# FINAL JEE–MAIN EXAMINATION – APRIL, 2023

**(Held On Saturday 08th April, 2023)** **TIME :9 : 00 AM to 12 : 00 NOON**

## SECTION-A

**61.** $2IO_3^- + xI^- + 12H^+ \rightarrow 6I_2 + 6H_2O$

What is the value of x?

(1) 12 (2) 2

(3) 6 (4) 10

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

**Ans. (4)**

**Sol.** Number of atoms of iodine on reactant side = number of atoms of Iodine on product side

$2 + x = 6 \times 2$

$X = 10$

$2IO_3^- + 10I^- + 12H^+ \rightarrow 6I_2 + 6H_2O$

**62.** Which of the following metals can be extracted through alkali leaching technique?

(1) Cu (2) Sn

(3) Pb (4) Au

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

**Ans. (2)**

**Sol.** Reference : NCERT

**63.** Match List I with List II

| | | | |
|---|---|---|---|
| A. | Saccharin | I. | High potency sweetener |
| B. | Aspartame | II. | First artificial sweetening agent |
| C. | Alitame | III. | Stable at cooking temperature |
| D. | Sucralose | IV | Unstable at cooking temperature |

Choose the correct answer from the options given below:

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

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

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

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

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

**Ans. (4)**

**Sol.** (A) Saccharin II. First artificial sweetener

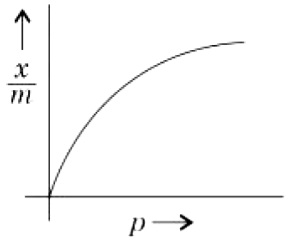
(B) Aspartame IV. Unstable at cooking temperature

(C) Alitame I. High potency sweetener

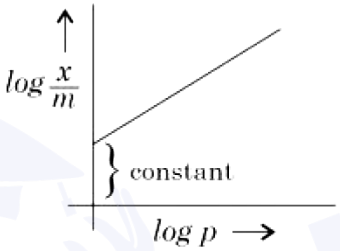
(D) Sucralose III. Stable at cooking temperature

**64.** Which of the following represent the Freundlich adsorption isotherms?

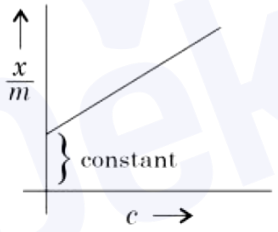
(A)



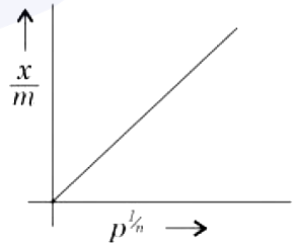

(B)




(C)




(D)




Choose the correct answer from the options given below:

(1) B, C, D only (2) A, B, D only

(3) A, B only (4) A, C, D only

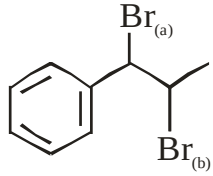
**Official Ans. by NTA (2)**

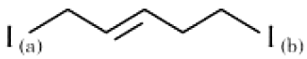
**Ans. (2)**

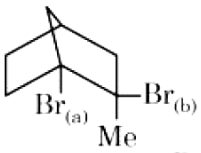
**Sol.** $\frac{x}{m} = k\ p^{1/n}$

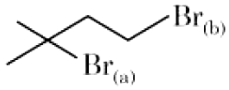
and $\log\frac{x}{m} = \log k + \frac{1}{n}\log P$

**65.** Choose the halogen which is most reactive towards SN1 reaction in the given compounds (A, B, C & D)

A. 

B. 

C. 

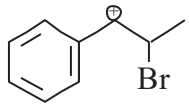
D. 

