CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

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

Assertion (A): Cu^{2+} in water is more stable than Cu^{+}.

Reason (R): Enthalpy of hydration for Cu^{2+} is much less than that of Cu^{+}.

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

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

(2) **(A)** is not correct but **(R)** is correct

(3) **(A)** is correct but **(R)** is not correct

(4) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**

Answer (3)

Sol. Cu^{2+} in water is more stable than Cu^{+} due to much higher hydration enthalpy of Cu^{2+} ion.

Hence correct answer is option (3)

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

Assertion (A): α-halocarboxylic acid on reaction with dil NH_3 gives good yield of α-amino carboxylic acid whereas the yield of amines is very low when prepared from alkyl halides.

Reason (R): Amino acids exist in zwitter ion form in aqueous medium.

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

(1) **(A)** is not correct but **(R)** is correct

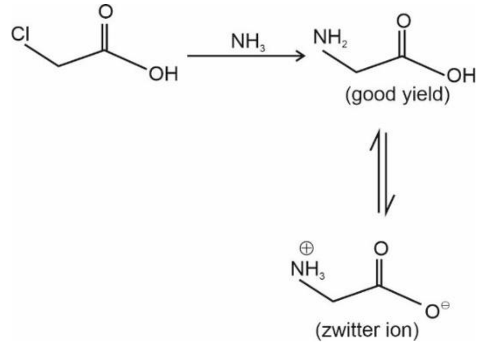
(2) **(A)** is correct but **(R)** is not correct

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

(4) Both **(A)** and **(R)** are correct but **(R)** is **not** the correct explanation of **(A)**

Answer (3)

Sol. Statement-I:



Statement-II : Reason is a correct statement as amino do exist as a zwitter ion. Reason is also a correct explanation.

33. Which element is not present in Nessler's reagent?

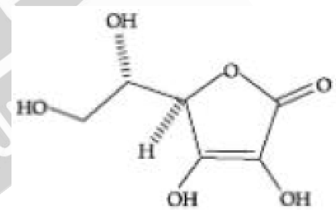
(1) Potassium (2) Oxygen

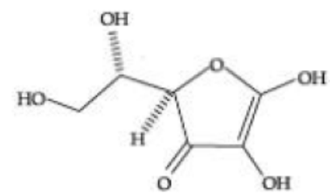
(3) Mercury (4) Iodine

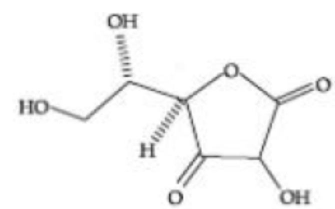
Answer (2)

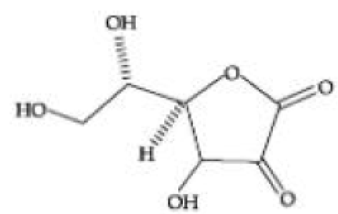
Sol. Nessler's reagent is $K_2[HgI_4]$

34. All structures given below are of vitamin C. Most stable of them is:

(1) 

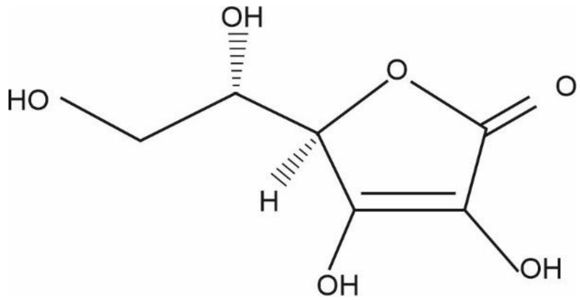
(2) 

(3) 

(4) 

Answer (1)

Sol. Most stable structure of vitamin(C) is :



35. Which one of the following sets of ions represents a collection of isoelectronic species?

(Given : Atomic Number : F : 9, Cl : 17, Na = 11, Mg = 12, Al = 13, K = 19, Ca = 20, Sc = 21)

(1) Ba^{2+}, Sr^{2+}, K^{+}, Ca^{2+}

(2) N^{3-}, O^{2-}, F^{-}, S^{2-}

(3) K^{+}, Cl^{-}, Ca^{2+}, Sc^{3+}

(4) Li^{+}, Na^{+}, Mg^{2+}, Ca^{2+}

Answer (3)

Sol. Isoelectronic species have same number of electrons.

k^{+}, Cl^{-}, Ca^{2+} and Sc^{3+} all have 18 electrons, hence these are isoelectronic.

