PAGE No 128

Solution: 01
International Union of Pure and Applied Chemistry

Solution: 02
(a) Law of conservation of mass – Antonie Lavoisier

(b) Law of constant proportions – Joseph Proust

Solution: 03
(a) Law of conservation of mass.
(b) Law of constant proportions.

PAGE No 129

Solution: 04
John Dalton

Solution: 05
Atoms can neither be created nor destroyed.

Solution: 06
The elements consist of atoms having fixed mass, and that the number and kind of atoms of each element in a given compound is fixed.

Solution: 07
Kanad ; ‘parmanu’.

Solution: 08
Law of Conservation of mass and law of constant proportions.

Solution: 09
Law of constant proportions.

Solution: 10
Law of Conservation of mass.

Solution: 11
Atoms are the building blocks of matter.

Solution: 12
The size of an atom indicated by its radius which is called ‘atomic radius’.
Solution: 13
The radius of an atom is usually expressed in ‘nanometers’.
Solution: 14
1 nanometer = 10-9 m
Solution: 15
‘nm’ represents nanometer.
Solution: 16
Because they are very very small.
Solution: 17
False ; it is Co

Solution: 18
The molecular mass of a substance is the relative mass of its molecule as compared with the mass of a Carbon-12 atom taken as 12 units.

Solution: 19
This means that a molecule of oxygen is 32 times heavier than 1/12 of a Carbon-12 atom.

Solution: 20
(a) 1:8

(b) Conservation of mass

Solution: 21
(a) Carbon is used as a standard for atomic mass scale.

(b) Atom with 6 neutrons and 6 protons in its nucleus so that its mass number is 12.

(c) Mass = 12 u

Solution: 22
The major drawback of Dalton’s atomic theory is that atoms were thought to be indivisible. But, it is not true since atoms are divisible.

Solution: 23
No, the statement is not valid because atoms can be divided into subatomic particles called electrons, protons and neutrons.

Solution: 24
Yes, 'THE SCANNING TUNNELLING MICROSCOPE' enables people to see atoms. This microscope can produce computer generated images of the surface of elements which show the individual atoms. The atoms show up as blurred images.

Solution: 25
The symbol of element is the "first letter" or "first letter and another letter" of the English name or Latin name of the element.
For example, symbol of Hydrogen is "H" and symbol of Calcium is "Ca".

Solution 26
(a) Ca, Mg

(b) Cu, Hg

Solution 27
Hydrogen- H, Helium-He, Lithium-Li , Beryllium-Be, Boron-B

Solution 28
Sodium – Na
Potassium – K
Iron – Fe
Copper – Cu
Mercury – Hg
Silver – Ag

Solution 29
Hg – Mercury
Pb – Lead
Au – Gold
Ag – Silver
Sn – Tin

Solution 30
The number of atoms present in one molecule of an element is called atomicity of that element.
For example, atomicity of sodium is 1 and that of nitrogen is 2.

Solution 31
(a) Oxygen = 2
(b) Ozone = 3

(c) Neon = 1
(d) Sulphur = 8
(e) Phosphorus = 4
(f) Sodium = 1

Solution 32
A chemical formula represents the composition of a molecule of the substance in terms of the symbols of the elements present in the molecule. It is also known as molecular formula.
Chemical formula of element – H_2 for hydrogen
Chemical formula of compound – H_2O for water

Solution 33
(a). Water- H_2O; Elements present are Hydrogen and Oxygen.

(b).Ammonia- NH_3; Elements present are Nitrogen and Hydrogen.

(c).Methane-CH_4; Elements present are Carbon and Hydrogen.

(d).Sulphur dioxide-SO_2; Elements present are Sulphur and Oxygen.

(e).Ethanol-C_2H_5OH; Elements present are carbon, hydrogen and oxygen.
Solution 34
2N represents two separate atoms of nitrogen and N_2 represents one molecule of nitrogen.

PAGE No: 130
Solution 35
(a) O- one atom of oxygen
(b) 2O- two separate atoms of oxygen
(c) O_2-one molecule of oxygen
(d)$3O_2$-three molecules of oxygen

Solution: **36**
H_2 represents two atoms of hydrogen, one atom of sulphur and four atoms of oxygen.
Solution 37
(a) Oxygen gas occurs as a diatomic molecule in nature.

(b) Noble gases occur as monoatomic gases in nature.

