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

(A) Both A and R are correct and R is the correct explanation of A.

(B) Both A and R are correct but R is NOT the correct explanation of A.

(C) A is correct but R is not correct.

(D) A is not correct but R is correct

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

**Ans. (A)**

**Sol.** Both A and R are correct and R is the correct explanation of A.

**8.** In 3d series, the metal having the highest $M^{2+}/M$ standard electrode potential is

(A) Cr                (B) Fe

(C) Cu                (D) Zn

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

**Ans. (C)**

**Sol.** $Cr^{+2}/Cr \rightarrow -0.90 \text{ V}$

$Fe^{+2}/Fe \rightarrow -0.44 \text{ V}$

$Cu^{+2}/Cu \rightarrow +0.34 \text{ V}$

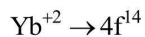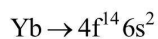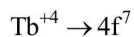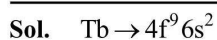$Zn^{+2}/Zn \rightarrow -0.76 \text{ V}$

So Ans. $Cu^{+2}/Cu$

**9.** The 'f' orbitals are half and completely filled, respectively in lanthanide ions

(Given: Atomic no. Eu, 63; Sm, 62; Tm, 69; Tb, 65; Yb, 70; Dy, 66]

(A) $Eu^{2+}$ and $Tm^{2+}$          (B) $Sm^{2+}$ and $Tm^{3+}$
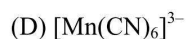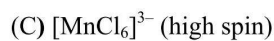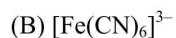
(C) $Tb^{4+}$ and $Yb^{2+}$          (D) $Dy^{3+}$ and $Yb^{3+}$

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

**Ans. (C)**

**Sol.** $Tb \rightarrow 4f^9 6s^2$

$Tb^{+4} \rightarrow 4f^7$

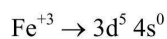$Yb \rightarrow 4f^{14} 6s^2$

$Yb^{+2} \rightarrow 4f^{14}$

**10.** Arrange the following coordination compounds in the increasing order of magnetic moments. (Atomic numbers: Mn = 25; Fe = 26)
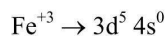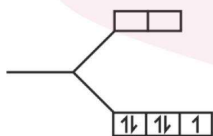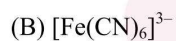
(A) $[FeF_6]^{3-}$

(B) $[Fe(CN)_6]^{3-}$

(C) $[MnCl_6]^{3-}$ (high spin)

(D) $[Mn(CN)_6]^{3-}$

(A) A < B < D < C        (B) B < D < C < A

(C) A < C < D < B        (D) B < D < A < C

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

**Ans. (B)**

**Sol.** (A) $[FeF_6]^{3-}$

$Fe^{+3} \rightarrow 3d^5 \, 4s^0$

n = 5

(B) $[Fe(CN)_6]^{3-}$



$Fe^{+3} \rightarrow 3d^5 \, 4s^0$

n = 1

(C) $[MnCl_6]^{3-}$



$Mn^{+3} \rightarrow 3d^4 \, 4s^0$

n = 4

(D) $[Mn(CN)_6]^{3-}$



$Mn^{+3} \rightarrow 3d^4 \, 4s^0$

n = 2

$\mu \Rightarrow A > C > D > B$
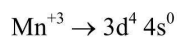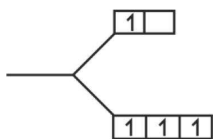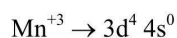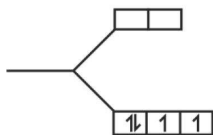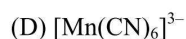
**11.** On the surface of polar stratospheric clouds, hydrolysis of chlorine nitrate gives A and B while its reaction with HCl produces B and C. A, B and C are, respectively

(A) $HOCl, HNO_3, Cl_2$

(B) $Cl_2, HNO_3, HOCl$

(C) $HClO_2, HNO_2, HOCl$

(D) $HOCl, HNO_2, Cl_2O$

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

**Ans. (A)**

**Sol.**
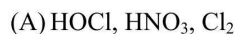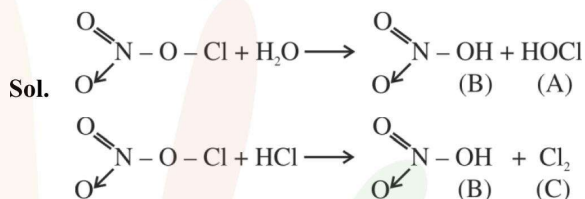


**12.** Which of the following is most stable?

(A)



