Some Basic Concepts of Chemistry

Question1

Mass of methane required to produce 22g of CO_2 after complete combustion is g.

(Given Molar mass in g mol-1 C = 12.0 H = 1.0 O = 16.0)

[27-Jan-2024 Shift 1]

Answer: 8

Solution:

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

$$\text{Moles of } CO_2 = \frac{22}{44} = 0.5$$

$$\text{So, required moles of } CH_4 = 0.5$$

$$\text{Mass } = 0.5 \times 16 = 8 \text{ gm}$$

Question2

9.3g of aniline is subjected to reaction with excess of acetic anhydride to prepare acetanilide. The mass of acetanilide produced if the reaction is 100% completed is ____ $\times 10^{-1}$g. (Given molar mass in gmol^{-1}N : 14, O : 16, C : 12, H : 1)

[27-Jan-2024 Shift 2]

Answer: 13.5

Solution:

$$\underset{\text{(Aniline MM = 93)}}{C_6H_5NH_2} + CH_3-\overset{\overset{O}{\parallel}}{C}-O-\overset{\overset{O}{\parallel}}{C}-CH_3 \longrightarrow$$

$$\underset{\text{(Ace tan ilide MM = 135)}}{C_6H_5NH-\overset{\overset{O}{\parallel}}{C}-CH_3} + CH_3COOH$$

$n_{\text{Acetan ilide}} = n_{\text{Aniline}}$

$\Rightarrow \frac{m}{135} = \frac{9.3}{93}$

$\Rightarrow m = 13.5g$

Question3

1 mole of PbS is oxidised by "X" moles of O3 to get "Y" moles of O2. X + Y =

[27-Jan-2024 Shift 2]

Answer: 8

Solution:

$PbS + 4O_3 \longrightarrow PbSO_4 + 4O_2$

$x = 4, y = 4$

Question4

0.05cm thick coating of silver is deposited on a plate of $0.05m^2$ area. The number of silver atoms deposited on plate are _____$\times 10^{23}$. (At mass Ag = 108, d = $7.9gcm^{-3}$)

[30-Jan-2024 Shift 1]

Answer: 11

Solution:

Volume of silver coating $= 0.05 \times 0.05 \times 10000$

$= 25 cm^3$

Mass of silver deposited $= 25 \times 7.9 g$

Moles of silver atoms $= \frac{25 \times 7.9}{108}$

Number of silver atoms $= \frac{25 \times 7.9}{108} \times 6.023 \times 10^{23}$

$= 11.01 \times 10^{23}$

Ans. 11

Question5

Number of moles of methane required to produce $22 g CO_{2(g)}$ after combustion is $x \times 10^{-2}$ moles. The value of x is

[31-Jan-2024 Shift 1]

Answer: 50

Solution:

$$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(\ell)}$$

$n_{CO_2} = \frac{22}{44} = 0.5$ moles

So moles of CH_4 required $= 0.5$ moles i.e. 50×10^{-2} mole

$x = 50$

Question6

A sample of $CaCO_3$ and $MgCO_3$ weighed 2.21g is ignited to constant weight of 1.152g. The composition of mixture is :

(Given molar mass in $g mol^{-1}$

$CaCO_3$: 100, $MgCO_3$: 84)

[31-Jan-2024 Shift 2]

Options:

A.

$1.187 g CaCO_3 + 1.023 g MgCO_3$

B.

$1.023gCaCO_3 + 1.023gMgCO_3$

C.

$1.187gCaCO_3 + 1.187gMgCO_3$

D.

$1.023gCaCO_3 + 1.187gMgCO_3$

Answer: A

Solution:

$$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$$

$$MgCO_3(s) \xrightarrow{\Delta} MgO(s) + CO_2(g)$$

Let the weight of $CaCO_3$ be x gm

$\therefore$ weight of $MgCO_3 = (2.21 - x)$ gm

Moles of $CaCO_3$ decomposed = moles of CaO formed

$\frac{x}{100} =$ moles of CaO formed

$\therefore$ weight of CaO formed $= \frac{x}{100} \times 56$

Moles of $MgCO_3$ decomposed = moles of MgO formed

$\frac{(2.21 - x)}{84} =$ moles of MgO formed

$\therefore$ weight of MgO formed $= \frac{2.21 - x}{84} \times 40$

$$\Rightarrow \frac{2.21 - x}{84} \times 40 + \frac{x}{100} \times 56 = 1.152$$

$\therefore x = 1.1886g =$ weight of $CaCO_3$

& weight of $MgCO_3 = 1.0214g$

Question7

The molarity of 1L orthophosphoric acid (H_3PO_4) having 70% purity by weight (specific gravity $1.54gcm^{-3}$) is______ M.

(Molar mass of H_3PO_4 = $98gmol_{-1}$)

[31-Jan-2024 Shift 2]

Answer: 11

Solution:

Specific gravity (density) $= 1.54 g/cc.$

Volume $= 1L = 1000\,ml$

Mass of solution $= 1.54 \times 1000$

$= 1540g$

% purity of H_2SO_4 is 70%

So weight of $H_3PO_4 = 0.7 \times 1540 = 1078g$

Mole of $H_3PO_4 = \frac{1078}{98} = 11$

Molarity $= \frac{11}{1L} = 11$

Question8

Consider the following reaction:

$$3PbCl_2 + 2(NH_4)_3PO_4 \longrightarrow Pb_3(PO_4)_2 + 6NH_4Cl$$

If 72mmol^2 of $PbCl_2$ is mixed with 50mmol of $(NH_4)_3PO_4$, then amount of $Pb_3(PO_4)_2$ formed is _____mmol. (nearest integer)

[1-Feb-2024 Shift 1]

Answer: 24

Solution:

Limiting Reagent is $PbCl_2$ mmol of $Pb_3(PO_4)_2$ formed $= \frac{\text{mmol of } PbCl_2 \text{ reacted}}{3} = 24\,\text{mmol}$

Question9

10mL of gaseous hydrocarbon on combustion gives 40mL of $CO_2(g)$ and 50mL of water vapour. Total number of carbon and hydrogen atoms in the hydrocarbon is____

[1-Feb-2024 Shift 2]

Answer: 14

Solution:

$$\underset{10\,ml}{CxHy} + O_2 \rightarrow CO_2 + H_2O$$

$$CxHy + \left(x + \frac{y}{4}\right)O_2 \rightarrow \underset{10x}{xCO_2} + \underset{5y}{\frac{y}{2}H_2O}$$

$10x = 40$

$x = 4$

$5y = 50$

$y = 10$

C_4H_{10}

Question10

When $Fe_{0.93}O$ is heated in presence of oxygen, it converts to Fe_2O_3 . The number of correct statement/s from the following is___

A. The equivalent weight of $Fe_{0.93}O$ is $\frac{\text{Molecular weight}}{0.79}$.

B. The number of moles of Fe^{2+} and Fe^{3+} in 1 mole of $Fe_{0.93}O$ is 0.79 and 0.14 respectively.

C. $Fe_{0.93}O$ is metal deficient with lattice comprising of cubic closed packed arrangement of O^{2-} ions.

D. The % composition of Fe^{2+} and Fe^{3+} in $Fe_{0.93}O$ is 85% and 15% respectively.
[24-Jan-2023 Shift 1]

Answer: 4

Solution:

A : $Fe_{0.93}O \rightarrow Fe_2O_3$

$nf = \left(3 - \frac{200}{93}\right) \times 0.93$

$nf = 0.79$

B : $2x + (0.93 - x) \times 3 = 2$

$x = 0.79$

$Fe^{2+} = 0.79,\ Fe^{3+} = 0.21$

C : $Fact^{D}$: $\%\%Fe^{2+} = \frac{0.79}{0.93} \times 100 = 85\%;\ Fe^{3+} = 15\%$

Question11

The number of units, which are used to express concentration of solutions from the following is____
Mass percent, Mole, Mole fraction, Molarity, ppm, Molality.
[24-Jan-2023 Shift 2]

Answer: 5

Solution:

Mass percent, mole fraction, molarity, ppm, molality are used for measuring concentration terms.

Question12

What is the mass ratio of ethylene glycol ($C_2H_6O_2$, molar mass = 62g / mol) required for making 500g of 0.25 molal aqueous solution and 250 mL of 0.25 molar aqueous solution ?
[25-Jan-2023 Shift 2]

Options:

A. 1 : 1

B. 3 : 1

C. 2 : 1

D. 1 : 2

Answer: C

Solution:

Assume : Mass of solvent ≈ Mass of solution
Case I :-

$$0.25 = \frac{W_1}{62} \times \frac{1000}{500}$$

Case II :-

$$0.25 = \frac{W_2}{62} \times \frac{1000}{250}$$

$$\frac{W_1}{W_2} = \frac{2}{1}$$

Question13

Number of hydrogen atoms per molecule of a hydrocarbon A having 85.8% carbon is _______

(Given : Molar mass of A = 84gmol^{-1})
[25-Jan-2023 Shift 2]

Answer: 12

Solution:

Element	Percentage	Mole	Mole ratio
C	85.8	$\frac{85.8}{12} = 7.15$	1
H	14.2	$\frac{14.2}{1} = 14.2$	2

Empirical formula (CH_2)
$14 \times n = 84$
$n = 6$
∴ Molecular formula C_6H_{12}

Question14

When a hydrocarbon A undergoes combustion in the presence of air, it requires 9.5 equivalents of oxygen and produces 3 equivalents of water. What is the molecular formula of A ?
[29-Jan-2023 Shift 2]

Options:

A. C_8H_6

B. C_9H_9

C. C_6H_6

D. C_9H_6

Answer: A

Solution:

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

$x + \frac{y}{4} = 9.5$

$\frac{y}{2} = 3$

$\Rightarrow x = 8, y = 6$

Question15

When 0.01 mol of an organic compound containing 60% carbon was burnt completely, 4.4g of CO_2 was produced. The molar mass of compound is ________ $gmol^{-1}$ (Nearest integer)
[29-Jan-2023 Shift 2]

Answer: 200

Solution:

Let M is the molar mass of the compound (g / mol)
mass of compound $= 0.01\,\mathrm{Mgm}$
mass of carbon $= 0.01\mathrm{M} \times \frac{60}{100}$
moles of carbon $= \frac{0.01\mathrm{M}}{12} \times \frac{60}{100}$
moles of CO_2 from combustion $= \frac{4.4}{44} =$ moles of carbon

$$\frac{0.01\mathrm{M}}{12} \times \frac{60}{100} = \frac{4.4}{44}$$

$$\mathrm{M} = \frac{4.4}{44} \times \frac{100}{60} \times \frac{12}{0.01} = 200\,\mathrm{gm / mol}$$

Question16

Some amount of dichloromethane (CH_2Cl_2) is added to 671.141 mL of chloroform ($CHCl_3$) to prepare 2.6×10^{-3}M solution of CH_2Cl_2(DCM). The concentration of DCM is ppm ________ (by mass).
Given: Atomic mass: C = 12; H : 1; Cl = 35.5 density of $CHCl_3 = 1.49 gcm^{-3}$
[30-Jan-2023 Shift 1]

Answer: 148

Solution:

$$\text{Molarity} = \frac{\text{mole}}{\text{volume}}$$

$$2.6 \times 10^{-3} = \frac{x / 85}{0.67141}$$

$x = 0.148\mathrm{g}$

conc. Fo DCM in ppm $= \frac{0.148}{1.49 \times 671.141} \times 10^6$

$= 148$ ppm

Question17

Match List I with List II:

List I (Mixture)	List II (Separation Technique)
(A) $CHCl_3 + C_6H_5NH_2$	I. Steam distillation
(B) $C_6H_{14} + C_5H_{12}$	II. Differential extraction
(C) $C_6H_5NH_2 + H_2O$	III. Distillation
(D) Organic compound in H_2O	IV. Fractionaldistillation

[30-Jan-2023 Shift 2]

Options:

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

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

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

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

Answer: B

Solution:

Solution:

List I (Mixture)	List II (Separation Technique)
$CHCl_3 + C_6H_5NH_2$	Distillation
$C_6H_{14} + C_5H_{12}$	Fractionaldistillation
$C_6H_5NH_2 + H_2O$	Steam distillation
Organic compound in H_2O	Differential extraction

Question18

On complete combustion, 0.492g of an organic compound gave 0.792g of CO_2.
The % of carbon in the organic compound is ______
(Nearest integer)
[31-Jan-2023 Shift 1]

Answer: 44

Solution:

weight of C in $0.792\,\text{gm}\,CO_2$

$= \frac{12}{44} \times 0.792 = 0.216$

$\%\ \text{of}\ C\ \text{in compound} = \frac{0.216}{0.492} \times 100$

$= 43.90\%$

Ans: 44

Question19

Zinc reacts with hydrochloric acid to give hydrogen and zinc chloride. The volume of hydrogen gas produced at STP from the reaction of 11.5g of zinc with excess HCl is ______ L (Nearest integer)
(Given : Molar mass of Zn is $65.4\,\text{gmol}^{-1}$ and Molar volume of H_2 at STP = 22.7L)
[31-Jan-2023 Shift 1]

Answer: 4

Solution:

$Zn + 2\,HCl \rightarrow ZnCl_2 + H_2\uparrow$

Moles of Zn used $= \frac{11.5}{65.4} =$ Moles of H_2 evolved

Volume of $H_2 = \frac{11.5}{65.4} \times 22.7L = 3.99L$

Question20

When a hydrocarbon A undergoes complete combustion it requires 11 equivalents of oxygen and produces 4 equivalents of water. What is the molecular formula of A ?
[31-Jan-2023 Shift 2]

Options:

A. C_9H_8

B. $C_{11}H_4$

C. C_5H_8

D. $C_{11}H_8$

Answer: A

Solution:

$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

$\frac{y}{2} = 4 \therefore y = 8$

$x + \frac{8}{4} = 11$

$\therefore x = 9$

$\therefore$ Hydrocarbon will be $= C_9H_8$

Question21

Assume carbon burns according to following equation :
$2C_{(s)} + O_{2(g)} \rightarrow 2\,CO(g)$
When 12g carbon is burnt in 48g of oxygen, the volume of carbon monoxide produced is _______ $\times 10^{-1}$L at STP [nearest integer]
[Given : Assume CO as ideal gas, Mass of C is $12 g mol^{-1}$, Mass of O is $16 g mol^{-1}$ and molar volume of an ideal gas at STP is $22.7 L mol^{-1}$]
[31-Jan-2023 Shift 2]

Answer: 227

Solution:

Solution:

$$2C(s) + O_2(g) \rightarrow 2\,CO(g)$$
$1\ \text{mol}\ 1.5\ \text{mol}$

Limiting reagent is carbon. One mole carbon produces one mole CO. Hence, volume at STP is 227×10^{-1} litre

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Question22

The density of 3M solution of NaCl is $1.0 gmL^{-1}$.
Molality of the solution is ______ $\times 10^{-2} m$
(Nearest integer).
Given: Molar mass of Na and Cl is 23 and $35.5 g\ mol^{-1}$ respectively.
[1-Feb-2023 Shift 1]

Answer: 364

Solution:

$$m = \frac{1000 \times M}{1000 \times d - M \times M.W \text{ of solute}}$$
$$= \frac{1000 \times 3}{1000 \times 1 - (3 \times 58.5)} = 3.64$$
$$= 364 \times 10^{-2}$$

Question23

The molality 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 = $160 gmol^{-1}$
atomic mass of C = $12 gmol^{-1}$
atomic mass of Cl = $35.5 gmol^{-1}$
density of dibromine = $3.2 gcm^{-3}$
density of CCl_4 = $1.6 gcm^{-3}$]
[1-Feb-2023 Shift 2]

Answer: 139

Solution:

($10\,\text{ml}$ solute in $90\,\text{ml}$ solvent
mass of solute $= 10 \times 3.2 = 32\text{g}$
mass of solvent $= 90 \times 1.6\text{g}$
$\text{m} = \dfrac{32 \times 1000}{160 \times 90 \times 1.6} = 1.388$
$\text{m} = 138.8 \times 10^{-2} = 139$

Question24

If 5 moles of $BaCl_2$ is mixed with 2 moles of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ formed is ....
(Nearest integer)
[6-Apr-2023 shift 1]

Answer: 1

Solution:

$$\underset{5}{3BaCl_2} + \underset{2}{2Na_3PO_4} \rightarrow Ba_3(PO_4)_2 + 6\,NaCl$$

Na_3PO_4 is limiting reagent.
2 mole Na_3PO_4 gives 1 mole of $Ba_3(PO_4)_2$

Question25

0.5g of an organic compound (X) with 60% carbon will produce ________ $\times 10^{-1}$g of CO_2 on complete combustion.
[8-Apr-2023 shift 1]

Answer: 11

Solution:

Moles of carbon $= \dfrac{0.5 \times 0.6}{12}$

Moles of CO_2 $= \dfrac{0.5 \times 0.6}{12}$

Mass of CO_2 $= \dfrac{0.5 \times 0.6}{12} \times 44 = 11 \times 10^{-1}$ gram

Question26

Which of the following have same number of significant figures?
A. 0.00253
B. 1. 0003
C. 15.0
D. 163
Choose the correct answer from the options given below
[8-Apr-2023 shift 2]

Options:

A. B and C only

B. A, B and C only

C. A, C and D only

D. C and D only

Answer: C

Solution:

Solution:
0.00253, 15.0, 163
All have three significant figures.