Solution: 38
2H represents two separate atoms of hydrogen and H_2 represents one molecule

of hydrogen.
Solution 39
(a) N – one atom of nitrogen
(b) 2N – two separate atoms of nitrogen
(c) N_2 – one molecule of nitrogen
(d) $2N_2$ – two molecules of nitrogen

Solution: 40
Significance of formula of a substance-
1. Formula represents the name of the substance.
2. Formula represents one molecule of a substance.
3. Formula gives the number of atoms of each element present in one molecule.
4. Formula also represents one mole of molecules of the substance.

Solution: **41**
Significance of the formula H_2O-
1. H_2O represents water.
2. It represents one molecule of water.
3. H_2O also represents 6.022 x 1023 molecules of water.
4. It represents 18gm of water.

Solution 42
Molecular formula of glucose = $C_6H_{12}O_6$
Molecular mass of glucose = (6xC)+(12xH)+(6xO) =72 + 12 + 96 = 180u.

Solution 43
(a).Molecular mass of Hydrogen (H_2) = 2 x H = 2 x 1 u = 2 u

(b).Molecular mass of oxygen (O_2) = 2 x O = 2 x 16 u = 32 u

(c).Molecular mass of chlorine (Cl_2) = 2 x Cl = 2 x 35.5 = 71 u

(d).Molecular mass of Ammonia (NH_3) = 1 x N + 3 x H = 14 + 3 = 17 u

(e).Molecular mass of carbon dioxide (CO_2) = 1 x C + 2 x O = 12 + 32 = 44 u

Solution 44
(a). Molecular mass of methane (CH_4) = 12 + 4 = 16 u

(b). Molecular mass of ethane (C_2H_6) = 2 x 12 + 6 x 1 = 30 u

(c). Molecular mass of ethane (C_2H_4) = 2 x 12 + 4 x 1 = 28 u

(d). Molecular mass of ethyne (C_2H_2) = 2 x 12 + 2 x 1 = 26 u

Solution 45
(a) Molecular mass of Methanol(CH_3OH) =
1xC + 3xH + 1xO +1xH = (12+3+16+1)u = 32u

(b) Molecular mass of Ethanol (C_2H_5OH) = 2xC + 5xH + 1xO +1xH
= (24 + 5 + 16 + 1) = 46u

Solution: **46**
Molecular mass of ethanoic acid (CH_3COOH)
= 1xC + 3xH + 1xC + 2xO +1xH = 12+3+12+32+1 = 60u

Solution: **47**
Molecular mass of Nitric acid (HNO_3) = 1xH + 1xN + 3xO
= (1 + 14 +48) u = 63 u

Solution: **48**
Molecular mass of chloroform ($CHCl_3$) = 1 x C + 1 x H + 3 x Cl
= (12 + 1 + 106.5)u = 119.5 u

Solution: **49**
Molecular mass of hydrogen bromide (HBr) = 1 x H + 1 x Br
= (1 + 80) u = 81u

Solution: **50**
(a).Molecular mass of hydrogen sulphide (H_2S) = 2xH + 1xS
= (2+32) u = 34u

(b). Molecular mass of Carbon disulphide (CS_2) = 1xC + 2xS = (12+2 x 32) u = 76 u

Solution: **51**
Law of conservation of mass by LAVOISIER states that: “Mass can neither be created nor be destroyed in a chemical reaction”. So, in a chemical reaction, the total mass of reactants must be equal to the total mass of products.
For example: When calcium carbonate is heated, a chemical reaction takes place to form calcium oxide and calcium carbonate. If 100 gms of calcium carbonate is decomposed completely, then 56 gms of calcium oxide and 44 gms of carbon dioxide are formed.
In the above example: the total mass of products = 56 gms (CaO) + 44gms (CO_2) = 100 gms.

As total mass of products is equal to the total mass of reactant so, the law of conservation of mass is satisfied.

Solution: 52

Law of constant proportion given by PROUST states that “A chemical compound always consists of the same elements combined together in the same proportion by mass.”

For example: If we decompose 100 gms of pure water by passing electricity through it, then 11 gms of hydrogen and 89 gms of oxygen are obtained. Now, if we repeat this experiment by taking pure water from different sources (like river, sea, well, etc.), the same masses of hydrogen and oxygen elements are obtained in each case. They are always combined together in the same constant proportion of 11:89 or 1:8 by mass. And this is the law of constant proportions.