36. The correct order of bond enthalpy (kJ mol^{-1}) is

(1) C – C > Si – Si > Sn – Sn > Ge – Ge

(2) Si – Si > C – C > Sn – Sn > Ge – Ge

(3) C – C > Si – Si > Ge – Ge > Sn – Sn

(4) Si – Si > C – C > Ge – Ge > Sn – Sn

Answer (3)

Sol.

Bond	Bond energy (kJ mol^{-1})
C–C	348
Si–Si	297
Ge–Ge	260
Sn–Sn	240

Correct answer will be (3)

37. The industrial activity held least responsible for global warming is

(1) industrial production of urea

(2) manufacturing of cement

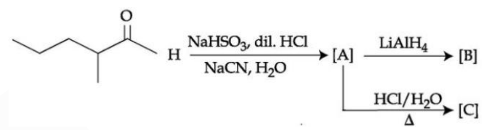
(3) steel manufacturing

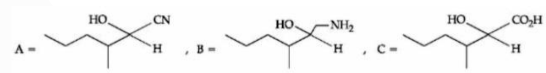
(4) Electricity generation in thermal power plants

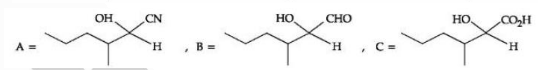
Answer (1)

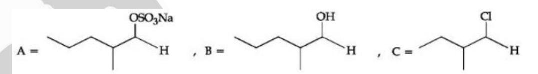
Sol. Industrial production of urea is least responsible for global warming.

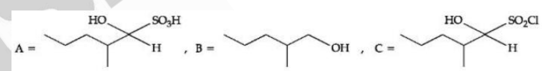
38. The structures of major products A, B and C in the following reaction are sequence.



(1) 

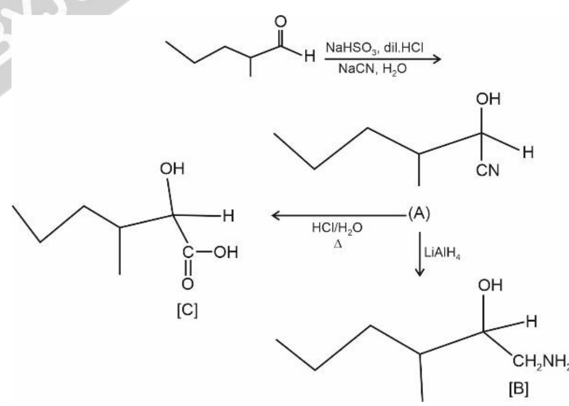
(2) 

(3) 

(4) 

Answer (1)

Sol.



39. The starting material for convenient preparation of deuterated hydrogen peroxide (D_2O_2) in laboratory is

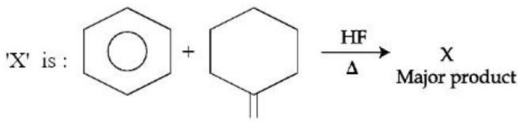
(1) 2-ethylanthraquinol (2) BaO

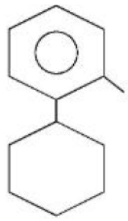
(3) BaO_2 (4) $K_2S_2O_8$

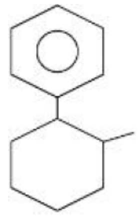
Answer (4)

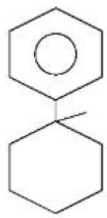
Sol. $K_2S_2O_8$ is used in the laboratory preparation of D_2O_2

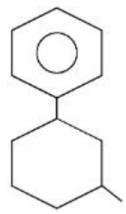
$K_2S_2O_8(s) + 2D_2O(l) \rightarrow 2KDSO_4(aq) + D_2O_2(l)$

40. 