Question27

The number of molecules and moles in 2.8375 litres of O_2 at STP are respectively
[10-Apr-2023 shift 1]

Options:

A. 7.527×10^{22} and $0.125\,\mathrm{mol}$

B. 1.505×10^{23} and $0.250\,\mathrm{mol}$

C. 7.527×10^{23} and $0.125\,\mathrm{mol}$

D. 7.527×10^{22} and $0.250\,\mathrm{mol}$

Answer: A

Solution:

Moles of $O_2(n_{O_2}) = \frac{\text{Volume of } O_2}{22.7} = 0.125$ moles
Molecules of O_2 = moles $\times N_A$
$= 0.125 \times 6.022 \times 10^{23}$
$= 7.527 \times 10^{22}$ molecules
Ans (1) 7.527×10^{22} and 0.125 mole

Question28

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A : 3.1500g of hydrated oxalic acid dissolved in water to make 250.0 mL solution will result in 0.1M oxalic acid solution.
Reason R : Molar mass of hydrated oxalic acid is $126 g mol^{-1}$ In the light of the above statements, choose the correct answer from the options given below:
[10-Apr-2023 shift 2]

Options:

A. A is false but R is true

B. A is true but R is false

C. Both A and R are true but R is NOT the correct explanation of A

D. Both A and R are true and R is the correct explanation of A

Answer: D

Solution:

Assertion is correct.
$H_2C_2O_4.2H_2O$
$M = \frac{3.15 \times 1000}{126 \times 250}$
$= \frac{12.6}{126} = 0.1$
Reason is correct. It is used as a fact in explanation of assertion.

Question29

Match List I with List II

LIST I	LIST II
A $16g$ of $CH_4(g)$	I. Weight $28g$
B $1g$ of $H_2(g)$	II 60.2×10^{23} electrons
C 1 mole of $N_2(g)$	III Weight $32g$
D 0.5 mol of $SO_2(g)$	IV Occupies $11.4L$ volume at STP

Choose the correct answer from the options given below:
[10-Apr-2023 shift 2]

Options:

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

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

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

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

Answer: A

Solution:

Solution:
$16gCH_4 = \text{ mole } = 1$
$e- = 60.0 \times 10^{23}$
$19\,Hz = 0.5\,mole = 11.4(L)\,STP$
$1\,mole\,N_2 = 2\,rg$
$0.5\,mol\,SO_2 = \text{ weights } 32g.$

Question30

25 mL of silver nitrate solution (1M) is added dropwise to 25 mL of potassium iodide (1.05M) solution. The ion(s) present in very small quantity in the solution is/are
[11-Apr-2023 shift 1]

Options:

A. NO_3^-only

B. $Ag^+$and I^-both

C. K^{+}only

D. I only

Answer: B

Solution:

Solution:
On adding $AgNO_3$ into KI, AgI will form and solubility of AgI is very low.
So, $[Ag^{+}]$and $[I^{-}]$ will be present in very small quantity.

Question31

A solution of sugar is obtained by mixing 200g of its 25% solution and 500g of its 40% solution (both by mass). The mass percentage of the resulting sugar solution is ______ (Nearest integer) [11-Apr-2023 shift 1]

Answer: 36

Solution:

Solution (I)→ Mass of sugar $= 200 \times \frac{25}{100} = 50\,\mathrm{gm}$
Mass of solution $= 200\,\mathrm{gm}$
Solution (II) → Mass of solution $= 500\,\mathrm{gm}$
Mass of sugar $= \frac{40}{100} \times 500 = 200\,\mathrm{gm}$

$$\text{Final } \%w/w = \frac{\text{Total mass of sugar}}{\text{Total mass of solution}} \times 100$$

$$= \frac{50+200}{200+500} \times 100 = \frac{250}{7}$$

$= 35.71\% \approx 36$

Question32

A solution is prepared by adding 2g of " X " to 1 mole of water. Mass percent of " X " in the solution is [11-Apr-2023 shift 2]

Options:

A. 5%

B. 20%

C. 2%

D. 10%

Answer: D

Solution:

Solute (X) = 2g
Solvent (H_2O) = 1 mole = 18g
Total mass = 2 + 18 = 20g
% mass of X = $\frac{2}{20} \times 100 = 10\%$

Question33

The volume of hydrogen liberated at STP by treating 2.4g of magnesium with excess of hydrochloric acid is ________ $\times 10^{-2}$L.
Given: Molar volume of gas is 22.4L at STP. Molar mass of magnesium is 24gmol^{-1}
[11-Apr-2023 shift 2]

Answer: 224

Solution:

$Mg + 2\,HCl \rightarrow MgCl_2 + H_2\uparrow$
w = 2.4g
N = $\frac{2.4}{24} = 0.1$ mole
1 mole of gas at STP $\Rightarrow$ 22.4 lit.
$\therefore$ 0.1 mole of gas = 0.1×22.4
= 2.24 lit. = 224×10^{-2} litre

Question34

A metal chloride contains 55.0% of chlorine by weight . 100 mL vapours of the metal chloride at STP weigh 0.57g. The molecular formula of the metal chloride is (Given: Atomic mass of chlorine is 35.5u)
[12-Apr-2023 shift 1]

Options:

A. MCl

B. MCl_3

C. MCl_2

D. MCl_4

Answer: C

Solution:

Solution:
Molecular. weight of metal chloride

$= \frac{0.57}{100} \times 22700$

$= 129.39$

weight of $Cl = 129.39 \times 0.55$

$= 71.1645$

$\therefore$ Mole of $Cl\,Cl = \frac{71.1645}{35.5} \cong 2$

Hence MCl_2

Question35

An organic compound gives 0.220g of CO_2 and 0.126g of H_2O on complete combustion. If the % of carbon is 24 then the % of hydrogen is ______ $\times 10^{-1}$. (Nearest integer)
[13-Apr-2023 shift 1]

Answer: 56

Solution:

Solution:

$\%$ of carbon $= \frac{\frac{0.220}{44} \times 12}{x} \times 100$

($x =$ mass of organic compound)

$24 = \frac{6}{x}$

$x = 0.25\,gm$

$\%$ of $H = \frac{\frac{0.126}{18} \times 2 \times 1}{0.25} \times 100$

$= 5.6 = 56 \times 10^{-1}$

Question36

1g of a carbonate (M_2CO_3) on treatment with excess HCl produces $0.01\,$mol of CO_2. The molar mass of M_2CO_3 is ______ $gmol^{-1}$. (Nearest integer)
[13-Apr-2023 shift 2]

Answer: 100

Solution:

Solution:

$$\underset{1\,gm}{M_2CO_3} + \underset{Excess}{2\,HCl} \rightarrow \underset{0.02\ mole}{2\,MCl} + H_2O + \underset{0.01 mole}{CO_2}$$

From principle of atomic conservation of carbon atom, Mole of $M_2CO_3 \times 1 =$ Mole of $CO_2 \times 1$

$$\frac{1\ gm}{\text{molar mass of } M_2CO_3} = 0.01 \times 1$$

$\therefore$ Molar mass of $M_2CO_3 = 100\,gm / mole$

Question37

Compound A contains 8.7% Hydrogen, 74% Carbon and 17.3% Nitrogen. The molecular formula of the compound is,
Given : Atomic masses of C, H and N are 12,1 and 14 amu respectively. The molar mass of the compound A is 162gmol^{-1}.
[28-Jun-2022-Shift-2]

Options:

A. $C_4H_6N_2$

B. C_2H_3N

C. C_5H_7N

D. $C_{10}H_{14}N_2$

Answer: D

Solution:

Solution:

Mole ratio of H, C and N

$= \frac{8.7}{1} : \frac{74}{12} : \frac{17.3}{14}$

$= 8.7 : 6.167 : 1.23$

$= \frac{8.7}{1.23} : \frac{6.167}{1.23} : \frac{1.23}{1.23}$

$= 7 : 5 : 1$

$\therefore$ Emperical formula $= C_5H_7N$

$\therefore$ Molecular formula $= (C_5H_7N)_n$

Given molecular mass $= 162$

Molecular mass of $(C_5H_7N)_n$

$= (5 \times 12 + 7 \times 1 + 14) \times n$

$= (81) \times n$

$\therefore 81 \times n = 162$

$\Rightarrow n = 2$

$\therefore$ Molecular formula $= C_{10}H_{14}N_2$

Question38

The complete combustion of 0.492g of an organic compound containing ' C ', ' H ' and ' O ' gives 0.793g of CO_2 and 0.442g of H_2O. The percentage of oxygen composition in the organic compound is______ (nearest integer)
[28-Jun-2022-Shift-2]

Answer: 46

Solution:

Solution:
Total organic compound $= 0.492\,\text{gm}$
Produced $CO_2 = 0.793\,\text{gm}$
$\therefore$ Moles of $CO_2 = \dfrac{0.793}{44}$
$\therefore$ Moles of C atoms $= \dfrac{0.793}{44}$
$\therefore$ Weight of C atoms $= \dfrac{0.793}{44} \times 12 = 0.216\text{g}$
Produced $H_2O = 0.442\,\text{gm}$
$\therefore$ Moles of $H_2O = \dfrac{0.442}{18}$
$\therefore$ Moles of H atoms $= \dfrac{0.442}{18}$
$\therefore$ Weight of H atoms $= \dfrac{0.442}{18} \times 2 = 0.05\text{g}$
$\therefore$ Weight of O atoms
$= 0.492 - (0.216 + 0.05)$
$= 0.226\,\text{gm}$
% by mass of oxygen in compound
$= \dfrac{0.226}{0.492} \times 100 = 46\%$

Question39

Production of iron in blast furnace follows the following equation
$$Fe_3O_4(s) + 4\,CO(g) \rightarrow 3\,Fe(l) + 4CO_2(g)$$
when $4.640\,$kg of Fe_3O_4 and $2.520\,$kg of CO are allowed to react then the amount of iron (in g) produced is:
[29-Jun-2022-Shift-1]

Options:

A. 1400

B. 2200

C. 3360

D. 4200

Answer: C

Solution:

Given,
Mass of $Fe_3O_4 = 4.640\,kg = 4640\,gm$
Molar mass of $Fe_3O_4 = 56 \times 3 + 16 \times 4 = 232g$
$\therefore$ Moles of $F\ _3O_4 = \frac{4640}{232} = 20$
Also, given
Mass of $CO = 2.520\,kg = 2520\,gm$
Molar mass of $CO = 12 + 16 = 28\,gm$
$\therefore$ Molar of $CO = \frac{2520}{28} = 90$

$$Fe_3O_4(s) + 4\,CO(g) \longrightarrow 3\,Fe(l) + 4\,CO_2(g)$$

$Fe_3O_4(s)$	$4\,CO(g)$	$3\,Fe(l)$	$4\,CO_2(g)$
20	90	0	0
0	$90 - 20 \times 4$	3×20	4×20
	$= 10$	$= 60$	$= 80$

Here Fe_3O_4 is limiting reagent as to find limiting reagent, divide the given moles of reactants with their respective stoichiometric coefficient and reactant for which this ratio is minimum will be limiting reagent
For Fe_3O_4, $\frac{\text{moles}}{\text{stoichiometric coefficient}} = \frac{20}{1}$
For CO, $\frac{\text{moles}}{\text{stoichiometric coefficient}} = \frac{90}{4} = 22.5$
$\therefore Fe_3O_4$ is limiting reagent.
Now produced $Fe = 20 \times 3 = 60\,mol$
$\therefore$ Weight of $Fe = 60 \times 56 = 3360g$

Question40

Geraniol, a volatile organic compound, is a component of rose oil. The density of the vapour is $0.46 gL^{-1}$ at $257^{\circ}C$ and $100\,mm\,Hg$. The molar mass of geraniol is ______$gmol^{-1}$. (Nearest Integer)
[. Given : $R = 0.082 L\,atm\,K^{-1}\,mol^{-1}$]
[29-Jun-2022-Shift-1]

Answer: 152

Solution:

From ideal gas equation we know
$PV = nRT$

$\Rightarrow PV = \frac{W}{M}RT$
$\Rightarrow P = \frac{W}{V} \cdot \frac{RT}{M}$
$\Rightarrow P = d \cdot \frac{RT}{M} \left[\because d = \frac{W}{V}\right]$
We know, $760\,mm$ of $Hg = 1\,atm$
$\therefore 100\,mm$ of $Hg = \frac{100}{760}\,atm$
$\therefore$ Pressure $(P) = \frac{100}{760}\,atm$
Density $(d) = 0.46$
$R = 0.082 L\,atm\,K^{-1}\,mol^{-1}$
$T = (257 + 273)K = 530K$
Putting the values in above equation, we get
$\frac{100}{760} = \frac{0.46 \times 0.082 \times 530}{M}$
$\Rightarrow M = 152$

Question41

Using the rules for significant figures, the correct answer for the expression $\frac{0.02858 \times 0.112}{0.5702}$ will be [29-Jun-2022-Shift-2]

Options:

A. 0.005613

B. 0.00561

C. 0.0056

D. 0.006

Answer: B

Solution:

Solution:
$\frac{0.02858 \times 0.112}{0.5702} = 0.00561$
Reported answer should not be more precise than least precise term (0.112 is the least precise term with three significant figures) in calculations, so there should be three significant figures in reported answer.

Question42

If a rocket runs on a fuel ($C_{15}H_{30}$) and liquid oxygen, the weight of oxygen required and CO_2 released for every litre of fuel respectively are : (Given : density of the fuel is 0.756g / mL) [24-Jun-2022-Shift-1]

Options:

A. 1188g and 1296g

B. 2376g and 2592g

C. 2592g and 2376g

D. 3429g and 3142g

Answer: C

Solution:

$C_{15}H_{30} + \frac{45}{2}O_2 \rightarrow 15CO_2 + 15H_2O$
Given, volume of fuel $= 1L = 1000ml$
And density of fuel $= 0.756g / ml$
We know,
$d = \frac{w}{v}$
$\Rightarrow 0.756 = \frac{w}{1000}$
$\Rightarrow W = 756gm$
$\therefore$ weight of fuel $= 756gm$
Molar mass of $C_{15}H_{30} = 15 \times 12 + 30 = 210$
$\therefore$ Moles of $C_{15}H_{30} = \frac{756}{210}$
From equation you can see,

1 mole of $C_{15}H_{30}$ react with $\frac{45}{2}$ mole of O_2
$\therefore \frac{756}{210}$ moles of $C_{15}H_{30}$ react with $\frac{45}{2} \times \frac{756}{210}$ moles of O_2
$\therefore$ Moles of O_2 required $= \frac{45}{2} \times \frac{756}{210}$
$\therefore$ Mass of O_2 required $= \frac{45}{2} \times \frac{756}{210} \times 32 = 2592g$
Also,
From 1 mole of $C_{15}H_{30}$15 moles of CO_2 formed
$\therefore$ From $\frac{756}{210}$ moles of $C_{15}H_{30}15 \times \frac{756}{210}$ moles of CO_2 formed
$\therefore$ Moles of CO_2 formed $= 15 \times \frac{756}{210}$
$\therefore$ Mass of CO_2 formed $= 15 \times \frac{756}{210} \times 44 =$
$2376g$

Question43

120g of an organic compound that contains only carbon and hydrogen gives 330g of CO_2 and 270g of water on complete combustion. The percentage of carbon and hydrogen, respectively are [24-Jun-2022-Shift-2]

Options:

A. 25 and 75

B. 40 and 60

C. 60 and 40

D. 75 and 25

Answer: D

Solution:

Solution:

$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

From the reaction,

Produced $CO_2 = x\,mol$

and produced $H_2O = \frac{y}{2}mol$

Given produced $CO_2 = 330g$

$\therefore$ moles of $CO_2 = \frac{330}{44} = \frac{30}{4} = x$

Also given produced $H_2O = 270\,gm$

$\therefore$ Moles of $H_2O = \frac{270}{18} = 15 = \frac{y}{2}$.