Solution: 53

[a]. Postulates of Dalton’s atomic theory:

a) All the matter is made up of very small particles called ‘atoms’.

b) Atoms cannot be divided.

c) Atoms can neither be created nor be destroyed.

d) Atoms are of various kinds. There are as many kinds of atoms as are elements.

e) All the atoms of a given element are identical in every respect, having the same mass, size and chemical properties.

f) Atoms of different elements differ in mass, size and chemical properties.

g) The ‘number’ and ‘kind’ of atoms in a given compound is fixed.

h) During chemical combination, atoms of different elements combine in small whole numbers to form compounds.

i) Atoms of the same elements can combine in more than one ratio to form more than one compound.

[b]. The postulate “The elements consists of atoms and that atoms can neither be created nor destroyed” can be used to explain the law of conservation of mass.

[c]. The postulate “The elements consist of atoms having fixed mass, and that the number and kind of atoms of each element in a given compound is fixed” can be used to explain the law of constant proportions.

Solution: 54

(a).Significance of symbol of element –

i. It represents name of the element.

ii. It represents one atom of the element.

iii. It represents a definite mass of the element.

iv. It represents one mole of atoms of the element.

For example – C represents one atom of the element Carbon. It also represents 12 gms of Carbon.

(b). Significance of symbol H –
i. It represents Hydrogen element.
ii. It represents one atom of Hydrogen element.
iii. It represents one mole of Hydrogen atoms.
iv. It represents 2 gms of Hydrogen.

Solution: 55
a) An atom is the smallest particle of an element that can take part in a chemical reaction. They usually exist in combination with the atoms of same element or another element.

b) A molecule is an electrically neutral group of two or more atoms chemically bonded together.
For example- Ozone gas has three oxygen atoms combined together, so ozone exists in the form of O3 molecule.

c) The molecule of an element contains two or more similar atoms chemically bonded together.
For example- A molecule of hydrogen element consists of 2 hydrogen atoms combined together.
Whereas the molecule of compound contains two or more different type of atoms chemically bonded together.
For example- The molecule of hydrogen chloride(HCl) contains two different type of atoms, i.e. H and Cl.

Solution: 56
(a) One atomic mass unit is defined as exactly one-twelfth the mass of an atom of carbon-12. Its symbol is ‘u’.

(b) The atomic mass of an element is the relative mass of its atom as compared with the mass of a carbon-12 atom taken as 12 units.

(c) It means that one atom of oxygen is 16 times heavier than 1/12 of a C-12 atom.

PAGE NO 131

Solution: 75
According to question-

$CuSO_4$ + 2NaOH → $Cu(OH)_2$ + Na_2SO_4
(15.95 gm) (8gm) (9.75 gm) (14.2 gm)

Clearly, in this case
total mass of reactants = (15.95 gm + 8 gm) = 23.95 gm
total mass of products = (9.75 gm + 14.2 gm) = 23.95 gm
Hence, Law of conservation of mass is valid here.

Solution: 76
According to question-
Potassium chlorate → Potassium chloride + Oxygen
(24.5 gm) (14.9 gm) (x gm)
Let, x gm of oxygen is formed
Then, according to law of conservation of mass-
24.5 gm = 14.9 gm + x gm
So, x = (24.5 – 14.9) gm = 9.6 gm.
Thus, 9.6 gm of oxygen is formed in the reaction

Solution: 77
According to question-
Reaction 1-

2 Cu + O_2 → 2CuO
(3.9 gm) (4.90 – 3.92 = 0.98 gm) (4.90 gm)

$$\frac{3.92}{3.92} = 1, \frac{0.98}{3.92} = 0.25, \frac{4.90}{3.92} = 1.25$$

So, 1 equivalent of Cu reacts with 0.25 equivalent of O_2 to form 1.25 equivalent of copper oxide Reaction 2 –
2 CuO → 2 Cu + O_2
(4.55 gm) (3.64 gm) (4.55 – 3.64 = 0.91 gm)
$$\frac{4.55}{3.64} = 1.25, \frac{3.64}{3.64} = 1, \frac{0.91}{3.64} = 0.25$$

Here again, one can see that 1.25 equivalent of CuO decomposed to form 1 equivalent of Cu and 0.25 equivalent of oxygen.
Hence, law of constant proportion is verified.