(B)



(C)



(D)



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

**Ans. (A)**

**Sol.**  is most stable as it is aromatic.
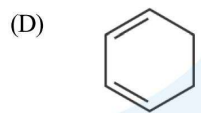
**13.** What will be the major product of following sequence of reactions?

$$n-Bu-\equiv \xrightarrow[\text{(ii) Lindlar cat, H}_2]{\begin{array}{c}\text{(i) n}-\text{BuLi,}\\ n-C_5H_{11}Cl\end{array}}$$

(A)

n–Bu / H₁₁C₅ / n–Bu

(B)

n–Bu / n-Bu / C₅H₁₁

(C)

H₁₁C₅ / n-Bu

(D)

C₅H₁₁ / n–Bu

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

**Ans. (C)**

**Sol.**   $n-Bu-C\equiv CH$ $\xrightarrow[\text{(acid base reaction)}]{nBuLi}$

$n-Bu-C\equiv C^-Li^+$

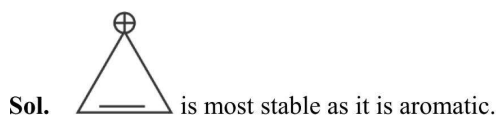$n-C_5H_{11}Cl \downarrow$ (SN reaction)

$\xleftarrow[\substack{\text{Lindlar's}\\ \text{Catalyst}}]{H_2}$ $n-Bu-C\equiv C-C_5H_{11}$
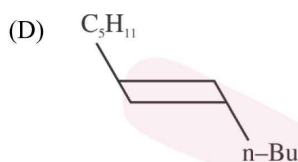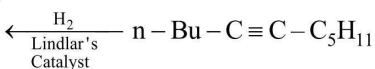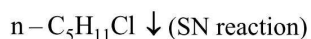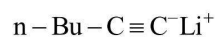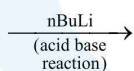
**14.** Product 'A' of following sequence of reactions is

Ethylbenzene $\xrightarrow[\substack{\text{(b) Cl}_2,\Delta\\ \text{(c) alc. KOH}}]{\text{(a) Br}_2.\text{Fe}}$ 'A'(Major product)

| | |
|---|---|
| (A) | |
| (B) | |
| (C) | |
| (D) | |

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

**Ans. (D)**

**Sol.**

$\xrightarrow[\text{EAS reaction}]{Br_2, Fe}$

$\xrightarrow[\substack{\text{benzylic}\\ \text{halogenation}}]{Cl_2, \Delta}$

$\xrightarrow[\substack{\text{(elimination}\\ \text{reaction)}}]{\text{alc. KOH}}$
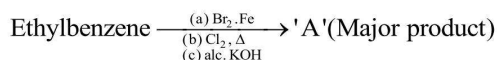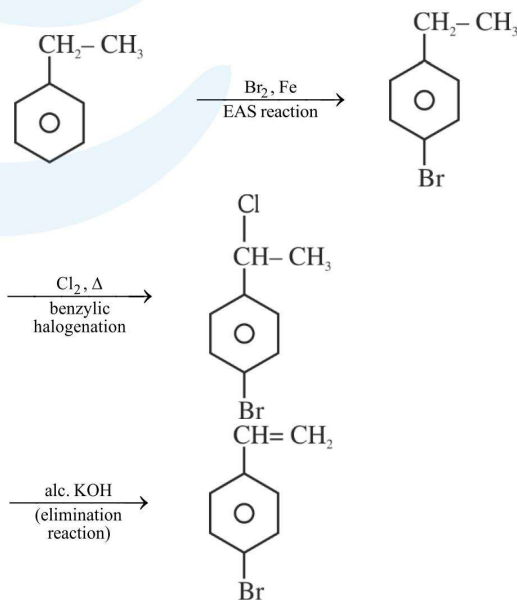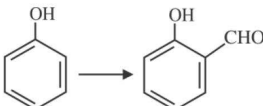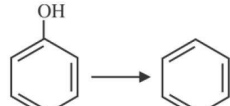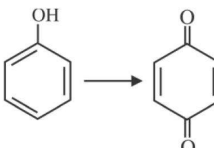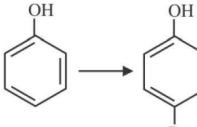
**15.** Match List I with List II

| List I | List II |
|--------|---------|
| A.  | I. Br$_2$ in CS$_2$ |
| B.  | II. Na$_2$Cr$_2$O$_7$/H$_2$SO$_4$ |
| C.  | III. Zn |
| D.  | IV. CHCl$_3$/NaOH |