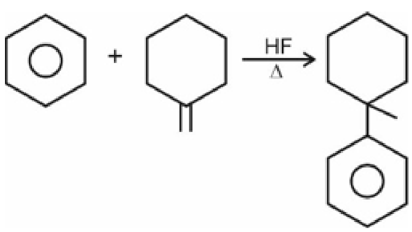
(1) 

(2) 

(3) 

(4) 

Answer (3)

Sol. 

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

Assertion (A) : An aqueous solution of KOH when used for volumetric analysis, its concentration should be checked before the use.

Reason (R) : On aging, KOH solution absorbs atmospheric CO_2.

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

(1) Both **(A)** and **(R)** are correct but **(R)** is **not** the correct explanation of **(A)**

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

(3) **(A)** is correct but **(R)** is not correct

(4) **(A)** is not correct but **(R)** is correct

Answer (2)

Sol. KOH absorbs CO_2 get converted to K_2CO_3

$$KOH + CO_2 \longrightarrow K_2CO_3 + H_2O$$

42. Given below are two statements :

Statement I : Sulphanilic acid gives esterification test for carboxyl group.

Statement II : Sulphanilic acid gives red colour in Lassigne's test for extra element detection.

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

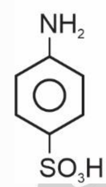
(2) Both **Statement I** and **Statement II** are incorrect

(3) **Statement I** is correct but **Statement II** is incorrect

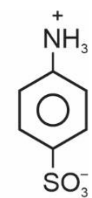
(4) Both **Statement I** and **Statement II** are correct

Answer (1)

Sol. Sulphanilic acid is p-amino benzene sulphonic acid



it exists as zwitter ion



Since it contain both N and S so it give red colour in Lassaigne's test.

43. The complex cation which has two isomers is:

(1) $[Co(NH_3)_5Cl]^+$

(2) $[Co(H_2O)_6]^{3+}$

(3) $[Co(NH_3)_5NO_2]^{2+}$

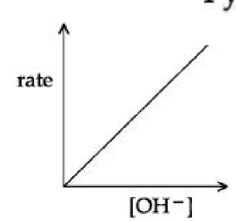
(4) $[Co(NH_3)_5Cl]^{2+}$

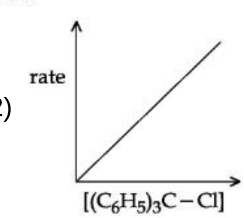
Answer (3)

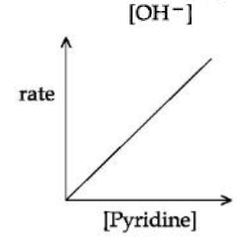
Sol. Complex $[Co(NH_3)_5NO_2]^{2+}$ will have two isomer one linked through N (Nitro) and one through O (Nitrite).

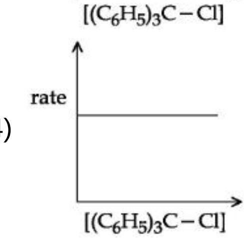
44. The graph which represents the following reaction is :

$$(C_6H_5)_3C-Cl \xrightarrow[\text{Pyridine}]{OH^-} (C_6H_5)_3C-OH$$

(1) 

(2) 

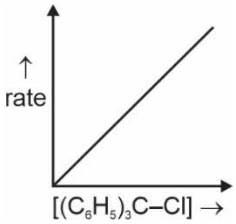
(3) 

(4) 

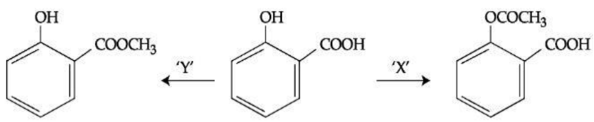
Answer (2)

Sol. Rate = K[$(C_6H_5)_3C-Cl$]

The correct mechanism is S_N1.