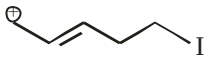
(1) A-$Br_{(b)}$ ; B-$I_{(b)}$ ; C-$Br_{(b)}$ ; D-$Br_{(b)}$
(2) A-$Br_{(a)}$ ; B-$I_{(a)}$ ; C-$Br_{(b)}$ ; D-$Br_{(a)}$
(3) A-$Br_{(b)}$ ; B-$I_{(a)}$ ; C-$Br_{(a)}$ ; D-$Br_{(a)}$
(4) A-$Br_{(b)}$ ; B-$I_{(a)}$ ; C-$Br_{(a)}$ ; D-$Br_{(a)}$

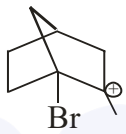
**Official Ans. by NTA (2)**

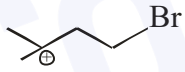
**Ans. (2)**

**Sol.** Stable is the carbocation, faster will be rate of SN1 reaction

(A)  (Benzylic carbocation)

(B)  (Allylic carbocation)

(C)  (Non bridgehead tertiary carbocation)

(D)  (Tertiary carbocation)

**66.** Sulphur (S) containing amino acids from the following are:

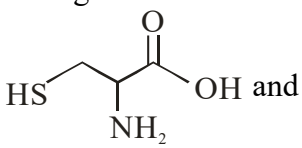
(a) isoleucine (b) cysteine (c) lysine
(d) methionine (e) glutamic acid

(1) a, d (2) b, d
(3) b, c, e (4) a, b, c

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

**Ans. (2)**

**Sol.** Sulphur containing amino acids

(b) cysteine  and

(d) methionine $CH_3–S–CH_2–CH_2–\underset{\underset{NH_2}{|}}{CH}–\overset{\overset{O}{||}}{C}–OH$.

**67.** The water gas on reacting with cobalt as a catalyst forms

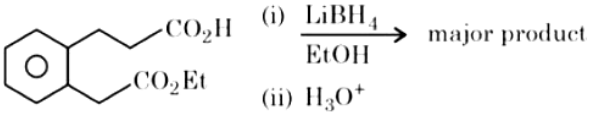
(1) Ethanol (2) Methanoic acid
(3) Methanal (4) Methanol

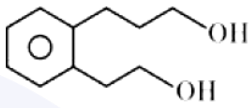
**Official Ans. by NTA (4)**

**Ans. (4)**

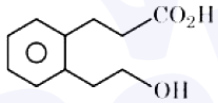
**Sol.** $CO + 2H_2 \xrightarrow{Co} CH_3OH$

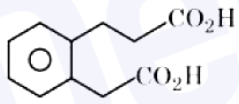
**68.** The major product formed in the following reaction is:



(1) 

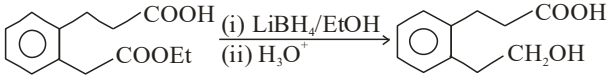
(2) 

(3) 

(4) 

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

**Ans. (3)**

**Sol.** 

$LiBH_4$ can reduce ester selectively but not carboxylic acids.

Hence correct answer is option (3).

**69.** Which of the following complex is octahedral, diamagnetic and the most stable?

(1) $Na_3[CoCl_6]$ (2) $[Ni(NH_3)_6]Cl_2$
(3) $K_3[Co(CN)_6]$ (4) $[Co(H_2O)_6]Cl_2$

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

**Ans. (3)**

**Sol.** $Co^{+3} = t_2g^6\ eg^0$

$CN^-$ -strong field ligand

All d-electrons should be paired ($\mu_s = 0$)

Hence diamagnetic.

**70.** The reaction

$$\frac{1}{2}H_2(g) + AgCl(s) \rightleftharpoons H^+(aq) + Cl^-(aq) + Ag(s)$$

occurs in which of the given galvanic cell.

(1) $Pt\left|H_2(g)\right|KCl(sol^n)\left|AgCl(s)\right|Ag$

(2) $Pt\left|H_2(g)\right|HCl(sol^n)\left|AgCl(s)\right|Ag$

(3) $Ag\left|AgCl(s)\right|KCl(sol^n)\left|AgCl(s)\right|Ag$

(4) $Pt\left|H_2(g)\right|HCl(sol^n)\left|AgNO_3(sol^n)\right|Ag$

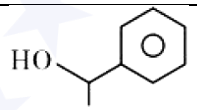
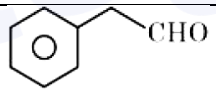
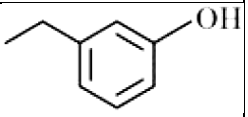
**Official Ans. by NTA (2)**