Choose the correct answer from the options given below:

(A) A-IV, B-III, C-II, D-I

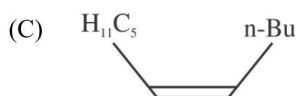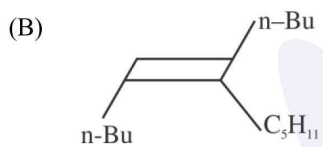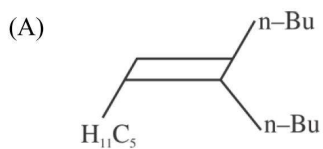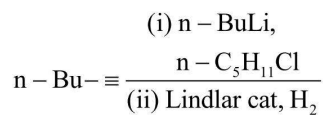(B) A-IV, B-III, C-I, D-II

(C) A-II, B-III, C-I, D-IV

(D) A-IV, B-II, C-III, D-I

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

**Ans. (A)**

**Sol.** (A)
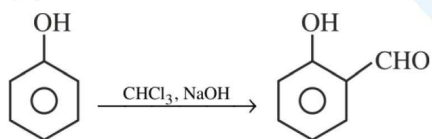


(B)
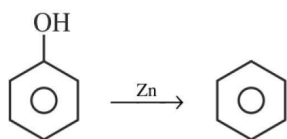


(C)



(D)
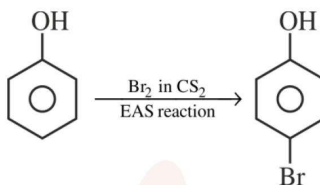


**16.** Decarboxylation of all six possible forms of diaminobenzoic acids C$_6$H$_3$(NH$_2$)$_2$COOH yields three products A, B and C. Three acids give a product 'A', two acids gives a product 'B' and one acid give a product 'C'. The melting point of product 'C' is

(A) 63ºC            (B) 90ºC

(C) 104ºC         (D) 142ºC

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

**Ans. (D)**

**Sol.**
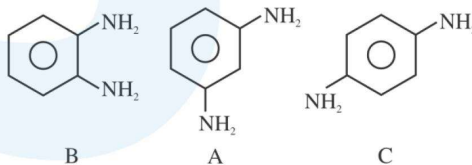


M.P. 142ºC

**17.** Which is true about Buna-N?

(A) It is a linear polymer of 1, 3-butadiene.

(B) It is obtained by copolymerization of 1, 3-butadiene and styrene.

(C) It is obtained by copolymerization of 1, 3-butadiene and acrylonitrile.

(D) The suffix N in Buna-N stands for its natural occurrence

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

**Ans. (C)**

**Sol.** It is copolymerization of 1, 3-butadiene and acrylonitrile.

**18.** Given below are two statements.

**Statments I:** Maltose has two $\alpha$-D-glucose units linked at $C_1$ and $C_4$ and is a reducing sugar.

**Statement II:** Maltose has two monosaccharides: $\alpha$-D-glucose and $\beta$-D-glucose linked at $C_1$ and $C_6$ and it is a non-reducing sugar.

In the light of the above statements, choose the correct answer from the options given below.

(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

(C) Statement I is true but Statement II is false

(D) Statement I is false but Statement II is true

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

**Ans. (C)**

**Sol.**



Maltose

**19.** Match List I with List Ii

| List I | List II |
|---|---|
| A. Antipyretic | I. Reduces pain |
| B. Analgesic | II. Reduces stress |
| C. Tranquilizer | III. Reduces fever |
| D. Antacid | IV. Reduces acidity (Stomach) |

Choose the correct answer from the options given below:

(A) A-III, B-I, C-II, D-IV

(B) A-III, B-I, C-IV, D-II

(C) A-I, B-IV, C-II, D-III

(D) A-I, B-III, C-II, D-IV
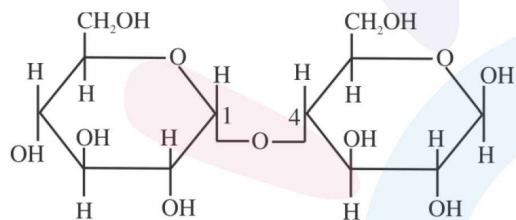
**Official Ans. by NTA (A)**