Solution: 78
According to question –
Magnesium + Oxygen → Magnesium Oxide

3x 2x x

i.e. three equivalents of Mg reacts with 2 equivalents of O2 to form 1 equivalent of MgO.
When mass of Mg = 3x = 24 gm
So, x = 8 gm
Then, mass of oxygen required = 2x = 16 gm

PAGE NO: 132

Solution: 79
When 5 gm of calcium is burnt in 2 gm of oxygen, then 7 gm of calcium oxide is formed. So, calcium and oxygen combine in the fixed proportion of 5:2 by mass. Now, when 5 gm of calcium is burnt in 20 gm of oxygen, then also 7gm of calcium oxide will be formed because chemical reactions follows law of constant proportion.
As a result, 18 gm of oxygen will be left unreacted.

Solution: 80
According to question-
X (liquid) → y(gas) + Z(gas)
200gm 178gm 22gm

(a) Liquid X – Water
Gas Y – Oxygen
Gas Z – Hydrogen

(b) mass of Z / mass of Y = 22gm / 178 gm = 1:8

(c) Law of constant proportion is illustrated by this example.

(d) Two sources of liquid X – Sea, Well

(e) Gas Y (oxygen) is necessary for breathing.

Solution: 81
According to question-
P(Solid) → Q(gas) + R(solid)
50gm 22gm 28gm

(a) Solid P – Calcium Carbonate (CaCO3)
Gas Q – Carbon dioxide (CO2)
Solid R – Calcium oxide (CaO)

(b) Total mass of Q and R = 22gm + 28gm = 50gm

(c) Total mass of Q and R (50gm) is equal to mass of reactant (50gm).

(d) The law of conservation of mass is followed, i.e. total mass of product is equal to mass of reactant.

(e) Law of conservation of mass is illustrated by the example.

PAGE No 150

Solution: 01
Ions

Solution: **02**
(a). Anions ; (b). Cations

Solution: **03**
The formula mass of an ionic compound is the relative mass of its 'formula unit' as compared with the mass of a Carbon-12 atom taken as 12 units.

PAGE NO 151

Solution: **04**
(a) Anions are formed by the gain of electrons by atoms

(b) Cations are formed by the loss of electrons by atoms

Solution: **05**
(a) False
(b) True

Solution: **06**
(a). Calcium oxide – CaO

(b). Magnesium hydroxide – Mg(OH)2

Solution: **07**
Valency of element Z = 3
Valency of oxygen = 2
So, formula of oxide of element = Z_2O_3

Solution: **08**
Its Na+ , the sodium ion.

Solution: **09**
Its Cl-, the chloride ion.

Solution: **10**
(a) Anion
(b) Cation
(c) Ion
(d) Electrons ; protons
(e) Protons ; electrons

Solution: **11**
Water is made up of Hydrogen and oxygen.
Valency of hydrogen is +1 ; Valency of oxygen is -2.
Chemical formula of water is H2O.

Solution: 12
Symbols: H N
Valencies: +1 -3

So, chemical formula of ammonia is NH3.

Solution: 13
Symbols: S O
Valencies: +4 -2

Chemical formula of sulphur dioxide is SO2.

Solution: 14
According to question-
Symbols: C S
Valencies: +4 -2

Name and formula of the resulting compound is Carbon disulphide; CS2.

Solution: 15
As the valency of element X is 4 and that of Y is 1, so the resulting formula is XY4.

Solution: 16

When the valency shown by B is 4, then
Symbols: B O
Valencies: +4 -2
The resulting compound is BO_2

When the valency shown by B is 6, then
Symbols: B O
Valencies: +6 -2
The resulting compound is BO_3

Solution: 17
Symbols: X Y
Valencies: 3 2
Thus, the resulting compound is X_2Y3

Solution: 18
Symbols: Mg HCO_3
Valencies: +2 -1
Thus, the resulting compound is $Mg(HCO_3)_2$

Solution: 19
(a). Bromide of element-
As valency of bromine is -1 and that of element X is +2 so, the resulting compound is XBr2.

(b). Oxide of element-
As valency of oxygen is -2 and that of element is +2 so, the resulting compound is XO.

Solution: 20
(a) Sodium oxide
Symbols: Na O
Valencies: +1 -2
Thus, the formula of sodium oxide is Na_2O.