**Ans. (2)**

**Sol.** $\text{Anode}: \frac{1}{2}H_2(g) \rightleftharpoons H^+(aq) + e^-$

$\text{Cathode}: AgCl(s) + e^- \rightarrow Ag(s) + Cl^-(aq)$

**71.** Match List-I with List-II :

| | **List-I (Reagents used)** | | **List-II (Compound with functional group detected)** |
|---|---|---|---|
| A. | Alkaline solution of copper sulphate and sodium citrate | I. |  |
| B. | Neutral $FeCl_3$ solution | II. |  |
| C. | Alkaline chloroform solution | III. |  |
| D. | Potassium iodide and sodium hypochlorite | IV. |  |

Choose the correct answer from the options given below:

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

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

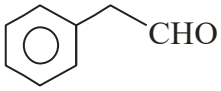
(3) A-III, B-IV, C-I, D-II

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

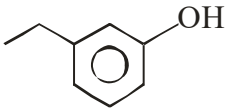
**Official Ans. by NTA (4)**

**Ans. (4)**

**Sol.** **A.** Alkaline solution of copper sulphate and sodium citrate is known as Benedict's solution and it is used to test aliphatic aldehydes. Hence it can be used to test compound (III) i.e.



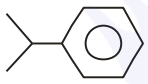
**B.** Neutral $FeCl_3$ solution is used to test phenolic compound (IV) i.e.



**C.** Alkaline chloroform solution is used to test primary amines (II) i.e.

**D.** $2KI + NaOCl + H_2O \rightarrow NaCl + I_2 + 2KOH$

Potassium iodide and sodium hypochlorite gives ($I_2$ + KOH) which is used to test those compounds which have $CH_3-\overset{\overset{O}{\|}}{C}-$ or $CH_3-\overset{\overset{OH}{|}}{CH}-$ group (iodoform test). Hence the compound is

(I)  .

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

**Assertion A:** Butan -1- ol has higher boiling point than ethoxyethane.

**Reason R:** Extensive hydrogen bonding leads to stronger association of molecules.

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

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

(2) A is true but R is false

(3) Both A and R are true but R is not the correct explanation of A

(4) A is false but R is true

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

**Ans. (1)**

**Sol.** Butan-1-ol ($CH_3CH_2CH_2CH_2OH$) can undergo hydrogen bonding. Ethoxyethane ($CH_3CH_2-O-CH_2CH_3$) has no hydrogen (attached with F, O, N) which can undergo hydrogen bonding.

More is the extent of intermolecular H-bonding, more will be association of molecules. Thus leading to higher boiling point.

Hence both Assertion (A) and Reason(R) are true and (R) is the correct explanation of (A).

**73.** In chromyl chloride, the number of d-electrons present on chromium is same as in (Given at no. of Ti : 22, V : 23, Cr : 24, Mn : 25, Fe : 26)

(1) Ti (III) (2) Fe (III)

(3) V (IV) (4) Mn (VII)

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

**Ans. (4)**

**Sol.** In $CrO_2Cl_2$ oxidation state of Cr is +6

Cr (VI) = $[Ar]^{18}\ 3d^0$

Mn(VII) = $[Ar]^{18}\ 3d^0$

Fe(III) = $[Ar]^{18}\ 3d^5$

Ti(III) = $[Ar]^{18}\ 3d^1$

V(IV) = $[Ar]^{18}\ 3d^1$

Hence Cr (VI) and Mn (VII) have same $d^0$ configuration.