**Ans. (A)**

**Sol.**

| A. Antipyretic | Reduces fever |
|---|---|
| B. Analgesic | Reduces pain |
| C. Tranquilizer | Reduces stress |
| D. Antacid | Reduces acidity (Stomach) |

**20.** Match List I with List II

| List I (Anion) | List II (Gas evolved on reaction with dil. $H_2SO_4$) |
|---|---|
| A. $CO_3^{2-}$ | I. Colourless gas which turns lead acetate paper black |
| B. $S^{2-}$ | II. Colourless gas which turns acidified potassium dichromate solution green. |
| C. $SO_3^{2-}$ | III. Brown fumes which turns acidified KI solution containing starch blue. |
| D. $NO_2^-$ | IV. Colourless gas evolved with brisk effervescence, which turns lime water milky. |

Choose the correct answer from the options given below:

(A) A-III, B-I, C-II, D-IV

(B) A-II, B-I, C-IV, D-III

(C) A-IV, B-I, C-III, D-II

(D) A-IV, B-I, C-II, D-III

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

**Ans. (D)**

**Sol.** $CO_3^{2-}$ will give $CO_2(g)$ which will turns lime water milky.

$S^{2-}$ will give $H_2S$ (g), will turns lead acetate paper black

$SO_3^{2-}$ will give $SO_2$ (g), which will turns acidified potassium dichromate solution green.

$NO_2^-$ will give brown $NO_2(g)$ will turn KI solution blue.

**SECTION-B**

**1.** 116 g of a substance upon dissociation reaction, yields 7.5 g of hydrogen, 60g of oxygen and 48.5 g of carbon. Given that the atomic masses of H, O and C are 1, 16 and 12 respectively. The data agrees with how many formulae of the following?

(A) $CH_3COOH$      (B) HCHO

(C) $CH_3OOCH_3$      (D) $CH_3CHO$

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

**Ans. (2)**

**Sol.** $\%H = \dfrac{7.5}{116} \times 100 = 6.5$

$\%O = \dfrac{60}{116} \times 100 = 51.7$

$\%C = \dfrac{48.5}{116} \times 100 = 41.8$

Relative atomicities =   $H \Rightarrow 6.5$

$O \Rightarrow \dfrac{51.7}{16} = 3.25$

$C \Rightarrow \dfrac{41.8}{12} = 3.5$

Emperically formula is approx.. $CH_2O$

(A) $C_2H_4O_2$ (B) $CH_2O$ relate to this formula.

**2.** Consider the following set of quantum numbers

| | n | 1 | $m_l$ |
|---|---|---|---|
| A. | 3 | 3 | -3 |
| B. | 3 | 2 | -2 |
| C. | 2 | 1 | +1 |
| D. | 2 | 2 | +2 |

The number of correct sets of quantum numbers is _____

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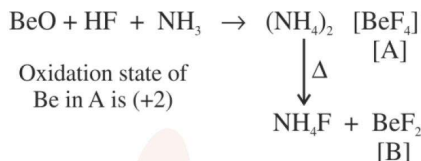
**Ans. (2)**

**Sol.** Quantum no. of set (B) and (C) can be correct.

(A) and (D) are wrong as $n = \ell$ is not possible.

**3.** BeO reacts with HF in presence of ammonia to give [A] which on thermal decomposition produces [B] and ammonium fluoride. Oxidation state of Be in [A] is_____

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

**Ans. (2)**

**Sol.**

$BeO + HF + NH_3 \rightarrow (NH_4)_2 \ [BeF_4]$
                                  [A]

Oxidation state of Be in A is (+2)    $\downarrow \Delta$

                     $NH_4F + BeF_2$
                             [B]

**4.** When 5 moles of He gas expand isothermally and reversibly at 300 K from 10 litre to 20 litre, the magnitude of the maximum work obtained is _____ J. [nearest integer] (Given: $R = 8.3 \ J \ K^{-1} mol^{-1}$ and $\log 2 = 0.3010$)

**Official Ans. by NTA (8630)**

**Ans. (8630)**

**Sol.** n = 5 mol

T = 300 K

$V_1$ = 10 L

$V_2$ = 20 L

$w = -nRT \ \ell n \dfrac{V_2}{V_1}$

$= -5 \times 8.3 \times 300 \times \ell n \dfrac{20}{10}$

$= -8630.38 \ J$

**5.** A solution containing $2.5 \times 10^{-3}$ kg of a solute dissolved in $75 \times 10^{-3}$ kg of water boils at 373.535 K. The molar mass of the solute is _____ g $mol^{-1}$. [nearest integer] (Given: $K_b$ ($H_2O$) = 0.52 K Kg $mol^{-1}$, boiling point of water = 373.15K)