$\Rightarrow y = 30$

$\therefore x : y = \frac{30}{4} : 30 = 1 : 4$

Formula of the compound $= (CH_4)_n$

$\therefore$ Weight of C in $(CH_4)_n = 12n$

Weight of H in $(CH_4)_n = 4n$

$\therefore$ Weight ratio of C and H

$= 12n : 4n$

$= 3 : 1$

$\therefore$% of C $= \frac{3}{4} \times 100 = 75$

and % of H $= \frac{1}{4} \times 100 = 25$

Question44

The number of N atoms in 681g of $C_7H_5N_3O_6$ is $x \times 10^{21}$. The value of x is ($N_A = 6.02 \times 10^{23}mol^{-1}$)

(Nearest Integer)

[25-Jun-2022-Shift-1]

Answer: 5418

Solution:

Molar mass of $C_7H_5N_3O_6$

$= 12 \times 7 + 5 + 14 \times 3 + 16 \times 6$

$= 227\,gm$

Given mass of $C_7H_5N_3O_6 = 681\,gm$

$\therefore$ Moles of $C_7H_5N_3O_6 = \frac{681}{227} = 3$

In one molecule of $C_7H_5N_3O_6$, 3N atoms present.

$\therefore$ In 1 mole $C_7H_5N_3O_6$, 3 moles of N atoms presents.

$\therefore$ In 3 moles of $C_7H_5N_3O_6$, $3 \times 3 = 9$ moles of N atoms presents.

We know, 1 mole of N atoms $= 6.02 \times 10^{23}$N atoms.

$\therefore$9 moles of N atoms $= 9 \times 6.02 \times 10^{23} = 54.18 \times 10^{23} = 5418 \times 10^{21}$

Question45

A protein ' A ' contains 0.30% of glycine (molecular weight 75). The minimum molar mass of the protein ' A ' is ____ $\times 10^3 g mol^{-1}$ [nearest integer]
[25-Jun-2022-Shift-2]

Answer: 25

Solution:

Solution:
Let, molar mass of protein A = x
Protein A contains 0.30% glycine
$\therefore \frac{x \times 0.3}{100} = 75$
$\Rightarrow x = 25000 = 25 \times 10^3$

Question46

A commercially sold conc. HCl is 35%HCl by mass. If the density of this commercial acid is 1.46g / mL, the molarity of this solution is:
(Atomic mass : Cl = 35.5 amu, H = 1 amu)
[26-Jun-2022-Shift-1]

Options:

A. 10.2M

B. 12.5M

C. 14.0M

D. 18.2M

Answer: C

Solution:

Solution:
35\% HCl by mass means in 100 gm HCl solution 35 gm HCl present.
Now, volume of 100 gm HCl solution
$= \frac{100}{1.46} \text{ml}$
$= \frac{\frac{100}{1.46}}{1000} \text{l}$
Moles of HCl = $\frac{35}{36.5}$

Now, molarity $= \dfrac{\text{moles of solute}}{\text{volume of solution (in L)}}$

$$= \frac{\frac{35}{36.5}}{\frac{100}{1.46}} = 14$$

Question47

On complete combustion 0.30g of an organic compound gave 0.20g of carbon dioxide and 0.10g of water. The percentage of carbon in the given organic compound is ____(Nearest integer)
[26-Jun-2022-Shift-1]

Answer: 18

Solution:

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

Given organic compound $C_xH_y = 0.3\,\text{gm}$

Produced carbon dioxide $(CO_2) = 0.2\,\text{gm}$

Produced water $(H_2O) = 0.1\,\text{gm}$

Moles of $CO_2 = \dfrac{0.2}{44}$

$\therefore$ Moles of C atom $= \dfrac{0.2}{44}$

$\therefore$ Mass of C atom $= \dfrac{0.2}{44} \times 12 = 0.0545$

Moles of $H_2O = \dfrac{0.1}{18}$

$\therefore$ Moles of H atoms $= \dfrac{0.1}{18} \times 2$

$\therefore$ Mass of H atoms $= \dfrac{0.1 \times 2}{18} \times 1 = 0.0111$

$\therefore$% of C atom $= \dfrac{0.0545}{0.3} \times 100 = 18\%$

Question48

The moles of methane required to produce 81g of water after complete combustion is ____ $\times 10^{-2}$ mol. [nearest integer]
[26-Jun-2022-Shift-2]

Answer: 225

Solution:

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
POAC on H atom
$n_{CH4} \times 4 = n_{H2O} \times 2$
$n_{CH_4} = \frac{81}{18} \times 2 \times \frac{1}{4} = \frac{81}{36}$
$n_{CH_4} = 2.25$
$= 225 \times 10^{-2}$
Nearest Integers $= 225$

Question49

116g of a substance upon dissociation reaction, yields 7.5g of hydrogen, 60g of oxygen and 48.5g 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
[27-Jun-2022-Shift-2]

Answer: 2

Solution:

$\%H = \frac{7.5}{116} \times 100 = 6.5$
$\%O = \frac{60}{116} \times 100 = 51.7$
$\%C = \frac{48.5}{116} \times 100 = 41.8$
Relative atomicities $= H \Rightarrow 6.5$
$O \Rightarrow \frac{51.7}{16} = 3.25$
$C \Rightarrow \frac{41.8}{12} = 3.5$
Emperically formula is approx.. CH_2O
(A) $C_2H_4O_2$ (B) CH_2O relate to this formula.

Question50

56.0 L of nitrogen gas is mixed with excess hydrogen gas and it is found that 20L of ammonia gas is produced. The volume of unused nitrogen gas is found to be______ L.
[25-Jul-2022-Shift-2]

Answer: 46

Solution:

Solution:
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
Since H_2 is in excess and $20L$ of ammonia gas is produced.
Hence, 2 moles $NH_3 \equiv 1$ mole N_2 $(v \propto n)$
$20LNH_3 \equiv 10LN_2$
Volume of N_2 left $= 56 - 10$
$= 46L$

Question51

Chlorophyll extracted from the crushed green leaves was dissolved in water to make 2L solution of Mg of concentration 48 ppm. The number of atoms of Mg in this solution is $x \times 10^{20}$ atoms. The value of x is _________. (Nearest Integer)
(Given : Atomic mass of Mg is $24 g mol^{-1}$; $N_A = 6.02 \times 10^{23} mol^{-1}$)
[26-Jul-2022-Shift-1]

Answer: 24

Solution:

Solution:
In $2L \rightarrow 96$ mg of Mg
Number of atoms of Mg $= \frac{96 \times 10^{-3}}{24} \times N_A$
$= 4 \times 10^{-3} \times 6 \times 10^{23}$
$= 24 \times 10^{20}$
$x = 24$

Question52

When 800 mL of 0.5M nitric acid is heated in a beaker, its volume is reduced to half and 11.5g of nitric acid is evaporated. The molarity of the remaining nitric acid solution is $x \times 10^{-2} M$. (Nearest integer)
(Molar mass of nitric acid is $63 g mol^{-1}$)
[26-Jul-2022-Shift-1]

Answer: 54

Solution:

Solution:
m moles of $HNO_3 = 800 \times 0.5$
Moles of $HNO_3 = 400 \times 10^{-3} = 0.4$ moles
Weight of $HNO_3 = 0.4 \times 63g = 25.2g$
Remaining acid $= 25.2 - 11.5 = 13.7g$
$M = \frac{13.7 \times 1000}{400 \times 63}$
$= \frac{137}{252} = 0.54$
$= 54 \times 10^{-2}$

Question53

Hemoglobin contains 0.34% of iron by mass. The number of Fe atoms in 3.3g of hemoglobin is (Given: Atomic mass of Fe is 56u, $N_A = 6.022 \times 10^{23} mol^{-1}$.)
[26-Jul-2022-Shift-2]

Options:

A. 1.21×10^5

B. 12.0×10^{16}

C. 1.21×10^{20}

D. 3.4×10^{22}

Answer: C

Solution:

Solution:
According to the question,
100g of hemoglobin contains 0.34g of iron
3.3g of hemoglobin contains $\frac{0.34}{100} \times 3.3g$ of iron
moles of Fe $= \frac{0.34 \times 3.3}{100 \times 56} = \frac{N}{N_A}$
$N = \frac{0.34 \times 3.3 \times 6.022 \times 10^{23}}{100 \times 56}$
$= 1.21 \times 10^{20}$

Question54

250g solution of D-glucose in water contains 10.8% of carbon by weight. The molality of the solution is nearest to

(Given: Atomic Weights are, H, 1u; C, 12u; O, 16u)
[27-Jul-2022-Shift-1]

Options:

A. 1.03

B. 2.06

C. 3.09

D. 5.40

Answer: B

Solution:

Solution:
$C_6H_{12}O_6 \rightarrow$ Glucose
We know: $\frac{\text{mass of C}}{\text{mass of glucose}} = \frac{72}{180}$
Given: %C = 10.8 = $\frac{\text{mass of C}}{\text{mass of solution}} \times 100$
$\frac{10.8 \times 250}{100} =$ mass of C$\Rightarrow$ Mass of C = $27\,\text{gm}$
$\therefore$ mass of glucose = 67.5 gm
$\therefore$ moles of glucose = $0.375\,\text{moles}$
Mass of solvent = $250 - 67.5\,\text{gm} = 182.5\,\text{gm}$
$\therefore$ Molality = $\frac{0.375}{0.1825} = 2.055 \approx 2.06$

Question55

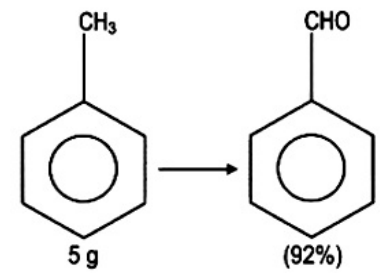
The normality of H_2SO_4 in the solution obtained on mixing $100\,\text{mL}$ of $0.1\text{M}H_2SO_4$ with $50\,\text{mL}$ of $0.1\text{M}\,\text{NaOH}$ _______ is $\times 10^{-1}$N. (Nearest Integer)
[27-Jul-2022-Shift-2]

Answer: 1

Solution:

Solution:
No. of equivalents of $H_2SO_4 = 100 \times 0.1 \times 2 = 20$
No. of equivalents of $\text{NaOH} = 50 \times 0.1 = 5$
No. of equivalents of H_2SO_4 left $= 20 - 5 = 15$
$\Rightarrow 150 \times x = 15$
$x = \frac{1}{10} = 0.1\text{N} = 1 \times 10^{-1}\text{N}$

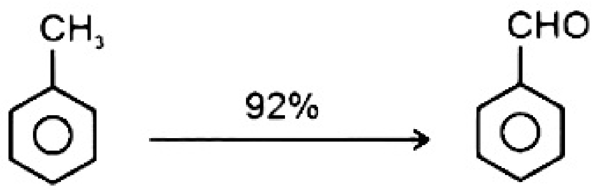
Question56



In the above reaction, 5g of toluene is converted into benzaldehyde with 92% yield. The amount of benzaldehyde produced is _______ $\times 10^{-2}$g. (Nearest integer)
[27-Jul-2022-Shift-2]

Answer: 530

Solution:



Moles $= \frac{5}{92}$

Moles of benzaldehyde produced $= \frac{5}{92} \times 0.92 = 0.05$

$\therefore$ Mass of benzaldehyde formed
$= 0.05 \times 106$
$= 5.3\text{g}$
$= 530 \times 10^{-2}$

Question57

In the given reaction,
$X + Y + 3Z \leftrightarrows XYZ_3$
if one mole of each of X and Y with 0.05 mol of Z gives compound XYZ_3 - (Given : Atomic masses of X, Y and Z are 10, 20 and 30 amu, respectively.) The yield of XYZ_3 is _______g. (Nearest integer)
[28-Jul-2022-Shift-1]

Answer: 2

Solution:

$$\underset{n_{moles}=1}{X} + \underset{1}{Y} + \underset{0.05}{3Z} \rightleftharpoons xyz_3$$

Limiting reagent is Z $= \frac{0.05}{3} = .016$

3 moles of Z $\rightarrow$ 1 mole of XYZ_3

0.05 mole of Z $\rightarrow \frac{1}{3} \times 0.05$ mole of XYZ_3

M.wt. of $XYZ_3 = 10 + 20 + 90$

$= 120\,\text{amu}$

Wt. of $XYZ_3 = \frac{.05}{3} \times 120$

$= 2g$

Question58

On complete combustion of 0.492g of an organic compound containing C, H and O, 0.7938g of CO_2 and 0.4428g of H_2O was produced. The % composition of oxygen in the compound is _______.

[28-Jul-2022-Shift-1]

Answer: 46

Solution:

% of H $= \frac{2}{18} \times \frac{\text{wt. of } H_2O}{\text{wt. of organic compound}} \times 100$

$= \frac{2}{18} \times \frac{0.4428}{0.492} \times 100$

$= 0.11 \times 0.9 \times 100$

$= 0.099 \times 100 = 9.9$

% of C $= \frac{12}{44} \times \frac{0.7938}{0.492} \times 100$

$= 0.27 \times 1.61 \times 100$

$= 43.47$

% Oxygen $= 100 - (43.47 + 9.9)$

$= 100 - 53.37 \simeq 46$

Question59

$$\underset{20g}{N_{2(g)}} + 3\underset{5g}{H_{2(g)}} \rightleftharpoons 2NH_{3(g)}$$

Consider the above reaction, the limiting reagent of the reaction and number of moles of NH_3 formed respectively are :

[29-Jul-2022-Shift-1]

Options:

A. H_2, 1.42 moles

B. H_2, 0.71 moles

C. N_2, 1.42 moles

D. N_2, 0.71 moles

Answer: C

Solution:

Solution:

$$\underset{20g}{N_{2(g)}} + \underset{5g}{3H_{2(g)}} \rightleftharpoons 2NH_{3(g)}$$

Ideally $28gN_2$ reacts with $6gH_2$ limiting reagent is N_2

$\therefore$ Amount of NH_3 formed on reacting $20gN$ is,

$= \frac{34 \times 20}{28} = 24.28g$

$= 1.42$ moles

Question60

Consider the reaction
$4HNO_3(1) + 3KCl(s) \rightarrow Cl_2(g) + NOCl(g) + 2H_2O(g) + 3KNO_3(s)$
The amount of HNO_3 required to produce 110.0g of KNO_3 is
(Given: Atomic masses of H, O, N and K are 1, 16, 14 and 39 , respectively.)
[29-Jul-2022-Shift-2]

Options:

A. 32.2g

B. 69.4g

C. 91.5g

D. 162.5g

Answer: C

Solution:

Solution:

$4HNO_3(l) + 3KCl(s) \longrightarrow Cl_2(g) + NOCl(g) + 2H_2O(g) + 3KNO_3(s)$

$\because$ 110g of $KNO_3 \Rightarrow$ moles of $KNO_3 = \frac{110}{101}$

$= 1.089\,mol$

As, 4 mole of HNO_3 produces $3\,mol$ of KNO_3.

Hence, the moles of HNO_3 required to produce

1.089 moles of $KNO_3 = \frac{4}{3} \times 1.089 = 1.452\,mol$

Hence, mass of HNO_3 required is $1.452 \times 63 = 91.5g$

Question61

$C(s) + O_2(g) \rightarrow CO_2(g) + 400k.J$

$C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g) + 100\,kJ$

When coal of purity 60% is allowed to burn in presence of insufficient oxygen, 60% of carbon is converted into ' CO ' and the remaining is converted into ' CO_2 '. The heat generated when 0.6 kg of coal is burnt is ______.

[29-Jul-2022-Shift-2]

Options:

A. 1600 kJ

B. 3200 kJ

C. 4400 kJ

D. 6600 kJ

Answer: D

Solution:

Solution:
Weight of coal $= 0.6\,kg = 600\,gm$
∴60% of it is carbon
So weight of carbon $= 600 \times \frac{60}{100} = 360g$
∴ moles of carbon $= \frac{360}{12} = 30$ moles
∴ Heat generated $= 12 \times 400 + 18 \times 100 = 6600\,kJ$

Question62

A 1.84 mg sample of polyhydric alcoholic compound 'X' of molar mass 92.0g / mol gave 1.344 mL of H_2 gas at STP. The number of alcoholic hydrogens present in compound ' X ' is _______.