**74.** What is the purpose of adding gypsum to cement?

(1) To facilitate the hydration of cement

(2) To speed up the process of setting

(3) To slow down the process of setting

(4) To give a hard mass

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

**Ans. (3)**

**Sol.** Factual

**75.** The correct order of spin only magnetic moments for the following complex ions is

(1) $[Fe(CN)_6]^{3-} < [CoF_6]^{3-} < [MnBr_4]^{2-} < [Mn(CN)_6]^{3-}$

(2) $[Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-} < [CoF_6]^{3-} < [MnBr_4]^{2-}$

(3) $[MnBr_4]^{2-} < [CoF_6]^{3-} < [Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-}$

(4) $[CoF_6]^{3-} < [MnBr_4]^{2-} < [Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-}$

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

**Ans. (2)**

| | | **Unpaired $e^-$** |
|---|---|---|
| **Sol.** $[Fe(CN)_6]^{3-}$ | $Fe^{+3} \Rightarrow t_2g^5\ eg^0$, | 1 |
| $[Mn(CN)_6]^{3-}$ | $Mn^{+3} \Rightarrow t_2g^4\ eg^0$, | 2 |
| $[CoF_6]^{3-}$ | $Co^{+3} \Rightarrow t_2g^4\ eg^2$, | 4 |
| $[MnBr_4]^{2-}$ | $Mn^{+2} \Rightarrow e^2\ t_2^3$, | 5 |

Spin magnetic moment $\mu = \sqrt{n(n+2)}$ B.M

**76.** Which halogen is known to cause the reaction given below:

$$2Cu^{2+} + 4X^- \rightarrow Cu_2X_2(s) + X_2$$

(1) Only Iodine (2) Only Bromine

(3) All halogens (4) Only Chlorine

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

**Ans. (1)**

**Sol.** $2Cu^{2+} + 4I^- \rightarrow Cu_2I_2(s) + I_2$

**77.** Match List-I with List-II :

| | **List-I (Species)** | | **List-II (Maximum allowed concentration in ppm in drinking water)** |
|---|---|---|---|
| A. | $F^-$ | I. | < 50 ppm |
| B. | $SO_4^{2-}$ | II. | < 5 ppm |
| C. | $NO_3^-$ | III. | < 2 ppm |
| D. | Zn | IV. | < 500 ppm |

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

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

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

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

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

**Ans. (Bonus)**

**Sol.** Correct answer

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

**78.** The correct order of electronegativity for given elements is:

(1) C > P > At > Br

(2) Br > P > At > C

(3) P > Br > C > At

(4) Br > C > At > P

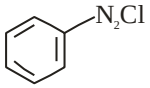
**Official Ans. by NTA (4)**

**Ans. (4)**

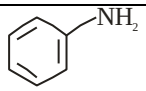
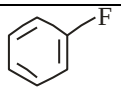
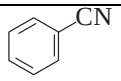
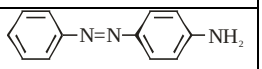
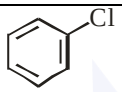
**Sol.**

| **Atom** | **E.N.** |
|---|---|
| Br | 3.0 |
| C | 2.5 |
| At | 2.2 |
| P | 2.1 |

**79.** Match List I with List II:



is reacted with reagents in List I to form products in List II.

| | List-I (Reagent) | | List-II (Product) |
|---|---|---|---|
| A. |  | I. |  |
| B. | $HBF_4, \Delta$ | II. |  |
| C. | Cu, HCl | III. |  |
| D. | CuCN/KCN | IV. |  |

Choose the correct answer from the options given below:

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

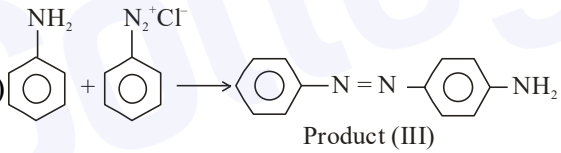
(2) A-I, B-III, C-IV, D-II

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

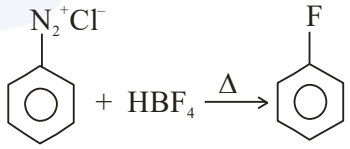
(4) A-III, B-I, C-IV, D-II

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

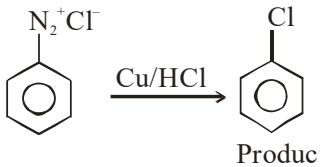
**Ans. (4)**

**Sol.** (A) 

Product (III)

(B) 

Product (I)

(C) 

Product (IV)

(D) 

Product (II)