**Official Ans. by NTA (45)**

**Ans. (45)**

**Sol.** w = 2.5 g        $K_b$ = 0.52

$w_{solvent}$ = 75 g      M = Mol. Wt. of solute

$T'_B = 373.535\,K$

$T^o_B = 373.15\,K$

$\Delta T_B = 0.385 = K_b$ molality

$0.385 = 0.52 \times \left( \dfrac{2.5}{M} \times \dfrac{1000}{75} \right)$

$M = 45\ g\ mol^{-1}$

**6.** pH value of 0.001 M NaOH solution is_____.

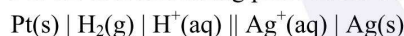**Official Ans. by NTA (11)**

      **Ans. (11)**

**Sol.** 0.001 M NaOH

$[OH^-] = 10^{-3}$

pOH = 3
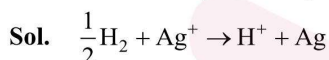
pH = 11

**7.** For the reaction taking place in the cell:

$Pt(s) \mid H_2(g) \mid H^+(aq) \parallel Ag^+(aq) \mid Ag(s)$

$E^o_{Cell} = +0.5332\ V.$

The value of $\Delta_f G^0$ is _____ kJ mol$^{-1}$. (in nearest integer)

**Official Ans. by NTA (51)**

      **Ans. (51 or 103)**

**Sol.** $\dfrac{1}{2} H_2 + Ag^+ \rightarrow H^+ + Ag$

$\Delta G^\circ = -nE^\circ\,F$

$= -1 \times 0.5332 \times 96500\ J$

$= -51.35\ kJ$

$(n = 2\ for\ H_2 + 2Ag^+ \rightarrow 2H^+ + 2Ag)$

**8.** It has been found that for a chemical reaction with rise in temperature by 9K the rate constant gets doubled. Assuming a reaction to be occurring at 300 K, the value of activation energy is found to be _____ kJ mol$^{-1}$. [nearest integer]

(Given ln 10 = 2.3, R = 8.3 JK$^{-1}$mol$^{-1}$, log2 = 0.30)

**Official Ans. by NTA (59)**

      **Ans. (59)**

**Sol.** $\log_{10} \dfrac{K_2}{K_1} = \dfrac{E_a}{2.303R} \left( \dfrac{1}{300} - \dfrac{1}{309} \right)$
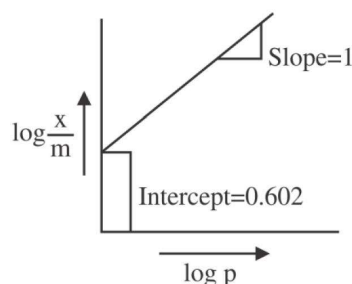
$0.3 = \dfrac{E_a}{2.303 \times 8.3} \left( \dfrac{9}{300 \times 309} \right)$

$E_a = \dfrac{0.3 \times 2.303 \times 8.3 \times 300 \times 309}{9}$

$= 59065.04\ J$

$E_a = 59.06\ kJ$

**9.**



If the initial pressure of a gas is 0.03 atm, the mass of the gas adsorbed per gram of the adsorbent is _____ $\times 10^{-2}$g.

**Official Ans. by NTA (12)**

      **Ans. (12)**

**Sol.** $\dfrac{x}{m} = kP^{\frac{1}{n}}$

$\log \dfrac{x}{m} = \log k + \dfrac{1}{n} \log P$

From graph

$Slope = \dfrac{1}{n} = 1 \Rightarrow n = 1$

Intercept = log k = 0.602

k = 4

$\dfrac{x}{m} = 4 \times (0.03)^{\frac{1}{1}}$

$\dfrac{x}{m} = 12 \times 10^{-2}$

**10.** 0.25 g of an organic compound containing chlorine gave 0.40 g of silver chloride in Carius estimation. The percentage of chlorine present in the compound is _____. [in nearest integer]

(Given: Molar mass of Ag is 108 g mol$^{-1}$ and that of Cl is 35.5 g mol$^{-1}$)

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

      **Ans. (40)**

**Sol.** wt. of organic compound = 0.25 g

mass of $Cl = \dfrac{35.5}{143.5} \times 0.4g$

mass % of Cl in the organic compound

$= \dfrac{35.5 \times 0.4}{143.5 \times 0.25} \times 100$

$= 39.58\%$