45. In a reaction,



reagents 'X' and 'Y' respectively are :

(1) $(CH_3CO)_2O/H^+$ and $(CH_3CO)_2O/H^+$

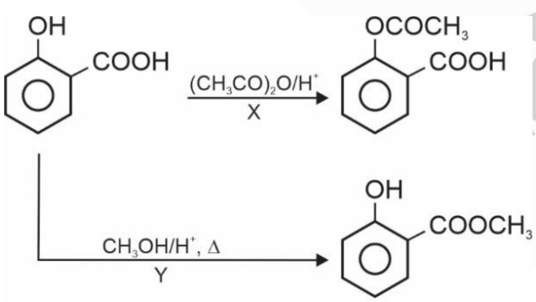
(2) $CH_3OH/H^+, \Delta$ and $CH_3OH/H^+, \Delta$

(3) $(CH_3CO)_2O/H^+$ and $CH_3OH/H^+, \Delta$

(4) $CH_3OH/H^+, \Delta$ and $(CH_3CO)_2O/H^+$

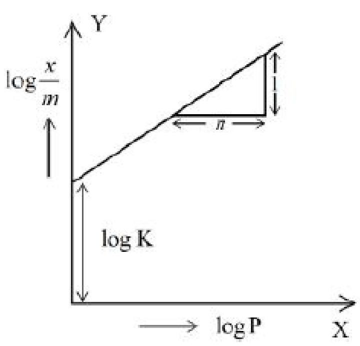
Answer (3)

Sol.



methyl salicylate

46. In figure, a straight line is given for Freundrich Adsorption (y = 3x + 2.505). The value of $\frac{1}{n}$ and log K are respectively.



(1) 3 and 2.505 (2) 0.3 and 0.7033

(3) 0.3 and log 2.505 (4) 3 and 0.7033

Answer (1)

Sol. $\log\frac{x}{m} = \log k + \frac{1}{n}\log p$

On comparing, we get

$\frac{1}{n} = 3 \Rightarrow n = 0.3$ and log k = 2.505

47. The effect of addition of helium gas to the following reaction in equilibrium state, is

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(1) the equilibrium will go backward due to suppression of dissociation of PCl_5

(2) addition of helium will not affect the equilibrium

(3) the equilibrium will shift in the forward direction and more of Cl_2 and PCl_3 gases will be produced

(4) helium will deactivate PCl_5 and reaction will stop

Answer (3)

Sol. If we consider addition of He gas at constant pressure, the reaction will shift in forward direction [As rigid container is not given]

48. For electron gain enthalpies of the elements denoted as $\Delta_{eg}H$, the incorrect option is

(1) $\Delta_{eg}H$ (Cl) < $\Delta_{eg}H$ (F) (2) $\Delta_{eg}H$ (Se) < $\Delta_{eg}H$ (S)

(3) $\Delta_{eg}H$ (I) < $\Delta_{eg}H$ (At) (4) $\Delta_{eg}H$ (Te) < $\Delta_{eg}H$ (Po)

Answer (2)

Sol. ΔH_{eg} (Cl) = –349 kJ/mole ΔH_{eg} (F) = –333 kJ/mole

ΔH_{eg} (I) = –296 kJ/mole

ΔH_{eg} (Se) = –195 kJ/mole

ΔH_{eg} (S) = –200 kJ/mole

ΔH_{eg} (Te) = –190 kJ/mole

ΔH_{eg} (Po) = –174 kJ/mole

Electron gain enthalpy of Se is less negative than that of sulphur.

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

Assertion (A): Gypsum is used for making fireproof wall boards.

Reason (R): Gypsum is unstable at high temperatures.

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

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

(2) **(A)** is correct but **(R)** is not correct

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

(4) **(A)** is not correct but **(R)** is correct

Answer (3)

Sol. Both statements are correct. However, II[nd] statement has no relation with I[st] Statement.

50. O – O bond length in H_2O_2 is $\underline{X}$ than the O – O bond length in F_2O_2. The O – H bond length in H_2O_2 is $\underline{Y}$ than that of the O – F bond in F_2O_2.