[29-Jul-2022-Shift-2]

Answer: 3

Solution:

Solution:
Volume of H_2 gas $= 1.344\,mL$
Mole of H_2 gas $= \frac{1.344}{22400} = 6 \times 10^{-5}$
No of H atoms per molecule of $H_2 = 2$.
No. of moles of organic compound $= \frac{1.84 \times 10^{-3}}{92} = 2 \times 10^{-5}$

No. of $-\mathrm{OH}$ (hydroxyl group in one molecule) $= \frac{6 \times 10^{-5}}{2 \times 10^{-5}} = 3$

Question63

The number of significant figures in 50000.020×10^{-3} is ………… [26 Feb 2021 Shift 1]

Answer: 7

Solution:

Solution:
Non-zero digits are always significant. Any zeros between two significant digits are significant.
∴ Zero's between 5 and 2 are all significant.
(Number of significant figures $= 7$)

Question64

The $NaNO_3$ weighed out to make 50mL of an aqueous solution containing $70.0 \mathrm{mg} Na^{+}$ per mL is ……… g. (Rounded off to the nearest integer) [Given : Atomic weight in $\mathrm{g mol}^{-1}$, $-Na : 23; N : 14; 0 : 16$]. [26 Feb 2021 Shift 2]

Answer: 13

Solution:

Solution:
$70 \mathrm{mg} Na^{+}$is present in $1 \mathrm{mL}$ of $NaNO_3$ solution.
∴$50 \mathrm{mL}$ of $NaNO_3$ will contain $= 70 \times 50 \mathrm{mg}$
$= \frac{70 \times 50}{1000} = 3.5 \mathrm{gm}$
Moles of Na^{+}in solution =Moles of $NaNO_3$ in solution
$[\because NaNO_3 \longrightarrow Na^{+} + NO_3^{-}]$
$= \frac{3.5}{23} \mathrm{mol} \quad [\because$ Molar mass of $Na^{+} = 23 \mathrm{g mol}^{-1}]$
Mass of $NaNO_3 =$ mole × molar mass
$[\because$ molar mass of $NaNO_3 = 85 \mathrm{g mol}^{-1}]$
$= \frac{3.5}{23} \times 85 = 12.934 \mathrm{g} \sim eq 13 \mathrm{g}$

Question65

Complete combustion of 1.80g of an oxygen containing compound ($C_xH_yO_z$) gave 2.64g of CO_2 and 1.08g of H_2O. The percentage of oxygen in the organic compound is [25 Feb 2021 Shift 1]

Options:

A. 50.33

B. 53.33

C. 63.53

D. 51.63

Answer: B

Solution:

Solution:

$$\underset{1.8g}{C_xH_yO_z} + O_2 \longrightarrow \underset{2.64g}{CO_2} + \underset{1.08g}{H_2O}$$

$$n_C = \underset{(Moles)}{CO_2} = \frac{2.64 \text{ (Given mass)}}{44 \text{ (Molecular mass)}} = 0.06$$

$$n_H = 2 \times n_{H_2O} = \frac{1.08}{18} \times 2 = 0.12$$

Weight of oxygen in $C_xH_yO_z$

$$= 1.80 - 12 \times \frac{2.64}{44} - \frac{1.08}{18} \times 2$$

$$= 1.80 - 0.72 - 0.12 = 0.96g$$

% of oxygen by weight $= \frac{0.96}{1.80} \times 100 = 53.33\%$

Question66

The formula of a gaseous hydrocarbon, which requires 6 times of its own volume of O_2 for complete oxidation and produces 4 times its own volume of CO_2 is C_xH_y. The value of y is .... [24 Feb 2021 Shift 2]

Answer: 8

Solution:

Combustion reaction:

$$C_xH_y(g) + \left(x + \frac{y}{4}\right)O_2(g) \longrightarrow xCO_2(g) + \frac{y}{z}H_2O(l)$$

Suppose, volume of C_xH_y is V and volume of O_2 is 6 times greater than $C_xH_y = 6V$

then volume of $xCO_2 \Rightarrow V x = 4V$
$x = 4$
Since, $V_{O_2} = 6 \times V_{C_xH_y}$

$V\left(x + \frac{y}{4}\right) = 6V$

$\left(x + \frac{y}{4}\right) = 6$

Put value of $x = 4$ in Eq. (i) We get,

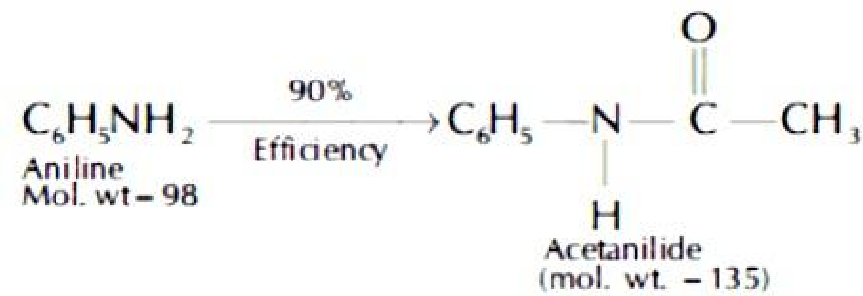
$4 + \frac{y}{4} = 6 \Rightarrow y = 8$

Question67

1.86g of aniline completely reacts to form acetanilide. 10% of the product is lost during purification. Amount of acetanilide obtained after purification (in g) is .... $\times 10^{-2}$.
[24 Feb 2021 Shift 2]

Answer: 243

Solution:



Given, weight $= 1.86g$
Here, 1 mole of aniline gives 1 mole of acetanilide
∴ mole of aniline = mole of acetanilide

$\Rightarrow \frac{1.86}{93} = \frac{W_{\text{Actanilide}}}{135}$

$W_{\text{Acetanilide}} = \frac{1.86 \times 135}{93} g = 2.70g$

But efficiency of reaction is 90% only.
Hence, mass of acetanilide produced

$= 2.70 \times \frac{90}{100} g = 2.43g = 243 \times 10^2 g$

$x = 243$

Question68

15mL of aqueous solution of Fe^{2+} in acidic medium completely reacted with 20mL of 0.03M aqueous $Cr_2O_7^{2-}$. The molarity of the Fe^{2+} solution is ...... $\times 10^{-2}$M (Round off to the nearest integer).
[17 Mar 2021 Shift 1]

Answer: 24

Solution:

$$\underset{+6}{Cr_2O_7^{2-}} + \underset{+2}{Fe^{2+}} \longrightarrow \underset{+3}{Cr^{3+}} + \underset{+3}{Fe^{3+}}$$

Dichromate ($Cr_2O_7^{2-}$) oxidised Fe^{2+} to Fe^{3+} and itself get reduced to Cr^{3+}.
Valency factor of $Cr_2O_7^{2-} = 6$ as Cr gets reduced from +6 to +3
From law of equivalence,
Milliequivalent of $Cr_2O_7^{2-}$ = Milliequivalent of Fe^{2+}
$M_1V_1n_1 = M_2V_2n_2$
$(M_1 \times V_1) \times 6 = (M_2 \times V_2) \times 1$
$(0.03 \times 20) \times 6 = (M_2 \times 15)1$
$\Rightarrow \quad M_2 = 0.24$ molar
$= 24 \times 10^{-2}$ molar

Question69

The mole fraction of a solute in a 100 molal aqueous solution .... $\times 10^{-2}$ (Round off to the nearest integer).
[Given, atomic masses H : 1.0u, O : 16.0u]
[17 Mar 2021 Shift 1]

Answer: 64

Solution:

Solution:
Given, molality = 100
$\Rightarrow$100 moles of solute in 1kg of solvent
Mole fraction of solute (χ_{solute}) = $\frac{\text{Moles of solute}}{\text{Total moles}}$

$= \frac{n_{\text{Solute}}}{n_{\text{Solute}} + n_{\text{Solvent}}}$

$n_{\text{solvent}} = \frac{1000}{18} = 55.5$

$\chi_{\text{solute}} = \frac{100}{100 + 55.5} = \frac{100}{155.5} = 0.643$

$\chi_{\text{solute}} = 64.3 \times 10^{-2} \Rightarrow 64 \times 10^{-2}$

Question70

10.0mL of Na_2CO_3 solution is titrated against 0.2M HCl solution. The following titre values were obtained in 5 readings. 4.8mL, 4.9mL, 5.0mL, 5.0mL and 5.0mL based on these readings and convention of

titrimetric estimation of concentration of Na_2CO_3 solution is .... mM (Round off to the nearest integer).
[18 Mar 2021 Shift 2]

Answer: 50

Solution:

10.0mL of Na_2CO_3 solution is titrated against 0.2M HCl

Volume of Na_2CO_3 solution (mL)	Volume of $0.2M$ HCl solution (mL)	Mean volume of HCl (ml)
10	4.8	
10	4.9	
10	5.0	5.0
10	5.0	
10	5.0	

$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2$
10mL 0.2M $_{HCl}$
$M_{Na_2CO_3} = ?$ 5mL
M_{eq} of $Na_2CO_3 = M_{eq}$ of HCl
$M_{Na_2CO_3} \times 10 \times 2 = 0.2 \times 5 \times 1$
$M_{Na_2CO_3} = 5 \times 10^{-2}M = 50 \times 10^{-3}M = 50mM$

Question71

Complete combustion of 750g of an organic compound provides 420g of CO_2 and 210g of H_2O. The percentage composition of carbon and hydrogen in organic compound is 15.3 and ...... respectively (Round off to the nearest integer).
[16 Mar 2021 Shift 1]

Answer: 3

Solution:

$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

Any hydrocarbon, on combustion gives CO_2 and H_2O. This is Liebig's method for estimation of ' C ' and ' H' percentage.

Mass of water formed $= 210g$

18g of H_2O contains $= 2g$ of hydrogen

210g of H_2O contains $= \left(\frac{2}{18} \times 210 = \frac{70}{3}\right)$ g of hydrogen.

Given, mass of organic compound $= 750g$

Percentage of hydrogen

$= \frac{\text{Mass of hydrogen}}{\text{Mass of organic compound}} \times 100$

$= \frac{70}{3 \times 750} \times 100$

$= 3.11\%$

Nearest integer $= 3$

Question72

10.0 mL of 0.05 M $KMnO_4$ solution was consumed in a titration with 10.0 mL of given oxalic acid dihydrate solution. The strength of given oxalic acid solution is .... $\times 10^{-2}$ g/L.
(Round off to the nearest integer)
[27 Jul 2021 Shift 2]

Answer: 1575

Solution:

$n_{eq}KMnO_4 = n_{eq}H_2C_2O_4 \cdot 2H_2O$

or, $\frac{10 \times 0.05}{1000} \times 5 = \frac{10 \times M}{1000} \times 2$

$\therefore$ Conc. of oxalic acid solution $= 0.125M$

$= 0.125 \times 126g / L = 15.75g / L$

$= 1575 \times 10^{-2} g / L$

Question73

When 10mL of an aqueous solution of Fe^{2+} ions was titrated in the presence of dil H_2SO_4 using diphenylamine indicator, 15mL of 0.02M solution of $K_2Cr_2O_7$ was required to get the end point. The molarity of the solution containing Fe^{2+} ions is $x \times 10^{-2}M$. The value of x is _______.
(Nearest integer)
[25 Jul 2021 Shift 1]

Answer: 18

Solution:

milli-equivalents of Fe^{2+} = milli-equivalents of $K_2Cr_2O_7$
$M \times 10 \times 1 = 0.02 \times 15 \times 6$
$M = 0.18 = 18 \times 10^{-2} M$

Question74

If the concentration of glucose ($C_6H_{12}O_6$) in blood is $0.72 gL^{-1}$, the molarity of glucose in blood is ______ $\times 10^{-3} M$. (Nearest integer)
[Given: Atomic mass of C = 12, H = 1, O = 16u]
[22 Jul 2021 Shift 2]

Answer: 4

Solution:

$$[\text{Glucose}] = \frac{C(gm / l)}{M(gm / mol)} = \frac{0.72}{180} = 4 \times 10^{-3} M$$

Question75

The number of significant figures in 0.00340 is __________ .
[25 Jul 2021 Shift 2]

Answer: 3

Solution:

Number of significant figures = 3

Question76

4g equimolar mixture of $NaOH$ and Na_2CO_3 contains xg of $NaOH$ and y g of Na_2CO_3. The value of x is_______ g. (Nearest integer)
[20 Jul 2021 Shift 2]

Answer: 1

Solution:

Total mass $= 4g$
Now
$NaOH$: a mol $W_{NaOH} + W_{Na_2CO_3} = 4$
Na_2CO_3 : 'a'mol $\Rightarrow 40a + 106a = 4$
$\Rightarrow a = \frac{4}{146} mol$
$\Rightarrow$ therefore mass of $NaOH$ is : $\frac{4}{146} \times 40g$
$= 1.095 \approx 1$

Question77

250mL of 0.5M $NaOH$ was added to 500mL of 1M HCl. The number of unreacted HCl molecules in the solution after complete reaction is _______ $\times 10^{21}$.
(Nearest integer)
$(N_A = 6.022 \times 10^{23})$
[20 Jul 2021 Shift 1]

Answer: 226

Solution:

We known that no. of moles $= V_{litre} \times$ Molarity & No. of millimoles $= V_{ml} \times$ Molarity
so millimoles of $NaOH = 250 \times 0.5 = 125$
Millimoles of $HCl = 500 \times 1 = 500$
Now reaction is

	$NaOH$	+	HCl	$\rightarrow$	$NaCl$	+	H_2O
t = 0	125		500		0		0
t = t	0		375		125		125

so millimoles of HCl left $= 375$
Moles of $HCl = 375 \times 10^{-3}$
No. of HCl molecules $= 6.022 \times 10^{23} \times 375 \times 10^{-3}$
$= 225.8 \times 10^{21}$
$\simeq 226 \times 10^{21} = 226$

Question78

Sodium oxide reacts with water to produce sodium hydroxide. 20.0g of

sodium oxide is dissolved in 500 mL of water. Neglecting the change in volume, the concentration of the resulting NaOH solution is ...... $\times 10^{-1}$M.(Nearest integer)
[Atomic mass: Na = 23.0, O = 16.0, H = 1.0]
[31 Aug 2021 Shift 2]

Answer: 13

Solution:

For the reaction,

$$\mathrm{Na_2}\underset{\substack{1\,\mathrm{mol}\\ \frac{20}{62}\mathrm{mol}}}{\mathrm{O}} + \mathrm{H_2O} \rightarrow 2\underset{\substack{2\,\mathrm{mol}\\ x\,\mathrm{mol}}}{\mathrm{NaOH}}$$

Moles of NaOH formed $\Rightarrow x = \frac{20}{62} \times 2$

Concentration of NaOH $= \frac{\text{Moles of NaOH}}{\text{Volume of solution(in litre)}}$

$$= \frac{\frac{20}{62} \times 2}{\frac{500}{1000}} = 1.29\mathrm{M} = 13 \times 10^{-1}\mathrm{M}$$

Question79

100g of propane is completely reacted with 1000g of oxygen. The mole fraction of carbon dioxide in the resulting mixture is x $\times 10^{-2}$. The value of x is .... (Nearest integer)
[Atomic weight : H = 1.008, C = 12.00, O = 16.00]
[27 Aug 2021 Shift 2]

Answer: 19

Solution:

For the reaction,

$$\underset{1}{\mathrm{CH_3CH_2CH_3(g)}} + \underset{5}{\mathrm{5O_2(g)}} \rightarrow \underset{3}{\mathrm{3CO_2(g)}} + \underset{4}{\mathrm{4H_2O(g)}}$$

1 mole of propane reacts completely with 5 moles of oxygen to form 3 moles of carbon dioxide and 4 moles of steam.