**80.** Given below are two statements:

**Statement I:** Lithium and Magnesium do not form superoxide

**Statement II:** The ionic radius of $Li^+$ is larger than ionic radius of $Mg^{2+}$

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

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

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

(3) Both Statement I and Statement II are correct

(4) Both Statement I and Statement II are incorrect

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

**Ans. (3)**

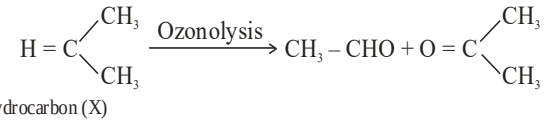
**Sol.** Li & Mg form oxide and order of size $Li^+ > Mg^{2+}$

**SECTION-B**

**81.** Molar mass of the hydrocarbon (X) which on ozonolysis consumes one mole of $O_3$ per mole of (X) and gives one mole each of ethanal and propanone is _____ g $mol^{-1}$ (Molar mass of C : 12 g $mol^{-1}$, H : 1 g $mol^{-1}$)

**Official Ans. by NTA (70)**

**Ans. (70)**

**Sol.** 

Hydrocarbon (X)

Hence molar mass of hydrocarbon (X) is 70.

**82.** The number of following factors which affect the percent covalent character of the ionic bond is____

(a) Polarising power of cation

(b) Extent of distortion of anion

(c) Polarisability of the anion

(d) Polarising power of anion

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

**Ans. (3)**

**Sol.** (a), (b) and (c) are factors which affect the percent covalent character of the ionic bond according to Fajan's rule

**83.** When a 60 W electric heater is immersed in a gas for 100s in a constant volume container with adiabatic walls, the temperature of the gas rises by 5°C. The heat capacity of the given gas is_____ $J\ K^{-1}$ (Nearest integer)

**Official Ans. by NTA (1200)**

**Ans. (1200)**

**Sol.** Power of heater = 60 W

= 60 J/sec

Total energy emitted

= 60 × 100 = 6000 J

Heat capacity × temp difference = 6000

$$\text{Heat capacity} = \frac{6000}{5} = 1200 JK^{-1}$$

**84.** The number of given statement/s which is/are correct is____

(A) The stronger the temperature dependence of the rate constant, the higher is the activation energy.

(B) If a reaction has zero activation energy, its rate is independent of temperature.

(C) The stronger the temperature dependence of the rate constant, the smaller is the activation energy.

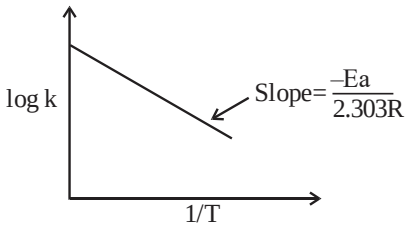
(D) If there is no correlation between the temperature and the rate constant then it means that the reaction has negative activation energy.

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

**Ans. (2)**

**Sol.** $k = A.e^{-Ea/RT}$

$$\underset{y}{\log k} = \underset{C}{\log A} - \underbrace{\frac{Ea}{2.303R}}_{m} \cdot \underset{x}{\frac{1}{T}}$$

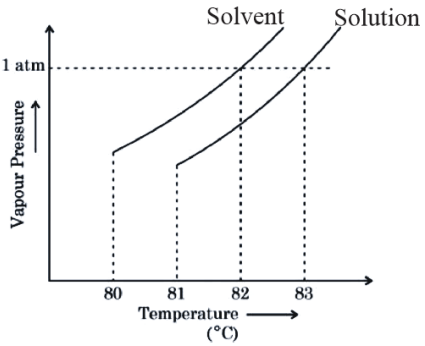



Higher is Ea, stronger is the temperature dependence of k (i.e. steeper the slope)

$$(B) \Rightarrow \frac{1}{k}\frac{dk}{dT} = \frac{Ea}{R}\frac{1}{T^2}$$

$$\Rightarrow \frac{dk}{dT} = A \times e^{-\frac{Ea}{R}} \cdot \frac{Ea}{RT^2}$$

**85.** The vapour pressure vs. temperature curve for a solution solvent system is shown below.




The boiling point of the solvent is _____°C

**Official Ans. by NTA (82)**

**Ans. (82)**

**Sol.** Boiling point of solvent is 82ºC

Boiling point of solution is 83ºC

**86.** $XeF_4$ reacts with $SbF_5$ to form

$[XeF_m]^{n+}\ [SbF_y]^{z-}$

m + n + y + z = _____

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

**Ans. (11)**

**Sol.** $XeF_4 + SbF_5 \rightarrow [XeF_3]^+[SbF_6]^-$

m = 3

n = 1

y = 6

z = 1

m + n + y + z = 11

**87.** 0.5 g of an organic compound (X) with 60% carbon will produce _____ × $10^{-1}$ g of $CO_2$ on complete combustion.