Choose the correct option for $\underline{X}$ and $\underline{Y}$ from those given below

(1) X – shorter, Y - shorter

(2) X – shorter, Y - longer

(3) X – longer, Y - shorter

(4) X – longer, Y - longer

Answer (3)

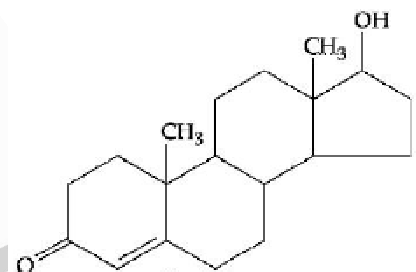
Sol. X – longer [because of more p-character in O – F bond]

Y – shorter [size of H is very small as compared to F]

SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse andw the on-screen virtual numeric keypad in the place designated to enter the answer.

51. Testosterone, which is a steroidal hormone, has the following structure.

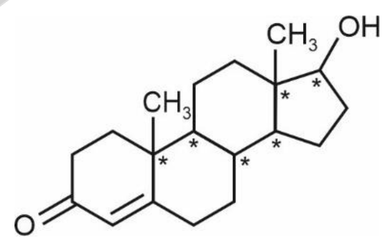


Testosterone

The total number of asymmetric carbon atom/s in testosterone is ________.

Answer (6)

Sol.



The total number of asymmetric carbon atoms in testosterone is 6.

52. A metal M crystallizes into two lattices: face centred cubic (fcc) and body centred cubic (bcc) with unit cell edge length of 2.0 and 2.5 Å respectively. The ratio of densities of lattices fcc to bcc for the metal M is ________.

(Nearest integer)

Answer (4)

Sol. d_1, Density of fcc lattice of metal M = $\dfrac{4 \times M}{N_0(a_{fcc})^3}$

d_2, Density of bcc lattice of metal M = $\dfrac{2 \times M}{N_0(a_{bcc})^3}$

$$\frac{d_1}{d_2} = \frac{4}{2}\left(\frac{a_{bcc}}{a_{fcc}}\right)^3 = 2\left(\frac{2.5}{2}\right)^3 = 3.90 \simeq 4$$

53. $A \rightarrow B$

The above reaction is of zero order. Half life of this reaction is 50 min. The time taken for the concentration of A to reduce to one-fourth of its initial value is _______ min.

Answer (75)

Sol. $\underset{a-x}{A} \longrightarrow \underset{x}{B}$ (Zero Order reaction)

$$a - x = \frac{a}{4} \Rightarrow x = \frac{3a}{4}$$

$$t_{1/2} = \frac{a}{2K} = 50 \text{ min.} \Rightarrow \frac{a}{K} = 100 \text{ min.}$$

$$t = \frac{x}{K} = \frac{3a}{4K} = 75 \text{ min.}$$

54. 0.3 g of ethane undergoes combustion at 27°C in a bomb calorimeter. The temperature of calorimeter system (including the water) is found to rise by 0.5°C. The heat evolved during combustion of ethane at constant pressure is ________ kJ mol^{-1}.

(Nearest integer)

[Given: The heat capacity of the calorimeter system is 20 kJ K^{-1}, R = 8.3 JK^{-1} mol^{-1}.

Assume ideal gas behaviour.

Atomic mass of C and H are 12 and 1 g mol^{-1} respectively]

Answer (1006)

Sol. $C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(\ell)$

No. of moles of ethane = $\dfrac{0.3}{30} = 0.01$

Heat evolved in Bomb calorimeter = 20 × 0.5

= 10 kJ

$$\Delta U = -\frac{10}{0.01} = -1000 \text{ kJ mol}^{-1}$$

$\Delta H = \Delta U + \Delta n_g RT$

$$= -1000 + (-2.5) \times \frac{8.3 \times 300}{1000}$$

$= -1000 - 6.225$

$= -1006.225$

$|\Delta H| \simeq 1006$ kJ mol^{-1}

55. The spin only magnetic moment of $[Mn(H_2O)_6]^{2+}$ complexes is _______ B.M. (Nearest integer)

(Given: Atomic no. of Mn is 25)

Answer (6)

Sol. $\left[Mn(H_2O)_6\right]^{2+}$

Mn^{2+} : $3d^5$

No. of unpaired electrons = 5

$\mu = \sqrt{35}$ BM $\simeq$ 6 BM

56. 20% of acetic acid is dissociated when its 5 g is added to 500 mL of water. The depression in freezing point of such water is _________ × 10^{-3}°C.