44 g of propane = 1 mole of propane

100g of propane $= \frac{1}{44} \times 100 = 2.27\,\mathrm{mol}$

32g of O_2 = 1 mole of O_2

1000g of $O_2 = \frac{1}{32} \times 1000 = 31.25$ moles

$\therefore$ 2.27 moles of propane requires $5 \times 2.27 = 11.35$ moles of O_2

moles of CO_2 formed $= 3 \times 2.7 = 6.681$ mol of CO_2

$$
\begin{array}{lcccccc}
 & CH_3CH_2CH_3 & + & 5O_2 & \rightarrow & 3CO_2 + & 4H_2O \\
 & 1 & : & 5 & & 3 \quad : & 4 \\
\text{at } t = 0 & 2.27\,\text{mol} & & 31.25\,\text{mol} & & 0 & 0 \\
\text{at } = t & 0 & & 31.25 - (5 \times 2.27) & & 3 \times 2.27 & 4 \times 2.27 \\
 & & & 19.90\,\text{mol} & & 6.81\,\text{mol} & 9.08\,\text{mol}
\end{array}
$$

When reaction is completed 19.90 moles of O_2,
6.81 moles of CO_2 and 9.08 moles of steam are left in the flask.

Mole fraction of $CO_2 = \frac{\text{Moles of } CO_2(g)}{\text{Total number of moles}}$

$= \frac{6.81}{19.90 + 6.81 + 9.08} = 0.19$

$x \times 10^{-2} = 0.19$

$x = 19$

Question80

A chloro compound A,(i) Forms aldehydes on ozonolysis followed by the hydrolysis.
(ii) When vaporised completely, 1.53g of A gives 448 mL of vapour at STP.
The number of carbon atoms in a molecule of compound A is ....
[26 Aug 2021 Shift 2]

Answer: 3

Solution:

Solution:
Given, 448 mL of A gives 1.53 g of vapours.

$\therefore 22400\,\text{mL}$ of A gives $= \frac{1.53}{445} \times 22400 = 76.50\text{g}$ of A

$\therefore$ Molecular mass is 76.5

$\therefore$ The possible compound is $CH_3 - CH = CH - Cl$

On ozonolysis followed by hydrolysis, it gives aldehyde as follows.

The compound (A) $CH_3 - CH = CH - Cl$ (chloropropene) has 3 carbon atoms.

Question81

The number of atoms in 8g of sodium is $x \times 10^{23}$. The value of x is .... (Nearest integer) [Given : $N_A = 6.02 \times 10^{23} \text{mol}^{-1}$ Atomic mass of Na = 23.0u]
[1 Sep 2021 Shift 2]

Answer: 2

Solution:

Given, mass of Na = 8g
Molar mass of Na = $23 gmol^{-1}$
$$\frac{\text{Weight of sodium atom}}{\text{Molecular mass of sodium atom}} = \frac{\text{Number of atoms}}{\text{Avogadro's number}}$$

$$\frac{8g}{23g} = \frac{\text{Number of atoms}}{6.022 \times 10^{23}}$$
Number of atoms $= \frac{8 \times 6.022}{23} \times 10^{23}$
Number of atoms $= 2.09 \times 10^{23}$
x ≈ 2
Hence, answer is 2.

Question82

4.5g of compound A($MW = 90$) was used to make 250mL of its aqueous solution. The molarity of the solution is M is $x \times 10^{-1}$. The value of x is (Rounded off to the nearest integer)
[2020]

Answer: 2

Solution:

Solution:
$$M = \frac{4.5 / 90}{250 / 1000} = 0.2 = 2 \times 10^{-1}$$

Question83

The molarity of HNO_3 in a sample which has density 1.4 g / mL and mass percentage of 63% is __________. (Molecular Weight of HNO_3 = 63)
[NV, Jan. 09, 2020(I)]

Answer: 14

Solution:

Mass percent of $HNO_3 = 63$
Thus, 100g of nitric acid solution contains 63g of nitric acid by mass.
No. of moles $= \frac{63g}{63gmol^{-1}} = 1$
Volume of 100g of nitric acid solution $= \frac{\text{Mass}}{\text{Density}} = \frac{100g}{1.4g / mL} = 71.4mL$

Molarity $= \frac{\text{No. of moles}}{\text{volume(mL)}} \times 1000 = \frac{1}{71.4} \times 1000 = 14\text{M}$

Question84

Amongst the following statements, that which was not proposed by Dalton was:
[Jan. 07,2020 (I)]

Options:

A. Chemical reactions involve reorganization of atoms. These are neither created nor destroyed in a chemical reaction.

B. All the atoms of a given element have identical properties including identical mass. Atoms of different elements differ in mass.

C. When gases combine or reproduced in a chemical reaction they do so in a simple ratio by volume provided all gases are at the same T & P.

D. Matter consists of indivisible atoms.

Answer: C

Solution:

Solution:
Except (3) all postulates was given by the Dalton.

Question85

10.30mg of O_2 is dissolved into a liter of sea water of density 1.03g / mL. The concentration of O_2 in ppm is _______.
[NV, Jan. 09, 2020 (II)]

Answer: 10

Solution:

Solution:
$\text{ppm} = \frac{10.3 \times 10^{-3}}{1.03 \times 1000} \times 10^{6} = 10$

Question86

Ferrous sulphate heptahydrate is used to fortify foods with iron. The amount (in grams) of the salt required to achieve 10 ppm of iron in 100kg of wheat is ______ .
Atomic weight: $Fe = 55.85$; $S = 32.00$; $O = 16.00$
[NV, Jan. 08 , 2020 (I)]

Answer: 4.96

Solution:

Solution:
$10ppm = \frac{\text{Mass of } Fe \text{ (in g)}}{100 \times 1000} \times 10^6$
⇒ Mass of $Fe = 1g$
Molar mass of $FeSO_4.7H_2O = 278$
56g of iron present in $1mole$ of $FeSO_4.7H_2O$
1g of Fe present $\frac{278}{56}$g in of salt $= 4.96g$

Question87

$NaClO_3$ is used, even in spacecrafts, to produce O_2. The daily consumption of pure O_2 by a person is 492L at 1 atm, 300K. How much amount of $NaClO_3$, in grams, is required to produce O_2 for the daily consumption of a person at 1atm, 300K ? ________.
$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaCl(s) + FeO(s)$ $R = 0.082$ Latm $mol^{-1}K^{-1}$
[NV, Jan. 08,2020 (II)]

Answer: 2130

Solution:

Solution:
$NaClO_3(s) + Fe(s) \longrightarrow NaCl(s) + FeO(s) + O_2(g)$
Moles of $NaClO_3 =$ Moles of O_2
Moles of $O_2 = \frac{PV}{RT} = \frac{1 \times 492}{0.082 \times 300} = 20mol$
Mass of $NaClO_3 = 20 \times 106.5 = 2130g$

Question88

The ammonia (NH_3) released on quantitative reaction of 0.6g urea (NH_2CONH_2) with sodium hydroxide ($NaOH$) can be neutralized by: [Jan. 07, 2020 (II)]

Options:

A. 200mL of 0.4N HCl

B. 200mL of 0.2N HCl

C. 100mL of 0.2N HCl

D. 100mL of 0.1N HCl

Answer: C

Solution:

Solution:
1 mol of urea $= 2$ mol of NH_3
60g of urea $= 2\text{mol}$ of NH_3
0.6g of urea $= \frac{2}{60} \times 0.6\text{mol} = 0.02\text{mol}$ of NH_3
mol of $NH_3 =$ mol of HCl
$\therefore$ mol of $HCl = 0.02\text{mol}$
$\Rightarrow$ Normality of $HCl = 0.2\text{N}$
Volume of $HCl = 100\text{mL}$

Question89

A solution of two components containing n_1 moles of the 1^{st} component and n_2 moles of the 2^{nd} component is prepared. M_1 and M_2 are the molecular weights of component 1 and 2 respectively. If d is the density of the solution in gmL^{-1}, C_2 is the molarity and x_2 is the mole fraction of the 2^{nd} component, then C_2 can be expressed as:
[Sep. 06,2020(I)]

Options:

A. $C_2 = \frac{1000x_2}{M_1 + x_2(M_2 - M_1)}$

B. $C_2 = \frac{d\,x_2}{M_2 + x_2(M_2 - M_1)}$

C. $C_2 = \frac{1000d\,x_2}{M_1 + x_2(M_2 - M_1)}$

D. $C_2 = \frac{d\,x_1}{M_2 + x_2(M_2 - M_1)}$

Answer: C

Solution:

	1st component	2nd component
mole	n_1	n_2
m.w	M_1	M_2
mass	n_1M_1	n_2M_2

[∵ mass = mole × m.w.]
Mass of solution $= n_1M_1 + n_2M_2$

Mole fraction of the 2nd component $(x_2) = \frac{n_2}{n_1 + n_2}$

$\Rightarrow n_1 = \frac{n_2(1 - x_2)}{x_2}$

Mass of solution $= n_1M_1 + n_2M_2$

$= \frac{n_2M_1(1 - x_2)}{x_2} + n_2M_2$

$= \frac{n_2}{x_2}[M_2x_2 - x_2M_1 + M_1]$

Volume of solution $= \frac{n_2[M_2x_2 - x_2M_1 + M_1]}{1000d\,x_2}$

$C_2 = \frac{1000n_2d\,x_2}{n_2[M_2x_2 - x_2M_1 + M_1]}$

$\Rightarrow C_2 = \frac{1000d\,x_2}{M_1 + x_2(M_2 - M_1)}$

Question90

The average molar mass of chlorine is 35.5gmol^{-1}. The ratio of ^{35}Cl to ^{37}Cl in naturally occrring chlorine is close to:
[Sep. 06, 2020 (II)]

Options:

A. 4 : 1

B. 3 : 1

C. 2 : 1

D. 1 : 1

Answer: B

Solution:

Solution:

$\underset{x}{^{35}Cl} \quad \underset{(1-x)}{^{37}Cl}$

$M_{avg} \overset{\text{Molar ratio}}{=} 35 \times x + 37(1 - x) = 35.5$

$= 35x + 37(1 - x) = 35.5$

$\Rightarrow 2x = 1.5$

$x = \frac{3}{4}$

So, ratio of $^{35}Cl : ^{37}Cl = \frac{3}{4} / \frac{1}{4} = 3 : 1$.

Question91

The ratio of the mass percentages of ' C&H ' and ' C&O ' of a saturated acyclic organic compound 'X' are 4 : 1 and 3 : 4 respectively. Then, the moles of oxygen gas required for complete combustion of two moles of organic compound ' X 'is ________.
[NV, Sep. 02,2020 (II)]

Answer: 5

Solution:

Solution:
Mass ratio of $C : H$ is $4 : 1 \Rightarrow 12 : 3$ and
$C : O$ is $3 : 4 \Rightarrow 12 : 16$
So,

	mass	mole	mole ratio
C	12	1	1
H	3	3	3
O	16	1	1

Empirical formula $\Rightarrow CH_3O$
As compound is saturated acyclic, so molecular formula is $C_2H_6O_2$

$\underset{2\,\text{mole}}{C_2H_6O_2} + \underset{5\,\text{mole}}{\frac{5}{2}O_2(g)} \longrightarrow 2CO_2(g) + 3H_2O(g)$ mole mole

$\therefore$ Number of moles of O_2 required to oxidise 2 moles of $(X) = 5$.

Question92

The minimum number of moles of O_2 required for complete combustion of 1 mole of propane and 2 moles of butane is ________.
[NV, Sep. 05, 2020(I)]

Answer: 18

Solution:

Complete combustion of hydrocarbons can be represented by the following reaction.

$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

For propane combustion reaction is

$C_3H_8 + \left(3 + \frac{8}{4}\right)O_2 \longrightarrow 3CO_2 + \frac{8}{2}H_2O$

$\therefore C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$

Similarly, for butane is

$C_4H_{10} + \left(4 + \frac{10}{4}\right)O_2 \longrightarrow 4CO_2 + \frac{10}{2}H_2O$

$\therefore C_4H_{10} + \frac{13}{2}, O_2 \longrightarrow 4CO_2 + 5^2H_2O$ $\because$ For 1mol of C_4H_{10} required $O_2 = \frac{13}{2}\text{mol}$

$\therefore$ For 2 mol of C_4H_{10} required $O_2 = \frac{13}{2} \times 2 = 13\text{mol}$

Question93

The volume, in mL, of 0.02M $K_2Cr_2O_7$ solution required to react with 0.288g of ferrous oxalate in acidic medium is _______. (Molar mass of $Fe = 56\text{gmol}^{-1}$)
[NV, Sep. 05,2020(II)]

Answer: 50

Solution:

Solution:

M. eq. of $K_2Cr_2O_7$ = M . eq. of FeC_2O_4

$FeC_2O_4 + Cr_2O_7^{2-} \longrightarrow Fe^{3+} + CO_2 + Cr^{3+}$

$V \times 0.02 \times 6 = \frac{0.288}{144} \times 3 \times 1000$

$V = 50\text{mL}$

Question94

A 20.0mL solution containing 0.2 g impure H_2O_2 reacts completely with 0.316g of $KMnO_4$ in acid solution. The purity of H_2O_2(in %) is ________. (mol. wt. of H_2O_2 = 34; mol. wt. of $KMnO_4$ = 158)
[NV, Sep. 04,2020(I)]

Answer: 85

Solution:

$5H_2O_2 + 2MnO_4 + 6H^+ \longrightarrow 2Mn^{2+} + 5O_2 + 8H_2O$

Moles of $KMnO_4 = \frac{0.316}{158} = 2 \times 10^{-3}$

Equivalents of $H_2O_2 =$ Equivalents of $KMnO_4$

Equivalents of $KMnO_4 = 2 \times 10^{-3} \times 5 = 0.01$

Moles of $H_2O_2 = \frac{0.01}{2} = 0.005$

Mass of pere $H_2O_2 = 0.005 \times 34 = 0.170g$

Percentage purity $= \frac{0.17}{0.2} \times 100 = 85\%$.

Question95

The mass of ammonia in grams produced when 2.8kg of dinitrogen quantitatively reacts with 1kg of dihydrogen is ________.
[NV, Sep. 04,2020(I)]

Answer: 3400

Solution:

Solution:

Mole of $N_2 = \frac{2800}{28} = 100$ and Mole of $H_2 = \frac{1000}{2} = 500$

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

Mass of NH_3 formed $= 200 \times 17 = 3400g$

Question96

A 100mL solution was made by adding 1.43g of $Na_2CO_3 \cdot xH_2O$. The normality of the solution is 0.1N.
The value of x is _______.
(The atomic mass of Na is 23g / mol)
[NV, Sep. 04, 2020 (II)]

Answer: 10

Solution:

Solution:

Normality $= \frac{\text{No. of equivalents of solute}}{\text{Volume of solution (in L)}}$

$0.1 = \frac{1.43}{\frac{(106+18x)}{2} \times 0.1} \Rightarrow \frac{106+18x}{2} = 143$

$\Rightarrow 18x = 286 - 106 = 180 \Rightarrow x = 10.$

Question97

The mole fraction of glucose ($C_6H_{12}O_6$) in an aqueous binary solution is 0.1. The mass percentage of water in it, to the nearest integer, is ______ .
[NV, Sep. 03, 2020 (I)]

Answer: 47

Solution:

Solution:
Let total mole of solution $= 1$
So, mole of glucose $= 0.1$
$\text{Mole of } H_2O = 0.9$

$\%(w / w) \text{ of } H_2O = \left[\frac{0.9 \times 18}{0.9 \times 18 + 0.1 \times 180}\right] \times 100$

$= 47.368 = 47.37.$

Question98

6.023×10^{22} molecules are present in 10g of a substance $'x'$. The molarity of a solution containing 5g of substance x' in 2 L solution is ________ $\times 10^{-3}$
[NV, Sep. 03, 2020 (II)]

Answer: 25

Solution:

Number of mole of $x = \frac{6.022 \times 10^{22}}{6.022 \times 10^{23}} = \frac{10}{\text{Molar mass of } x}$

So molar mass of $x = 100g$

Molarity $= \frac{5}{100 \times 2} = 0.025M$.