(b) Calcium carbonate
Symbols: Ca CO_3
Valencies: +2 -2
Thus, the resulting compound is $CaCO_3$

Solution: 21
(a).Molecular mass of Na2O = (2 x Na) + (1 x O) = (2 x 23) + (1 x 16) = 62u

(b). Molecular Mass of Al2O3 = (2 x Al) + (3 x O) = (2 x 27) + (3 x 16) = 102u

Solution: 22
(a). CuSO4 : Copper sulphate; Cu+2 and SO4-2
(b). (NH4)2SO4 : Ammonium sulphate; NH4+ and SO4-2.
(c). Na2O : Sodium oxide; Na+ and O-2
(d). Na2CO$\square$3 : Sodium carbonate; Na+ and CO4-2.
(e). CaCl2 : Calcium chloride; Ca+2 and Cl-.

Solution: 23
(a). CH3COONa : Na+ (cation) and CH3COO- (anion)
(b). NaCl : Na+ (cation) and Cl- (anion)
(c). H2 : It is a covalent molecule. So, cation and anion are not present.
(d). NH4NO3 : NH4+ (cation) and NO3- (anion)

Solution: 24
(a) Element: Ca F
Valencies: +2 -1
Thus, the resulting compound is CaF_2

(b) Element: H S
Valencies: +1 -2
Thus, the resulting compound is H_2s.

(c) Element: N H
Valencies: -3 +1
Thus, the resulting compound is NH_3

(d) Element: C Cl
Valencies: +4 -1
Thus, the resulting compound is CCI_4

(e) Element: Na O
Valencies: +1 -2
Thus, the resulting compound is Na_2o

(f) Element: C O
Valencies: +4 -2
Thus, the resulting compound is CO_2

Solution: 25

i. Ionic compounds- The compounds which are formed by combination of metals and non-metals are called ionic compounds. For ex: CaCl2 and CaCO3.

ii. Molecular compounds- These compounds are formed by the combination between two non-metal elements. For ex. HCl and H2S.

PAGE No 152

Solution: 26

(a) An ion is a positively or negatively charged atom (or group of atoms). An ion is formed by the loss or gain of an electrons contains an unequal number of protons and electrons.
Example – (1) Sodium ion, Na^+, formed by loss of one electron.
(2) Chloride ion, $Cl^?$, formed by gain of one electron.

(b) i. Sodium phosphate – Na_3PO_4
ii. Ammonium sulphate – $(NH_4)_2SO_4$
iii. Calcium Hydroxide – $Ca(OH)_2$
iv. Lead bromide – $PbBr_2$

Solution: 27

(a) A cation is formed by the loss of one or more electrons by an atom. For ex. Magnesium loses 2 electron to form Mg+2.
An anion is formed by the gain of one or more electrons by an atom. For Ex. Chlorine loses one electron to form Cl-.

(b) (i). Na2S
(ii). Cu (NO3)2

Solution: 28

(i).

$$Na\ (11\ protons,\ 11\ electrons) \xrightarrow{-1\ electron} Na^+\ (11\ protons,\ 10\ electrons)$$

The reason for positive charge on sodium is the loss of electron.

(ii).

$$Cl\ (17\ protons,\ 17\ electrons) \xrightarrow{+1\ electron} Cl^-\ (17\ protons,\ 18\ electrons)$$

The reason for negative charge on chlorine is the gain of electron.

Solution: 29

(a). Simple ions: Br- and Na+; Compound ions: NH4+ and Al+3

(b). (i). YCl4 (ii). YO2 (iii). Y (SO4)2 (iv). Y (CO3)2 (v). Y (NO3)4

Solution: 30
(a). The simplest combination of ions that produces an electrically neutral unit, is called 'formula unit' of the ionic compound.
Formula unit of sodium chloride – NaCl
Formula unit of magnesium chloride – MgCl2

(b).
(i). Formula Mass of Calcium chloride (CaCl2) = 1xCa + 2xCl = (40+71) u = 111 u
(ii). Formula Mass of Sodium carbonate (Na2CO3) = 2xNa + 1xC + 3xO= (2×23 + 1×12 + 3×16) u = 106 u

PAGE NO 153

Solution: 46
(a). Let the valency of element A be y, then
2y + 5(-2) = 0
So, y = valency of element A = 5

(b). As valency of element A is 5 and valency of chlorine is -1,
So, the formula of chloride of A is ACl5.