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

**Ans. (11)**

**Sol.** Percentage of Carbon

$$= \frac{12}{44} \times \frac{\text{mass of } CO_2 \text{ formed}}{\text{mass of compound taken}} \times 100$$

$$60 = \frac{12}{44} \times \frac{\text{mass of } CO_2 \text{ formed}}{0.5} \times 100$$

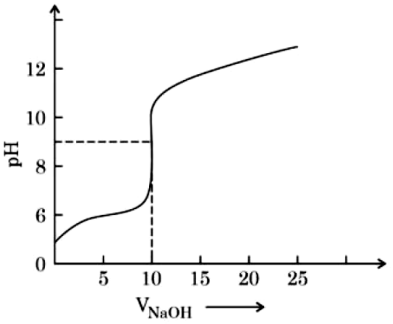
$$\text{Mass of } CO_2 \text{ formed} = \frac{60 \times 44 \times 0.5}{12 \times 100} g$$

= 1.1 gram

= 11 × $10^{-1}$ gram

**88.** The titration curve of weak acid vs. strong base with phenolphthalein as indictor) is shown below. The $K_{phenolphthalein} = 4 \times 10^{-10}$.

Given: log2 = 0.3




The number of following statements which is/are correct about phenolphthalein is_____

A. It can be used as an indicator for the titration of weak acid with weak base.

B. It begins to change colour at pH = 8.4

C. It is a weak organic base

D. It is colourless in acidic medium

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

**Ans. (2)**

**Sol.** (B) $pk_{In} = -\log(4 \times 10^{-10}) = 9.4$

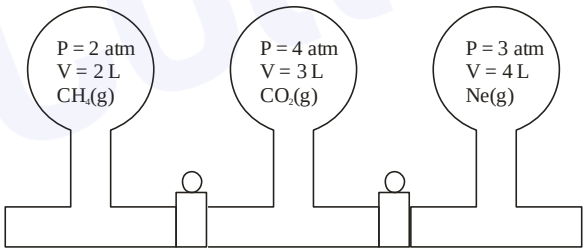
Indicator range

$\Rightarrow pk_{In} \pm 1$

i.e. 8.4 to 10.4

(D) In acidic medium, phenolphthalein is in unionized form and is colourless.

**89.**




Three bulbs are filled with $CH_4$, $CO_2$ and Ne as shown in the picture. The bulbs are connected through pipes of zero volume. When the stopcocks are opened and the temperature is kept constant throughout, the pressure of the system is found to be_____atm. (Nearest integer)

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

**Ans. (3)**

**Sol.** $P_TV_T = n_TRT$

For $CH_4$

$2 \times 2 = n_1RT$

$\Rightarrow n_1 = \frac{4}{RT}$

For $CO_2$

$\Rightarrow n_2 = \frac{12}{RT}$

For Ne

$\Rightarrow n_3 = \frac{12}{RT}$

$\Rightarrow n_T = \frac{1}{RT}[4+12+12] = \frac{28}{RT}$

$P_T = \frac{28}{RT}\frac{RT}{V_T}$

$P_T = \frac{28}{V_T} = 3.11$

**90.** The number of following statement/s which is/are incorrect is_____

(A) Line emission spectra are used to study the electronic structure

(B) The emission spectra of atoms in the gas phase show a continuous spread of wavelength from red to violet

(C) An absorption spectrum is like the photographic negative of an emission spectrum

(D) The element helium was discovered in the sun by spectroscopic method

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

**Ans. (1)**

**Sol.** Statement (B) is incorrect.