Atomic mass of C, H and O are 12, 1 and 16 a.m.u. respectively.

[Given : Molal depression constant and density of water are 1.86 K kg mol^{-1} and 1 g cm^{-3} respectively.

Answer (372)

Sol. $\underset{1-0.2}{CH_3COOH} \rightleftharpoons \underset{0.2}{H^+} + \underset{0.2}{CH_3COO^-}$

i = 1.2

$$[CH_3COOH] = \frac{5}{60 \times 0.5} = \frac{5}{30} M$$

$\Delta T_f = i\, K_f\, m$

$$1.2 \times 1.86 \times \frac{5}{30} = 0.372\,^{o}C$$

= 372 × 10^{-3} °C

57. 1×10^{-5} M $AgNO_3$ is added to 1 L of saturated solution of AgBr. The conductivity of this solution at 298 K is ____________ $\times 10^{-8}$ S m^{-1}.

[Given : $K_{SP}(AgBr) = 4.9 \times 10^{-3}$ at 298 K

$$\lambda^0_{Ag^+} = 6 \times 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$$

$$\lambda^0_{Br^-} = 8 \times 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$$

$$\lambda^0_{NO_3^-} = 7 \times 10^{-3} \text{ S m}^2 \text{ mol}^{-1}]$$

Answer (13039.2)

Sol. $$AgBr(S) \rightleftharpoons \underset{(10^{-5}+x)}{Ag^+}(aq) + \underset{x}{Br^-}(aq)$$

$x(x + 10^{-5}) = 4.9 \times 10^{-13}$

$x \simeq 4.9 \times 10^{-8}$M

$\lambda^o_{Ag^+} = 6 \times 10^{-3}$ S cm^2 mol^{-1}

$\lambda^o_{Br^-} = 8 \times 10^{-3}$ S cm^2 mol^{-1}

$\lambda^o_{NO_3^-} = 7 \times 10^{-3}$ S cm^2 mol^{-1}

$$K_{solution} = K_{Ag^+} + K_{Br^-} + K_{NO_3^-}$$

$= 6 \times 10^{-3} \times 10^{-5} \times 10^3 + 8 \times 10^{-3} \times 4.9 \times 10^{-8} \times 10^3 + 7 \times 10^{-3} \times 10^{-5} \times 10^3$

$= (6000 + 39.2 + 7000) \times 10^{-8}$

$= 13039.2 \times 10^{-8}$ Sm^{-1}

58. Among the following, the number of tranquilizer/s is /are _______________.

A. Chloroliazepoxide

B. Veronal

C. Valium

D. Salvarsan

Answer (3)

Sol. Chloroliazepoxide

Veronal

Valium

Salvarsan is an antibiotic

59. The molarity of a 10% (v/v) solution of di-bromine solution in CCl_4 (carbon tetrachloride) is 'x'.

x = ____________ $\times 10^{-2}$ M. (Nearest integer)

[Given : molar mass of Br_2 = 160 g mol^{-1}

atomic mass of C = 12 g mol^{-1}

atomic mass of Cl = 35.5 g mol^{-1}

density of dibromine = 3.2 g cm^{-3}

density of CCl_4 = 1.6 g cm^{-3}]

Answer (139)

Sol. Mass of 10 mL of Br_2 = 10 × 3.2 = 32 gm

Mass of 90 mL of CCl_4 = 90 × 1.6 = 144 gm

Molality of Br_2 solution in CCl_4 = $\dfrac{32 \times 1000}{160 \times 144}$

= 1.39 M

= $139 \times 10^{-}$

60. Among following compounds, the number of those present in copper matte is __________.

A. $CuCO_3$

B. Cu_2S

C. Cu_2O

D. FeO

Answer (3)

Sol. Copper matte contains

Cu_2S, Cu_2O, FeO