Solution: 47
Valency of X –
(i). In H2X: -2
(ii).In CX2 : -2
(iii).In XO2 : +4
(iv).In XO3 : +6

Solution: 48
Let the valency of X be y, then
2 x (+3) + 3 x y = 0
So, valency of X = y = -2
As valency of Mg is +2 and that of X is -2 so the formula of Magnesium salt of X will be MgX.

Solution: 49
According to formula M2CO3, valency of M is +1.
(a). formula of iodide = MI (as valency of iodine is -1)

(b). formula of nitride = M3N (as valency of nitrogen is -3)

(c). formula of phosphate = M3PO4

Solution: 50
(a). Anion will be formed by element X ; Symbol : X-

(b). (i). No. of protons in X = 17
(ii). No. of electrons in X = 18
(iii). No. of neutrons in X = 18

(c). Cation will be formed by element Y ; Symbol : Y+
(d). (i). No. of protons in Y = 11
(ii). No. of electrons in Y = 10
(iii). No. of neutrons in Y = 12

(e).Atomic mass of X = No. of protons(17) + No. of neutrons(18) = 35 u
Atomic mass of Y = No. of protons (11) + No. of neutrons (12) = 23 u

(f). Element X is Chlorine (Cl).
Element Y is Sodium (Na).

PAGE NO: 172

Solution: 1
A mole

Solution: 2
1 mole

Solution: 3

Solution: 4
One mole of atoms(6.022×10^{23} atoms)

Solution: 5
6.022×10^{23}

Solution: 6
Avogadro number

Solution: 7

Given mass of oxygen = 12g
Molar mass of oxygen = 32g
No. of moles = Given mass / Molar mass = 12g /32g = 0.375

Solution: 8
No. of moles = 3.6g / 18g = 0.2 mole

Solution: 9
Mass of 0.2 moles of oxygen atoms = 0.2 x 16 = 3.2g

Solution: 10
Mass of 2 moles of nitrogen atoms = 2 x 14 = 28g

Solution: 11
Given mass of CaCO3 = 10g
Molar mass of CaCO3 = 1xCa + 1xC + 3xO = (40+12+48)gm = 100gm
So, no. of moles of CaCO3 = Given mass/Molar mass = 10/100 = 0.1 moles

Solution: 12
(a) 6.022×10^{23} atoms
(b) One mole
(c) Avogadro's Number

Solution 13
One mole of O_2 = 32gm
6.022×10^{23} molecules of O_2 have mass = 32 gm
So, 12.044×10^{25} molecules of O_2 will have mass = 6400 gm = 6.4 kg

Solution 14
One mole of ammonia contains = 6.022×10^{23} molecules of ammonia
So, 1.5 moles of ammonia contains = $1.5 \times 6.022 \times 10^{23}$ molecules
= 9.033×10^{23} molecules of ammonia

Solution 15
Given mass of $CaCO_3$ = 10g
Molar mass of $CaCO_3$ = 1 ×Ca + 1×C + 3×O = (40+12+48)gm = 100 gm
So, no of moles of $CaCO_3$ = Given mass / Molar mass = 10/100 = 0.1 moles

Solution: 16

One mole of O_2 contains = 6.022×10^{23} molecules of oxygen
So, 1 molecules of O_2 has = $1/6.022 \times 10^{23}$ moles of O_2
Therefore, 1.2×10^{22} molecules of O_2 will have = $1.2 \times 10^{22}/6.022 \times 10^{23}$ moles of O_2

= 0.0199 moles of O_2

Solution: 17

6.022×10^{23} molecules of N_2 weigh = 28 gm

So, 1 molecule of N_2 will weigh = $28 / 6.022 \times 10^{23}$ grams of N_2

= 4.648×10^{-23} grams of N_2

Solution: 18

1 mole of sodium weighs = 23 gm

So, 1 gm of sodium will have = 1/23 moles of sodium

Therefore, 34.5 gm of sodium will have = 34.5/23 = 1.5 moles of sodium.