Question99

The volume (in mL) of 0.1N $NaOH$ required to neutralise 10mL of 0.1N phosphinic acid is ________.
[NV, Sep. 03, 2020 (II)]

Answer: 10

Solution:

Phosphinic acid is hypophosphorous acid (H_3PO_2).
$NaOH + H_3PO_2 \longrightarrow NaH_2PO_2 + H_2O$
For neutrization,
$(N_1V_1)_{add} = (N_2V_2)_{bese}$
$0.1 \times 10 = 0.1 \times (V_{mL})_{NaOH}$
$V_{NaOH} = 10\mathrm{mL}$

Question100

8g of NaOH is dissolved in 18g of H_2O. Mole fraction of NaOH in solution and molality (in $\mathrm{mol\,kg^{-1}}$) of the solution respectively are :
[Jan. 12, 2019 (II)]

Options:

A. 0.2,22.20

B. 0.2,11.11

C. 0.167,11.11

D. 0.167,22.20

Answer: C

Solution:

No. of moles of $H_2O(n_1) = \frac{18}{18} = 1$

No. of moles of $NaOH(n_2) = \frac{8}{40} = \frac{1}{5}$

Mole fraction of NaOH $= \frac{n_2}{n_2 + n_1} = \frac{\frac{1}{5}}{\frac{1}{5} + 1} = 0.167$

Molality $= \frac{\text{No. of moles of solute}}{\text{Mass of solvent (kg)}} = \frac{1}{5} \times \frac{1000}{18} = 11.11\mathrm{m}$

Question101

The amount of sugar ($C_{12}H_{22}O_{11}$) required to prepare 2 L of its 0.1M aqueous solution is:
[Jan. 10 2019(II)]

Options:

A. 136.8g

B. 17.1g

C. 68.4g

D. 34.2g

Answer: C

Solution:

Solution:
As we know,
Molarity $= \frac{\text{No. of moles of sugar}}{\text{Volume of solution (in L)}}$
$\Rightarrow 0.1 = \frac{\text{No. of moles of sugar}}{2L}$
So, no. of moles of sugar $= 0.2$ mole
$\therefore$ Mass of sugar = No. of moles of sugar × Molar mass of sugar $= 0.2 \times 342 = 68.4g$

Question102

50mL of 0.5M oxalic acid is needed to neutralize 25mL of sodium hydroxide solution. The amount of $NaOH$ in 50mL of the given sodium hydroxide solution is:
[Jan. 12,2019 (I)]

Options:

A. 40g

B. 10g

C. 20g

D. 80g

E. None of Above

Answer: E

Solution:

Solution:
Oxalic acid Sodium hydroxide
$N_1V_1 = N_2V_2$
$(2 \times M_1)V_1 = M_2V_2$

$2 \times 0.5 \times 50 = M_2 \times 25$
$M_2 = 2$
$$\text{Molarity} = \frac{\text{No.of moles}}{\text{Vol.(L)}}$$
$$2 = \frac{\text{No.of moles}}{50 / 1000}$$
$$\text{No. of moles} = \frac{1}{10} = 0.1$$
$$\text{No. of moles} = \frac{W}{\text{Molar mass}}$$
$W = 0.1 \times 40 = 4g$
No option is correct.

Question103

A 10mg effervescent tablet containing sodium bicarbonate and oxalic acid releases 0.25mL of CO_2 at $T = 298.15K$ and $P = 1$ bar. If molar volume of CO_2 is 25.0L under such condition, what is the percentage of sodium bicarbonate in each tablet?
[Molar mass of $NaHCO_3 = 84 g mol^{-1}$]
[Jan. 11, 2019 (I)]

Options:

A. 0.84

B. 33.6

C. 16.8

D. 8.4

Answer: D

Solution:

Solution:
$2NaHCO_3 + H_2C_2O_4 \longrightarrow Na_2C_2O_4 + 2CO_2 + 2H_2O$
Moles of CO_2 evolved $= \frac{0.25}{25 \times 10^3} = 10^{-5}$
$\therefore$ Moles of $NaHCO_3 = 10^{-5}$
$\therefore$ Mass of $NaHCO_3 = 84 \times 10^{-5} g$
$= 0.84 \times 10^{-3} g = 0.84 mg$
$\therefore$ % by weight $= \times 100 = 8.4\%$

Question104

25mL of the given HCl solution requires 30mL of 0.1M sodium carbonate solution. What is the volume of this HCl solution required to titrate 30mL of 0.2M aqueous $NaOH$ solution?
[Jan.11,2019 (II)]

Options:

A. 25mL

B. 75mL

C. 50mL

D. 12.5mL

Answer: A

Solution:

Solution:
25mL of HCl solution requires 30mL of 0.1M Na_2CO_3 solution.
$\because N_1V_1 = N_2V_2$
$\therefore 25 \times N_1 = 30 \times 0.2(0.1M\, Na_2CO_3 = 0.2N\ Na_2CO_3)$
$N_1 = \frac{6}{25} = 0.24N$
Now, HCl solution is titrated with $NaOH$ solution.
$M_1V_1 = M_2V_2$; $0.24N\, HCl = 0.24M\, HCl$
$\therefore V \times 0.24 \times 1 = 30 \times 0.2 \times 1 \Rightarrow V = 25mL$

Question105

For the following reaction the mass of water produced from 445g of $C_{57}H_{110}O_6$ is:
$2C_{57}H_{110}O_6(s) + 163O_2(g) \rightarrow 114CO_2(g) + 110H_2O(1)$
[Jan. 9, 2019 (II)]

Options:

A. 490g

B. 445g

C. 495g

D. 890g

Answer: C

Solution:

Solution:
For the given reaction:
$2C_{57}H_{110}O_6(s) + 163O_2(g) \rightarrow 114CO_2(g) + 110H_2O(1)$
Moles of $C_{57}H_{110}O_6 = \frac{445}{890} = 0.5$
Now, moles of water $= \frac{110}{2} \times 0.5 = 27.5$
$\therefore 1 = 27.5 \times 18 = 495g$

Question106

The percentage composition of carbon by mole in methane is : [April 8, 2019(II)]

Options:

A. 75%

B. 80%

C. 25%

D. 20%

Answer: D

Solution:

Solution:
CH_4 has one atom of carbon among 5 atoms $(1C + 4H)$
$\therefore$ Mole % of C = $\frac{1}{5} \times 100 = 20\%$

Question107

5 moles of AB_2 weigh 125×10^{-3}kg and 10 moles of A_2B_2 weigh 300×10^{-3}kg. The molar mass of A(M_A) and molar mass of B(M_B) in kgmol^{-1} are: [April 12, 2019(I)]

Options:

A. $M_A = 10 \times 10^{-3}$ and $M_B = 5 \times 10^{-3}$

B. $M_A = 50 \times 10^{-3}$ and $M_B = 25 \times 10^{3}$

C. $M_A = 25 \times 10^{-3}$ and $M_B = 50 \times 10^{-3}$

D. $M_A = 5 \times 10^{-3}$ and $M_B = 10 \times 10^{-3}$

Answer: D

Solution:

Solution:
$5\text{mol}\ AB_2$ weighs 125g
$\therefore AB_2 = 25\text{g / mol}$
$10\text{mol}\ A_2B_2$ weighs 300g
$\therefore A_2B_2 = 30\text{g / mol}$
$\therefore$ Molar mass of A(M_A) = 5g or 5×10^{-3}kg
Molar mass of B(M_B) = 10g or 10×10^{-3}kg

Question108

The minimum amount of $O_2(g)$ consumed per gram of reactant is for the reaction : (Given atomic mass: $Fe = 56$, $O = 16$, $Mg = 24$, $P = 31$, $C = 12$, $H = 1$) [April 10, 2019 (II)]

Options:

A. $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

B. $P_4(s) + 5O_2(g) \rightarrow P_4O_{10}(s)$

C. $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$

D. $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

Answer: A

Solution:

Solution:

(a) $4Fe + 3O_2 \longrightarrow 2Fe_2O_3$

1g Fe requries $= \frac{3 \times 32}{4 \times 56} = 0.43g$ of oxygen

(b) $P_4 + 5O_2 \longrightarrow P_4O_{10}$

1g of P requries $= \frac{5 \times 32}{31 \times 4} = 1.3g$ of oxygen

(c) $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$

1g of C_3H_8 requires $= \frac{5 \times 32}{44} = 3.6g$ of O_2

(d) $2Mg + O_2 \longrightarrow 2MgO$

1 g Mg requires $= \frac{32}{2 \times 24} g = 0.66g$ of O_2

Question109

For a reaction, $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$; identify dihydrogen ($H_2$) as a limiting reagent in the following reaction mixtures. [April 9, 2019 (I)]

Options:

A. 56g of N_2 + 10g of H_2

B. 35g of N_2 + 8g of H_2

C. 28g of N_2^{2} + 6g of H_2

D. 14g of N_2^{2} + 4g of H_2^{2}

Answer: A

Solution:

Solution:
According to the stoichiometry of balanced equation, $28gN_2$ reacts with $6gH_2$

$$\underset{1\text{ mole }28\text{ g}}{N_2} + \underset{3\text{ mole }6\text{ g}}{3H_2} \longrightarrow 2NH_3$$

$\therefore$ For 56g of N_2, 12g of H_2 is required.

Question110

0.27g of a long chain fatty acid was dissolved in $100cm^3$ of hexane. 10mL of this solution was added dropwise to the surface of water in a round watch glass. Hexane evaporates and a monolayer is formed. The distance from edge to centre of the watch glass is 10cm. What is the height of the monolayer?
[Density of fatty acid $= 0.9gcm^{-3}$; $\pi = 3$]
[April 8, 2019 (II)]

Options:

A.

10^{-8} m

B.

10^{-6} m

C.

10^{-4} m

D.

10^{-2} m

Answer: B

Solution:

Solution:
Given: 0.27g is present in $100cm^3$ of hexane
$\therefore$10mL of aqueous solution contains only 0.027 g acid.
Volume of 0.027g acid $= \frac{0.027}{0.9}mL$
$\therefore \pi r^2 h = \frac{0.027}{0.9}\left(\text{given } r = 10cm, \pi = 3 \right)$
$\therefore h = 10^{-4}cm = 10^{-6}m$

Question111

An unknown chlorohydrocarbon has 3.55% of chlorine. If each molecule of the hydrocarbon has one chlorine atom only, chlorine atoms present in 1g of chlorohydrocarbon are:
(Atomic wt. of Cl $= 35.5u$; Avogadro constant $= 6.023 \times 10^{23}mol^{-1}$)

[Online April 16,2018]

Options:

A. 6.023×10^{9}

B. 6.023×10^{23}

C. 6.023×10^{21}

D. 6.023×10^{20}

Answer: D

Solution:

Solution:
Given percentage of chlorine in an hydrocarbon $= 3.55\%$
i.e.,
100g of chlorohydrocarbon has 3.55g of chlorine.
1 g of chlorohydrocarbon will have $\frac{3.55}{100} = 0.0355\text{g}$ of chlorine.
Atomic wt. of Cl $= 35.5\text{g / mol}$
Number of moles of Cl $= \frac{0.0355\text{g}}{35.5\text{g / mol}} = 0.001\text{mol}$
Number of atoms of Cl $= 0.001\text{mol} \times 6.023 \times 10^{23}\text{mol}^{-1}$
$= 6.023 \times 10^{20}$

Question112

The ratio of mass percent of C and H of an organic compound ($C_xH_YO_Z$) is 6 : 1. If one molecule of the above compound ($C_XH_YO_2$) contains half as much oxygen as required to burn one molecule of compound C_XH_Y completely to CO_2 and H_2O. The empirical formula of compound $C_XH_YO_Z$ is:
[2018]

Options:

A. $C_3H_6O_3$

B. C_2H_4O

C. $C_3H_4O_2$

D. $C_2H_4O_3$

Answer: D

Solution:

Solution:
So, $x = 1$, $y = 2$
Equation for combustion of C_xH_y

$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

Oxygen atoms required $= 2\left(x + \frac{y}{4}\right)$

As mentioned,

$2\left(x + \frac{y}{4}\right) = 2z;\ \left(x + \frac{y}{4}\right) = z$

Now putting the values of x and y

$\Rightarrow \left(1 + \frac{2}{4}\right) = z \Rightarrow z = 1.5$

∴ Molecule ($C_xH_yO_2$) can be written as

$C_1H_2O_{3/2}$

$\Rightarrow C_2H_4O_3$

Question113

A sample of $NaClO_3$ is converted by heat to $NaCl$ with a loss of 0.16 g of oxygen. The residue is dissolved in water and precipitated as AgCl. The mass of AgCl (in g) obtained will be: (Given: Molar mass of AgCl $= 143.5 g mol^{-1}$) [Online April 15, 2018 (I)]

Options:

A. 0.35

B. 0.54

C. 0.41

D. 0.48

Answer: D

Solution:

Solution:

No. of moles of oxygen in 0.16g of oxygen molecule

$= \frac{0.16g}{32g/mol} = 0.005mol$

$2NaClO_3 \xrightarrow{\Delta} 2NaCl + 3O_2$

According to the reaction,

3 moles of O_2 = 2 moles of $NaCl$ = 2 moles of AgCl

Molar mass of AgCl = 143.5g / mol

0.005 moles of O_2 will ppt. $= 0.005 \times \frac{2}{3}$ moles AgCl

$= 0.0033$moles of AgCl

∴ Mass of AgCl (in g) obtained will be

$= 143.5g/mol \times 0.0033moles = 0.48g.$

Question114

Excess of $NaOH$ (aq) was added to 100mL of $FeCl_3$(aq) resulting into 2.14g of $Fe(OH)_3$. The molarity of $FeCl_3$ (aq) is:

(Given molar mass of $Fe = 56 g mol^{-1}$ and molar mass of $Cl = 35.5 g mol^{-1}$)
[Online April 8, 2017]

Options:

A. $0.2M$

B. $0.3M$

C. $0.6M$

D. $1.8M$

Answer: A

Solution:

Solution:

$$\underset{\text{limiting reagent}}{FeCl_3(aq.)} + \underset{\text{(Excess amount) Not behave as limiting reagent}}{3NaOH(aq.)} \longrightarrow Fe(OH)_3(s) + 3NaCl(aq.)$$

Moles of $Fe(OH)_3 = \dfrac{\text{weight in g}}{\text{Mol. mass of } Fe(OH)_3}$

$= \dfrac{2.14g}{107 g / mol} = 0.02 mol$

$1.0 mole$ of $Fe(OH)_3$ is obtained from $= 1.0 mole$ of $FeCl_3$

0.02 mole of $Fe(OH)_3$ will be obtained from $= 0.02$ mole $FeCl_3$ Molarity $= \dfrac{\text{No. of moles}}{\text{Volume in L}} = \dfrac{0.02 mole}{0.1L} = 0.2M$

Question115

The most abundant elements by mass in the body of a healthy human adult are: [2017] Oxygen (61.4%); Carbon (22.9%), Hydrogen (10.0%); and Nitrogen (2.6%). The weight which a 75kg person would gain if all ^1H atoms are replaced by ^2H atoms is
[2017]

Options:

A. $15kg$

B. $37.5kg$

C. $7.5kg$

D. $10kg$

Answer: C

Solution:

Solution:
Percentage (by mass) of elements given in the body of a healthy human adult is :
Oxygen $= 61.4\%$, Carbon $= 22.9\%$
Hydrogen $= 10.0\%$ and Nitrogen $= 2.6\%$
$\because$ Total weight of person $= 75kg$

$\therefore$ Mass due to ^1H is $= 75 \times \frac{10}{100} = 7.5kg$
If ^1H atoms are replaced by ^2H atoms.
Mass gain by person would be $= 7.5kg$

Question116

What quantity (in mL) of a 45% acid solution of a monoprotic strong acid must be mixed with a 20% solution of the same acid to produce 800mL of a 29.875% acid solution?
[Online April 9,2017]

Options:

A. 320

B. 325

C. 316

D. 330

Answer: C

Solution:

Solution:

$$\frac{V \times 45}{100} + \frac{(800 - V) \times 20}{100} = \frac{800 \times 29.875}{100}$$

$$\Rightarrow \frac{9V}{20} + 160 - \frac{V}{5} = 239 \Rightarrow V = 316$$

Question117

5L of an alkane requires 25L of oxygen for its complete combustion. If all volumes are measured at constant temperature and pressure, the alkane is:
[Online April 9, 2016]

Options:

A. Isobutane

B. Ethane

C. Butane

D. Propane

Answer: D

Solution:

Since the compound undergoing combustion is an alkane. Hence the combustion reaction can be written as

$$\underset{5L}{C_nH_{2n+2}} + \underset{25L}{\left(\frac{3n+1}{2}\right)O_2} \longrightarrow nCO_2 + (n+1)H_2O$$

Since volumes are measured at constant T &P, hence according to Avogadro's law
Volume ∝ mole

1 Lalkane requires $\frac{3n+1}{2}$ Lof O_2

5 Lalkane requires $25L$ of O_2

$$\frac{1}{5} = \frac{\frac{3n+1}{2}}{25}$$

$\therefore n = 3$

Hence alkane is propane (C_3H_8)

Question118

At 300K and 1atm, 15mL of a gaseous hydrocarbon requires 375mL air containing 20%O_2 by volume for complete combustion. After combustion the gases occupy 330mL. Assuming that the water formed is in liquid form and the volumes were measured at the same temperature and pressure, the formula of the hydrocarbon is:
[2016]

Options:

A. C_4H_8

B. C_4H_{10}

C. C_3H_6

D. C_3H_8

E. None of above

Answer: E

Solution:

Solution:

(N) $C_xH_y(g) + \left(\frac{4x+y}{4}\right)O_2(g) \longrightarrow xCO_2(g) + \frac{y}{2}H_2O(l)$

Volume of O_2 used $= \frac{20}{100} \times 375 = 75mL$

Volume of air $= 375 - 75 = 300mL$

Total volume of gases after combustion

$=$ vol. of $CO_2 +$ vol. of air $= 330mL$

Volume of $CO_2 = 330 - 300 = 30mL$

$15mLC_xH_y$ gives $= 30mLCO_2$

$1mLC_xH_y$ gives $= \frac{30}{15} = 2mLCO_2$

At constant T and P; Volume ∝ mole

$\therefore 1mol\, C_xH_y = 2mol\, CO_2$

$x = 2$

$$\left(\frac{4x+y}{4}\right) = \frac{75}{15}$$

$4x + y = 20$

$y = 20 - 4 \times 2 = 12$

Hence, formula of the hydrocarbon is C_2H_{12}.

Question119

The amount of arsenic pentasulphide that can be obtained when 35.5g arsenic acid is treated with excess H_2S in the presence of conc. HCl (assuming 100% conversion) is:
[Online April 9, 2016]

Options:

A. 0.25mol

B. 0.50mol

C. 0.333mol

D. 0.125mol

Answer: D

Solution:

Solution:

$$\underset{\substack{2\,\text{mol}\\1\,\text{mol}}}{2H_3AsO_4} + 5H_2S \xrightarrow{\text{Conc. HCl}} \underset{\substack{1\,\text{mol}\\1/2\,\text{mol}}}{As_2S_5} + 8H_2O$$

$\because$ The molar mass of H_3AsO_4 is $3 \times 1 + 79 + 4 \times 16$
$= 142g / mol$

$\therefore$ Number of moles of $H_3ASO_4 = \dfrac{35.5}{142} = 0.25mol$

$\therefore$ Number of moles of $As_2S_5 = \dfrac{0.25}{2} = 0.125mol$.

Question120

The volume of 0.1N dibasic acid sufficient to neutralize 1 g of a base that furnishes 0.04 mole of OH^- in aqueous solution is :
[Online April 10,2016]

Options:

A. 400mL

B. 600mL

C. 200mL

D. 800mL

Answer: A

Solution:

Applying law of equivalence
Equivalence of acid = Equivalence of base
Equivalent of acid = Normality × volume $= 0.1 \times V$
Another formula of equivalence $= n$ factor × number of moles
$\therefore$ Equivalent of base $= n$ factor of OH^- × moles of OH
$= 1 \times 0.04$
$0.1 \times V = 1 \times 0.04$
$V = 0.4L = 0.4 \times 1000 = 400mL.$

Question121

The molecular formula of a commercial resin used for exchanging ions in water softening is $C_8H_7SO_3 - Na^+$ (Mol. wt. 206 . What would be the maximum uptake of Ca^{2+} ions by the resin when expressed in mole per gram resin? [2015]

Options:

A. $\frac{2}{309}$

B. $\frac{1}{412}$

C. $\frac{1}{103}$

D. $\frac{1}{206}$

Answer: B

Solution:

Solution:
2 mole of water softner require 1 mole of Ca^{2+} ion
So, 1 mole of water softner require $\frac{1}{2}$ mole of Ca^{2+} ion
Thus, $\frac{1}{2 \times 206} = \frac{1}{412} mol / g$ will be maximum uptake.

Question122

Choose the incorrect formula out of the four compounds for an element X below: [Online April 11, 2015]

Options:

A. X_2O_3

B. X_2Cl_3

C. $X_2(SO_4)_3$

D. X PO_4

Answer: C

Solution:

Solution:
Mass of substance $= 250mg = 0.250g$
Mass of $AgBr = 141mg = 0.141g$
1 mole of $AgBr$ = 1g atom of Br
188g of $AgBr$ = 80g of Br
∴ fof $AgBr$ contain bromine $= 80g$
0.141g of AgBr contain bromine
$= \frac{80}{188} \times 0.141 = 0.06g$
0.06g of bromine is present in 0.250g of organic compound
∴% of bromine $= \frac{0.06}{0.250} \times 100 = 24\%$

Question123

3 g of activated charcoal was added to 50mL of acetic acid solution (0.06N) in a flask. After an hour it was filtered and the strength of the filtrate was found to be 0.042N . The amount of acetic acid adsorbed (per gram of charcoal) is:
[2015]

Options:

A. 42mg

B. 54mg

C. 18mg

D. 36mg

Answer: C

Solution:

Solution:
Let the weight of acetic acid initially be w_1 in 50mL of $0.060N$ solution.
$N = \frac{w_1 \times 1000}{M\ .wt \cdot \times 50}$ (Normality $= 0.06N$)
$0.06 = \frac{w_1 \times 1000}{60 \times 50}$
$\Rightarrow w_1 = \frac{0.06 \times 60 \times 50}{1000} = 0.18g = 180mg$
After an hour, the strength of acetic acid $= 0.042N$
so, let the weight of acetic acid be w_2
$N = \frac{w_2 \times 1000}{60 \times 50}$
$0.042 = \frac{W_2 \times 1000}{3000}$
$\Rightarrow w_2 = 0.126g = 126mg$
So amount of acetic acid adsorbed per 3g
$= 180 - 126mg = 54mg$

∴ amount of acetic acid absorbed per g = 54 / 3 = 18mg

Question124

A sample of a hydrate of barium chloride weighing 61g was heated until all the water of hydration is removed. The dried sample weighed 52g. The formula of the hydrated salt is : (atomic mass, Ba = 137amu, Cl = 35.5 amu) [Online April 10, 2015]

Options:

A. $BaCl_2 \cdot 4H_2O$

B. $BaCl_2 \cdot 3H_2O$

C. $BaCl_2H_2O$

D. $BaCl_2{}^{-}2H_2O$

Answer: D

Solution:

Solution:
Weight of hydrated $BaCl_2$ = 61g
Weight of anhydrous $BaCl_2$ = 52g
Loss in mass = 9g
Assuming $BaCl_2xH_2O$ as hydrate
Mass of H_2O = 9g
Moles of $H_2O = \frac{9}{18} = 0.5mol$
Grass molecular wt. of $BaCl_2 = 208g / mol$.
% of H_2O in this hydrated $BaCl_2 = \frac{9}{61} \times 100 = 14.75\%$
% of H_2O in $BaCl_2 \cdot xH_2O = \frac{18x}{208 + 18x} \times 100$
Thus, $\frac{18x}{208 + 18x} \times 100 = 14.75$
On solving $x = 2$
Hence, the formula of hydrated salt is $BaCl_2.2H_2O$

Question125

$A + 2B + 3C \rightleftharpoons AB_2C_3$ Reaction of 6.0g of A, 6.0×10^{23} atoms of B, and 0.036 mol of C yields 4.8g of compound AB_2C_3. If the atomic mass of A and C are 60 and 80amu, respectively, the atomic mass of B is (Avogadro no. = 6×10^{23}) : [Online April 11, 2015]

Options:

A. 50amu

B. 60amu

C. 70amu

D. 40amu

Answer: A

Solution:

Solution:
$A + 3B + 3C \rightleftharpoons AB_2C_3$ ....(i)
No. of moles of A = $\frac{6.0g}{60g / mol} = 0.1mol$
No. of moles of B = $\frac{6.00 \times 10^{23}}{6.000 \times 10^{23}} = 1mol$
No. of moles of C = 0.036
Therefore, C is the limiting reagent,
The number of moles of product formed
$= \frac{0.036}{3} = 0.012mol$
The expression for the molar mass is Molar mass
$= \frac{\text{Given mass}}{\text{mole of product}}$
$60 + (2 \times x) + (3 \times 80) = \frac{4.8}{0.012}$
$x = 50amu$
Hence, atomic mass of B is 50 amu

Question126

In Carius method of estimation of halogens, 250mg of an organic compound gave 141mg of AgBr. The percentage of bromine in the compound is : (at. mass Ag = 108; Br = 80) [2015]

Options:

A. 48

B. 60

C. 24

D. 36

Answer: C

Solution:

Solution:
Mass of substance = 250mg = 0.250g
Mass of AgBr = 141mg = 0.141g
1 mole of AgBr = 1g atom of Br
188g of AgBr = 80g of Br
$\therefore$ 188g of AgBr contain bromine = 80g
0.141 g of AgBr contain bromine

$= \frac{80}{188} \times 0.141 = 0.06g$
0.06g of bromine is present in 0.250g of organic compound
$\therefore$% of bromine $= \frac{0.06}{0.250} \times 100 = 24\%$

Question127

Dissolving 120g of a compound of (mol. wt. 60) in 1000g of water gave a solution of density 1.12g / mL. The molarity of the solution is: [Online April 9,2014]

Options:

A. 1.00M

B. 2.00M

C. 2.50M

D. 4.00M

Answer: B

Solution:

Solution:
Given
mass of solute (w) = 120g
mass of solvent (w) = 1000g
Mol. mass of solute $= 60g$
density of solution $= 1.12g / mL$
From the given data,
Mass of solution $= 1000 + 120 = 1120g$

$\because d = \frac{\text{Mol. mass}}{V}$ or $V = \frac{\text{Mol. mass}}{d}$
Volume of solution $V = \frac{1120}{1.12} = 1000mL$ or $= 1$ litre
Now molarity $(M) = \frac{w}{\text{Mol. mass} \times V(L)} = \frac{120}{60 \times 1} = 2M$

Question128

The amount of oxygen in 3.6 moles of water is: [Online April 9, 2014]

Options:

A. 115.2g

B. 57.6g

C. 28.8g

D. 18.4g

Answer: B

Solution:

1 mole of water contains = 16 gof oxygen
$\therefore$3.6 mole of water contains
= 16 × 3.6 = 57.6g

Question129

A gaseous compound of nitrogen and hydrogen contains 12.5% (by mass) of hydrogen. The density of the compound relative to hydrogen is 16. The molecular formula of the compound is:
[Online April 11,2014]

Options:

A. NH_2

B. N_3H

C. NH_3

D. N_2H_4

E. None of above.

Answer: D

Solution:

$X_2O_3 \Rightarrow X^{3+}O^{2-}$
$X_2Cl_3 \Rightarrow X^{3+}Cl^{2-}$
$X_2(SO_4)_3 \Rightarrow X^{3+}SO_4^{2-}$
$XPO_4 \Rightarrow X^{3+}PO_4^{3-}$
Since Cl^{2-} does not exist. So, X_2Cl_3 is incorrect.
The correct formula should be XCl_3

Question130

A gaseous compound of nitrogen and hydrogen contains 12.5% (by mass) of hydrogen. The density of the compound relative to hydrogen is 16. The molecular formula of the compound is:
[Online April 11,2014]

Options:

A. NH_2

B. N_3H

C. NH_3

D. N_2H_4

Answer: D

Solution:

Solution:
In an unknown compounds containing N and H given % of H $= 12.5\%$
$\therefore$ % of N $= 100 - 12.5 = 87.5\%$

Element	Percentage	Atomic ratio	Simple ratio
H	12.5%	$\frac{12.5}{1} = 12.5$	$\frac{12.5}{6.25} = 2$
N	87.5	$\frac{87.5}{14} = 6.25$	$\frac{6.25}{6.25} = 1$

Empirical formula $= NH_2$
Mol. wt $= 2\times$ vapour density $= 16 \times 2 = 32.$
Molecular formula $= n\times$ empirical formula mass
$n = \frac{32}{16} = 2$
$\therefore$ Molecular formula of the compound will be $= (NH_2)_2$
$= N_2H_4{}^2$

Question131

The amount of $BaSO_4$ formed upon mixing 100mL of 20.8% $BaCl_2$ solution with 50mL of 9.8%H_2SO_4 solution will be:
$(Ba = 137, Cl = 35.5, S = 32, H = 1$ and $O = 16)$
[Online April 12, 2014]

Options:

A. 23.3g

B. 11.65g

C. 30.6g

D. 33.2g

Answer: B

Solution:

Solution:
$$\underset{208\,g}{BaCl_2} + \underset{98\,g}{H_2SO_4} \longrightarrow \underset{233\,g}{BaSO_4} + \underset{73\,g}{2HCl}$$
Mass of $BaCl_2$ in solution $= 100\times \frac{20.8}{100} = 20.8g$
Mass of H_2SO_4 in solution $= 50\times \frac{9.8}{100} \times 4.9 = 4.9g$
98g of H_2SO_4 reacts with $208gBaCl_2$

$4.9gH_2SO_4$ will react with $\frac{208}{98} \times 4.9 = 10.4gBaCl_2$
H_2SO_4 reacts as a limiting reagent because $BaCl_2$ is given in excess
$98gH_2SO_4$ produces $233gBaSO_4$
$4.9gH_2SO_4$ will produce $\frac{233}{98} \times 4.9 = 11.65gBaSO_4$

Question132

The density of 3M solution of sodium chloride is 1.252g mL^{-1}. The molality of the solution will be: (molar mass, $NaCl = 58.5gmol^{-1}$) [Online April 22, 2013]

Options:

A. 260m

B. 2.18m

C. 2.79m

D. 3.00m

Answer: C

Solution:

Solution:

The relation between molarity (M) and molality (m) is $d = M\left(\frac{1}{m} + \frac{M_2}{1000}\right)$, $M_2 =$ Mol. mass of solute
On putting value $1.252 = 3\left(\frac{1}{m} + \frac{58.5}{1000}\right)$
On solving $m = 2.79$

Question133

Number of atoms in the following samples of substances is the largest in: [Online April 23, 2013]

Options:

A. 4.0g of hydrogen

B. 71.0g of chlorine

C. 127.0g of iodine

D. 48.0g of magnesium

Answer: A

Solution:

4g of hydrogen = 4 mole of hydroge
n $= 4 \times 6.023 \times 10^{23}$ atoms
$71.0g$ of chlorine $= \frac{71.0}{71.0} = 1$ moles of chlorine
$= 6.023 \times 10^{23}$ atoms
$127g$ of iodine $= \frac{127}{254}mol$
$= 6.023 \times 10^{23} \times \frac{1}{2}$ atoms
$48.0g$ of magnesium $= \frac{48.0}{24.0}mol$
$= 2 \times 6.023 \times 10^{23}$ atoms
$\therefore 4.0gH_2$ has largest number of atoms.

Question134

10mL of 2(M)NaOH solution is added to 200mL of 0.5 (M) of NaOH solution. What is the final concentration ?
[Online April 25, 2013]

Options:

A. 0.57(M)

B. 5.7(M)

C. 11.4(M)

D. 1.14(M)

Answer: A

Solution:

Solution:
From molarity equation
$M_1V_1 + M_2V_2 = MV_{(total)}$
$M = \frac{M_1V_1 + M_2V_2}{Total} = \frac{2 \times 10 + 0.5 \times 200}{210}$
$M = \frac{120}{210} = 0.57M$

Question135

6 litres of an alkene require 27 litres of oxygen at constant temperature and pressure for complete combustion. The alkene is:
[Online April 25, 2013]

Options:

A. Ethene

B. Propene

C. 1 -Butene

D. 2 -Butene

Answer: B

Solution:

Solution:

General combustion reaction for hydrocarbons is $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

For alkane, $x = n$ and $y = 2n$

$C_nH_{2n} + \left(n + \frac{2n}{4}\right)O_2 \longrightarrow nCO_2 + \frac{2n}{2}H_2O$

$C_nH_{2n} + \frac{3n}{2}O_2 \longrightarrow nCO_2 + nH_2O$

$\therefore 1$ mole alkene reacts with $\frac{3n}{2}$ mole of O_2

moles $\propto$ volume (at constant temp & spress.)