Solution: 19

1 mole of Zn = 65gm of zinc = 6.022×10^{23} atoms of zinc

Given mass of zinc = 10gm

No. of moles of zinc = 10/65 = 0.15 moles of zinc

Total no. of atoms in 0.15 moles = $0.15 \times 6.022 \times 10^{23}$ atoms of Zn

= 9.264×10^{22} atoms of Zn

Solution: 20

Mass of 6.022×10^{23} atoms of Carbon = 12 g

So, Mass of 1 Carbon atom = $12/6.022 \times 10^{23}$ g

Hence, mass of 3.011×10^{24} atoms of Carbon = $3.011 \times 10^{24} \times 12 / 6.022 \times 10^{23}$ = 60 g

Solution: 21

6.022×10^{23} atoms of Oxygen weigh = 16 g

So, mass of 1 atom of Oxygen = $16/6.022 \times 10^{23} = 2.656 \times 10^{-23}$ g.

Page No 173

Solution: 22

1 mole of hydrogen has = 6.022×10^{23} atoms of hydrogen

So, 0.25 moles of hydrogen will have = $6.022 \times 10^{23} \times 0.25 = 1.50 \times 10^{23}$ atoms of hydrogen.

Solution: 23

6.022×10^{23} atoms of phosphorus has = 1 mole of phosphorus

So, 12.044×10^{25} atoms of phosphorus will have = $12.044 \times 10^{25}/6.022 \times 10^{23}$

= 200 moles

Solution: 24

Given mass of $CHCl_3$ = 0.0239 g

Molar mass of $CHCl_3$ = 1 x C + 1 x H + 3 x Cl = 119.5 g

No. of moles = Given mass/ Molar mass

No. of moles = 0.0239/119.5 = 0.0002

So, no. of molecules present in 0.0239 g of chloroform = $0.0002 \times 6.022 \times 10^{23}$

= 12.044×10^{19} molecules

Solution: 25

1 mole of Na_2CO_3 = 106g

So, 5 x mole of Na_2CO_3 = 5 x 106g = 530g

Solution: 26

32 g of oxygen (1 mole of oxygen) has = 6.022×10^{23} molecules of oxygen

So, 4 g of oxygen will have = $6.022 \times 10^{23} \times 4/32 = 7.528 \times 10^{22}$ molecules of oxygen

Solution: 27

Molar mass of glucose = 180 g

180 g of glucose has = 1 mol

So, 100 g of glucose will have = 1 x 100/180 = 0.55 moles

Solution: 28

1 mole of H_2S weighs = 34g
So, 0.17 mole of H_2S will weight = 34 × 0.17 g = 5.78 g

Solution: 29

Molar mass of CO_2 = 44G
Molar mass of H_2O = 18G
Mass of 5 mole of CO_2 = 5 × 44G = 220G
So, 5 mole of H_2O and 5 mole of CO_2 do not have same mass
And the difference in their masses = 220g – 90g = 130g

Solution: 30

240g of calcium has 240/40 = 6 moles
240g of magnesium has = 240/24 = 10 moles
So, required mole ratio = 6:10 = 3:5

Solution: 31

(a) A group 6.022×10^{23} particles (atoms molecules or ions) of a substance is called a mole of that substance. One mole represent of a substance equal to its 'GRAM ATOMIC MASS' or 'GRAM MOLECULAR MASS' and 6.022×10^{23} no. of particles of the substance.

(b) 1.5 moles of Na_2SO_3 has 3 moles of Na,1.5 moles of S and 4.5 moles of O.
Thus, mass of sodium = 3 × 23g = 69g
Mass of sulphur = 1.5 × 32 = 48g
Mass of oxygen = 4.5 × 16g = 72g

Solution: 32

(a) A mole of carbon atoms means a carbon sample weighing 12g and containing 6.022×10^{23}

(b) 1 mole of aluminum weighing 27g has = 6.022×10^{23} atoms of Al
So, 1g of Al = 0.22×10^{23} atoms of Al
Hence, 50g of Al will have = $50 \times 0.22 \times 10^{23}$ atoms of Al
= 11×10^{23} atoms of Al
1 mole of iron weighing 56g has = 6.022×10^{23} atoms of Fe
So, 1g of Fe has = 0.10×10^{23} atoms of Fe
Hence, 50g of Fe will have = $50 \times 0.10 \times 10^{23}$ atoms of Fe = 5×10^{23} atoms of Fe
Thus, 50g of Al has more no. of atoms as compared to 50g of Fe.

Solution: 33
(a) The amount of substance whose mass in grams is numerically equal to its atomic mass, is called gram atomic mass of gram atomic mass of oxygen is 16g.

(b) Moles of oxygen atom are
(i) Al_2O_3: 3 mole
(ii) CO_2: 2 mole
(iii) Cl_2O_7: 7 mole
(iv) H_2SO_4: 4 mole
(v) $Al_2(SO_4)_3$: 12 MOLE

Solution: 34
(a) The amount of substance whose mass in grams in numerically equal to its molecular mass is called gram molecular mass of gram molecular of the oxygen is 32g.

(b) Given mass of sulphur = 100g
Molar mass of S_8 = 32 × 8g = 256g
No. of moles = Given mass/Molar mass = 100/256 = 0.39 moles.

Solution: 35
(a) The molar mass of the substance is the mass of 1 mole of that substance. Molar mass is generally expressed.
(b) (i) Molar mass of ozone (O_3) = 3) = 3 × gram atomic mass of O = 3 × 16g = 48g/ mole
(ii) Molar mass of Ethanoic acid (CH_3COOH) = 2×C + 4×H + 2×O
= (24 + 4 + 32)u = 60g/mole

Page No 174

Solution: 43

1 mole of SO_2 = Mass of S + 2× Mass of O = 64 grams
64g of SO_2 = 1 mole
So, 1 g of SO_2 = 1/64 mole
Now since equal moles of all the substances contain equal number of molecules
so, 1/64 mole of O_2 will also contain x molecules like SO_2
32g of oxygen = 1mole
So, 1 g of oxygen = 1/32 mole
Now, 1/64 mole of oxygen contains = x molecules
So, 1/32 mole of oxygen will contain = x × 64/32 = 2x molecules

Solution: 44
Mass of one molecules of substance = 4.65×10^{-23} u
So, mass of 1 mole of substance = Mass of 6.022×10^{23} molecules of the substance
= $4.65 \times 10^{-23} \times 6.022 \times 10^{23}$ u = 28u
The substance is nitrogen with molecular mass 28 u

Solution: 45
Molar mass of SO_2 = (32 + 2× 16)g = 64g
Molar mass of oxygen (O_2) = 32G
Given mass of SO_2 = 10g = Given mass of oxygen (O_2)
1 mole of substance = 6.023×10^{23} particles of the substance

(a) No. of moles of SO_2 = 10g/64g = 0.15
Total no of molecules of SO_2 = $0.15 \times 6.022 \times 10^{23} = 0.90 \times 10^{23}$ molecules of SO_2

(b) No. of moles of O_2 = 10g/32g = 0.31
Total no. of molecules of O_2 = $0.31 \times 6.022 \times 10^{23} = 1.88 \times 10^{23}$ molecules of O_2
Thus, 10g of O_2 contains more no. of molecules.

Solution: 46
Given mass of nitrogen = 56g
Molar mass of nitrogen = 14g
No. of moles of nitrogen = 56g/14g = 4 moles
Equal number of moles of all the substances contain equal number of molecules.
So, 4 moles of nitrogen and 4 moles of oxygen contains same no. of molecules.
Hence, mass of 4 mole of oxygen = 4 × 16g = 64g

Solution: 47
Given mass of water = 1.8 g
Molar mass of water = 18g
No. of moles of water = 1.8g/ 18g = 0.1 moles

Equal number of moles of all the substances contain equal number of molecules.
So, 0.1 moles of water and 0.1 moles of nitrogen contains same no. of molecules.
Hence, mass of 0.1 mole of nitrogen = 0.1 × 28g = 2.8g

Solution: 48
32g of S = 1 mole,
So, 1g of S = 1/32 mole
Now since equal moles of all the substances contain equal number of atoms so, 1/32 mole of oxygen will also contain x atoms like S.
16g of oxygen = 1/ 16 mole
Now, 1/32 mole of oxygen contains = x atoms
So, 1/16 mole of oxygen will contain = x × 32/16 = 2x atoms

Solution: 49
Given mass of carbon = 6g
Molar mass of carbon = 12g
No. of moles of carbon = 6g/ 12g = 0.5 moles
Equal number of moles of all the substances contain equal number of molecules.
So, 0.5 moles of carbon and 0.5 moles of magnesium contains same no. of molecules.
Hence, mass of 0.5 moles of magnesium = 0.5 × 24g = 12g

Solution: 50
(i) Mass of 1 g of element X = 2×10^{-23}g
Mass of 1 mole of element X = $2 \times 10^{-23} \times 6.022 \times 10^{23} = 12.044$ g
Molar mass of the element X = mass of 1 mole of element = 12 u

(ii) Element X is CARBON.