1 L alkene requires $\frac{3n}{2}L$ of O_2

6L alkene requires $27L$ of O_2

$\frac{1}{6} = \frac{\frac{3n}{2}}{27}$

$3n = \frac{54}{6}$

$n = 3^6$

Hence alkene is propene (C_3H_6)

Question136

A gaseous hydrocarbon gives upon combustion 0.72g of water and 3.08g. of CO_2. The empirical formula of the hydrocarbon is : [2013]

Options:

A. C_2H_4

B. C_3H_4

C. C_6H_5

D. C_7H_8

Answer: D

Solution:

Solution:

$\because 18g$, H_2O contains $= 2gH$

$\therefore 0.72gH_2O$ contains

$= \frac{2}{18} \times 0.72g = 0.08gH$

$\because 44gCO_2$ contains $= 12gC$

$\therefore 3.08gCO_2$ contains $= \frac{12}{44} \times 3.08 = 0.84gC$

$\therefore C : H = \frac{0.84}{12} : \frac{0.08}{1}; 0.07 : 0.08 = 7 : 8$
$\therefore$ Empirical formula $= C_7H_8$

Question137

1 gram of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01186mole of CO_2. The molar mass of M_2CO_3 in $gmol^{-1}$ is:
[2013]

Options:

A. 1186

B. 84.3

C. 118.6

D. 11.86

Answer: B

Solution:

Solution:
Given chemical eq^n
$M_2CO_3 + 2HCl \rightarrow 2MCl + H_2O + CO_2$ 1g
0.01186mol From the above chemical eq".
$nM_2CO_3 = nCO_2$
$$\frac{1}{\text{Molar mass of } M_2CO_3} = 0.01186$$
$\therefore$ Molar mass of $M_2CO_3 = \frac{1}{0.01186}$
Molar mass $= 84.3g / mol$

Question138

The concentrated sulphuric acid that is peddled commercial is 95%H_2SO_4 by weight. If the density of this commercial acid is $1.834gcm^{-3}$, the molarity of this solution is
[Online May 7, 2012]

Options:

A. 17.8M

B. 12.0M

C. 10.5M

D. 15.7M

Answer: A

Solution:

$95\%H_2SO_4$ by weight means $100gH_2SO_4$ solution contains $95gH_2SO_4$ by mass.
Molar mass of $H_2SO_4 = 98gmol^{-1}$
Moles in $95gH_2SO_4 = \frac{95}{98} = 0.969mol$
Volume of $100gH_2SO_4$ solution
$= \frac{mass}{density} = \frac{100g}{1.834gcm^{-3}}$
$= 54.52cm^3 = 54.52 \times 10^{-3}L$
$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Volume of solution in L}}$
$= \frac{0.969}{54.52 \times 10^{-3}} = 17.8M$

Question139

The ratio of number of oxygen atoms (O) in 16.0 g ozone (O_3), 28.0g carbon monoxide (CO) and 16.0 oxygen (O_2) is (Atomic mass: C = 12, O = 16 and Avogadro's constant $N_A = 6.0 \times 10^{23} mol^{-1}$) [Online May 7, 2012]

Options:

A. 3 : 1 : 2

B. 1 : 1 : 2

C. 3 : 1 : 1

D. 1 : 1 : 1

Answer: D

Solution:

Solution:
O_3 molecular weight $= 16 + 16 + 16 = 48g / mol$
It means weight of 1mol of O_3 is 48g and in 1mol of O_3 we have 3 atoms of Oxygen
In 48g of O_3, number of atoms of oxygen $= 3$
so in 16g of O_3, number of atoms of oxygen $= (3 / 48) \times 16 = 1$
CO molecular weight $= 12 + 16 = 28g / mol$
It means weight of 1 mol of CO is 28g and in 1 mol of CO we have 1 atom of Oxygen
so in 28g of CO, number of atoms of oxygen $= 1$
O2 molecular weight $= 12 + 16 = 32g / mol$
It means weight of 1 mol of O_2 is 32g and in 1mol of O_2 we have 2 atoms of Oxygen
In 32g of O2, number of atoms of oxygen $= 2$
so in 16g of O2, number of atoms of oxygen $= (2 / 32) \times 16 = 1$
So answer is 1:1:1

Question140

The ppm level of F^- in a 500g sample of a tooth paste containing 0.2gF^- is
[Online May 12, 2012]

Options:

A. 400

B. 1000

C. 250

D. 200

Answer: A

Solution:

$$\text{ppm} = \frac{\text{mass of solute (g)}}{\text{mass of solution (g)}} \times 10^6$$
$$= \frac{0.2}{500} \times 10^6 = 400\,\text{ppm}$$

Question141

5g of benzene on nitration gave 6.6g of nitrobenzene. The theoretical yicld of the nitrobenzene will be
[Online May 12, 2012]

Options:

A. 4.5g

B. 5.6g

C. 8, 09g

D. 6.6g

Answer: C

Solution:

Solution:
$$\underset{78g}{C_6H_6} + HNO_3 \longrightarrow \underset{123g}{C_6H_5NO_2} + H_2O$$
Now since 78g of benzene on nitration give = 123g nitrobenzene
hence 5g of benzene on nitration give
$$= \frac{123}{78} \times 5 = 7.88g$$
The nearest answer is (c) i.e. theoritical yield = 7.88g

Question142

A transition metal M forms a volatile chloride which has a vapour density of 94.8. If it contains 74.75% of chlorine the formula of the metal chloride will be
[Online May 26, 2012]

Options:

A. MCl_3

B. MCl_2

C. MCl_4

D. MCl_5

Answer: C

Solution:

Solution:
74.75% of chlorine means 74.75g chlorine is present in 100g of metal chloride.
$\text{Weight of metal} = 100 - 74.75$
$= 25.25\text{g}$
$\text{Equivalent weight} = \dfrac{\text{weight of metal}}{\text{weight of chlorine}} \times 35.5$
$= \dfrac{25.25}{74.75} \times 35.5 = 12$
Valency of metal
$= \dfrac{2 \times V.D}{\text{Equivalent wt. of metal} + 35.5}$
$= \dfrac{2 \times 94.8}{12 + 3.5.5} = 4$
∴ Formula of metal chloride is MCl_4
Alternate method:
Mol. wt $= 2\times$ vapour density
$= 2 \times 98.4 = 189.6\text{g}$
Since 74.75% is chlorine therefore,
189.6 metal chloride contains
$= \dfrac{74.75}{100} \times 189.6 = 141.72\text{g chloride}$
$\text{Number of atoms of chloride} = \dfrac{141.72}{35.5} = 3.99 \approx 4$
Hence, formula of metal chloride is MCl_4

Question143

An aqueous solution of oxalic acid dihydrate contains its 6.3 g in 250mL. The volume of 0.1N $NaOH$ required to completely neutralize 10mL of this solution
[Online May 12, 2012]

Options:

A. 4mL

B. 20mL

C. 2mL

D. 40mL

Answer: D

Solution:

Normality of oxalic acid solution

$= \dfrac{6.3 \times 1000}{63 \times 250} = 0.4N$

Now from

$N_1V_1 = N_2V_2$

$0.4 \times 10 = 0.1 \times V_2$

$V_2 = 40mL$

Question144

The molality of a urea solution in which 0.0100g of urea, $[(NH_2)_2CO]$ is added to $0.3000 dm^3$ of water at STP is:
[2011RS]

Options:

A. $5.55 \times 10^{-4}m$

B. 33.3 m

C. $3.33 \times 10^{-2}m$

D. 0.555m

Answer: A

Solution:

Solution:
Molality = Moles of solute/ Mass of solvent in kg

Molality $= \dfrac{0.01 / 60}{0.3} = \dfrac{0.01}{60 \times 0.3}$;

$= 5.55 \times 10^{-4}m$

Question145

The density (in gmL^{-1}) of a 3.60M sulphuric acid solution that is 29%H_2SO_4 (molar mass $= 98gmol^{-1}$) by mass will be
[2007]

Options:

A. 1.45

B. 1.64

C. 1.88

D. 1.22

Answer: D

Solution:

Solution:
Since molarity of solution is $3.60M$. It means 3.6 moles of H_2SO_4 is present in its 1 litre solution.
Mass of 3.6 moles of H_2SO_4
$= \text{Moles} \times \text{Molecular mass}$
$= 3.6 \times 98g = 352.8g$
$\therefore 1000mL$ solution has $352.8g$ of H_2SO_4
Given that 29g of H_2SO_4 is present in
= 100g of solution
$\therefore 352.8g$ of H_2SO_4 is present in
$= \frac{100}{29} \times 352.8g$ of solution
$= 1216g$ of solution
$\text{Density} = \frac{\text{Mass}}{\text{Volume}} = \frac{1216}{1000}$
$= 1.216g / mL = 1.22g / mL$

Question146

In the reaction, [2007]
$2Al(s) + 6HCl(aq) \rightarrow 2Al^{3+}(aq) + 6Cl^{-}(aq) + 3H_2(g)$
[2007]

Options:

A. $11.2LH_2(g)$ at STP is produced for every mole of HCl(aq) consumed

B. $6LHCl(aq)$ is consumed for every 3L of $H_2(g)$ produced

C. $33.6LH_2(g)$ is produced regardless of temperature and pressure for every mole of Al that reacts

D. $67.2H_2(g)$ at STP is produced for every mole of Al that reacts.

Answer: A

Solution:

Solution:
$2Al(s) + 6HCl(aq) \rightarrow 2Al^{3+}(aq) + 6Cl^{-}(aq) + 3H_2(g)$
$\because$ 6 moles of HCl produces = 3 moles of H_2
$= 3 \times 22.4L$ of H_2 at S.T.P
$\therefore$ 1 mole of $HC1$ produces
$= \frac{3 \times 22.4}{6}L$ of H_2 at S.T.P
$= 11.2L$ of H_2 atSTP

Question147

How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms?
[2006]

Options:

A. 1.25×10^{-2}

B. 2.5×10^{-2}

C. 0.02

D. 3.125×10^{-2}

Answer: D

Solution:

Solution:
1 Mole of $Mg_3(PO_4)_2$ contains 8 moles of oxygen atoms
$\therefore$8 mole of oxygen atoms $\equiv$ 1 mole of $Mg_3(PO_4)_2$
0.25 mole of oxygen atom $\equiv \frac{1}{8} \times 0.25$ mole of $Mg_3(PO_4)_2$
$= 3.125 \times 10^{-2}$ mole of $Mg_3(PO_4)_2$

Question148

Density of a 2.05M solution of acetic acid in water is 1.02 g / mL. The molality of the solution is
[2006]

Options:

A. 2.28mol kg^{-1}

B. 0.44mol kg^{-1}

C. 1.14mol kg^{-1}

D. 3.28mol kg^{-1}

Answer: A

Solution:

Solution:
Apply the formula $d = M\left(\frac{1}{m} + \frac{M_2}{1000}\right)$
$\therefore 1.02 = 2.05\left(\frac{1}{m} + \frac{60}{1000}\right)$
On solving we get, $m = 2.288 \text{mol / kg}$

Question149

Two solutions of a substance (non electrolyte) are mixed in the following manner: 480mL of 1.5M first solution + 520mL of 1.2M second solution. What is the molarity of the final mixture? [2005]

Options:

A. 2.70M

B. 1.344M

C. 1.50M

D. 1.20M

Answer: B

Solution:

Solution:
From the molarity equation
$M_1V_1 + M_2V_2 = MV$
Let M be the molarity of final mixture,
$M = \frac{M_1V_1 + M_2V_2}{V}$ where $V = V_1 + V_2$
$M = \frac{480 \times 1.5 + 520 \times 1.2}{480 + 520} = 1.344M$

Question150

If we consider that 1 / 6, in place of 1 / 12, mass of carbon atom as the relative atomic mass unit, the mass of one mole of the substance will [2005]

Options:

A. be a function of the molecular mass of the substance

B. remain unchanged

C. increase two fold

D. decrease twice

Answer: D

Solution:

Solution:
Relative atomic mass $= \frac{\text{Mass of one atom of the element}}{1/12^{\text{th}} \text{ part of the mass of one atom of carbon } - 12}$
or $\frac{\text{Mass of one atom of the element}}{\text{Mass of one atom of the C - 12}} \times 12$

Now if we use $\frac{1}{6}$ in place of $\frac{1}{12}$ the formula becomes Relative atomic mass

$= \frac{\text{Mass of one atom of element}}{\text{Mass of one atom of carbon}} \times 6$

∴ Relative atomic mass decrease twice.

Question151

6.02×10^{20} molecules of urea are present in 100ml of its solution. The concentration of urea solution is (Avogadro constant, $N_A = 6.02 \times 10^{23} mol^{-1}$) [2004]

Options:

A. 0.02M

B. 0.01M

C. 0.001M

D. 0.1M

Answer: B

Solution:

Solution:

Moles of urea present in 100mL of sol.

$= \frac{6.02 \times 10^{20}}{6.02 \times 10^{23}} mol$

$\therefore M = \frac{6.02 \times 10^{20} \times 1000}{6.02 \times 10^{23} \times 100} = 0.01M$

[$\because M =$ Moles of solute present in 1L of solution]

Question152

To neutralise completely 20mL of 0.1M aqueous solution of phosphorous acid (H_3PO_3), the value of 0.1M aqueous KOH solution required is [2004]

Options:

A. 40mL

B. 20mL

C. 10mL

D. 60mL

Answer: A

Solution:

Solution:
The neutralization reaction is $H_3PO_3 + 2\,KOH \rightarrow K_2HPO_3 + 2H_2O$.
Phosphorus acid is diprotic acid as it has two ionizable hydrogens. Thus, 1 mole of phosphorous acid will neutralize 2 moles of KOH.
The number of moles of phosphorus acid present in $20\,mL$ of $0.1M$ aqueous solution is $0.1 \times 20 \times \frac{1}{1000} = 0.002\,mol$.
They will neutralize $2 \times 0.002\,mol = 0.004$ moles of KOH.
The molarity of KOH solution is $0.1M$.
The volume of KOH solution required will be $\frac{0.004}{0.1} = 0.04L = 40\,ml$.

Question153

25mL of a solution of barium hydroxide on titration with a 0.1 molar solution of hydrochloric acid gave a litre value of 35mL. The molarity of barium hydroxide solution was [2003]

Options:

A. 0.14

B. 0.28

C. 0.35

D. 0.07

Answer: D

Solution:

$Ba(OH)_2 \quad HCl$
$N_1V_1 = N_2V_2$
$N_1 \times 25 = 0.1 \times 35$
$N_1 = 0.14$
Since, $Ba(OH)_2$ is diacid base
Hence $N = M \times 2$ or $M = \frac{N}{2}$
$M = 0.07M$

Question154

What volume of hydrogen gas, at 273K and 1atm. pressure will be consumed in obtaining 21.6g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen ? [2003]

Options:

A. 67.2L

B. 44.8L

C. 22.4L

D. 89.6 L

Answer: A

Solution:

$2BCl_3 + 3H_2 \rightarrow 2B + 6HCl$

or $BCl_3 + \frac{3}{2}H_2 \rightarrow B + 3HCl$

Now, since 10.8g boron requires hydrogen

$= \frac{3}{2} \times 22.4L$ at S.T.P

Hence 21.6 boron requires hydrogen

$= \frac{3}{2} \times \frac{22.4}{10.8} \times 21.6 = 67.2L$ at S.T.P.

Question155

With increase of temperature, which of these changes? [2002]

Options:

A. molality

B. weight fraction of solute

C. molarity

D. mole fraction.

Answer: C

Solution:

Solution:
Among all the given options, molarity changes with temperature because the term molarity involves volume which increases on increasing temperature.

Question156

Number of atoms in 558.5 gram Fe (at. wt. of $Fe = 55.85 gmol^{-1}$) is [2002]

Options:

A. twice that in 60g carbon

B. 6.023×10^{22}

C. half that in 8g He

D. $558.5 \times 6.023 \times 10^{23}$

Answer: A

Solution:

Solution:

$Fe(\text{No. of moles}) = \frac{558.5}{55.85} = 10\text{mol}$

C (No. of moles) in 60g of C = 60 / 12 = 5mol .

Question157

In a compound C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular weight of compound is 108 . Molecular formula of compound is
[2002]

Options:

A. $C_2H_6N_2$

B. C_3H_4N

C. $C_6H_8N_2$

D. $C_9H_{12}N_3$.

Answer: C

Solution:

Element	%	Relative no. of atoms	Simple ratio of atoms
C	9	$\frac{9}{12} = \frac{3}{4}$	3
H	1	$\frac{1}{1} = 1$	4
N	3.5	$\frac{3.5}{14} = \frac{1}{4}$	1

Empirical formula $= C_3H_4N$

$(C_3H_4N)_n = 108$

$(12 \times 3 + 4 \times 1 + 14)_n = 108$

$(54)_n = 108 \quad n = \frac{108}{54} = 2$

$\therefore$ Molecular formula $= C_6H_8N_2$
