Chapter 3 - Atoms and Molecules Exercise 128

Question 1

Write the full form of IUPAC.

Solution 1

International Union of Pure and Applied Chemistry

Question 2

Name the scientist who gave:

(a) Law of conservation of mass

(b) Law of constant proportions

Solution 2

(a) Law of conservation of mass - Antonie Lavoisier

(b) Law of constant proportions - Joseph Proust

Question 3

Name the law of chemical combination:

(a) Which was given by Lavoisier

(b) Which was given by Proust.

Solution 3

(a) Law of conservation of mass.

(b) Law of constant proportions.

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Question 4

Name the scientist who gave atomic theory of matter.

Solution 4

John Dalton

Question 5

Which postulate of Dalton's atomic theory is the result of law of conservation of mass given by Lavoisier?

Solution 5

Atoms can neither be created nor destroyed.

Question 6

Which part of the Dalton's atomic theory came from the law of constant proportions given by Proust?

Solution 6

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.

Question 7

Which ancient Indian philosopher suggested that all matter is composed of very small particles? What name was given by him to these particles?

Solution 7

Kanad ; 'parmanu'.

Question 8

Name any two laws of chemical combination.

Solution 8

Law of Conservation of mass and law of constant proportions.

Question 9

'If 100 grams of pure water taken from different sources is decomposed by passing electricity, 11 grams of hydrogen and 89 grams of oxygen are always obtained'. Which chemical law is illustrated by this statement?

Solution 9

Law of constant proportions.

Question 10

'If 100 grams of calcium carbonate(whether in the form of marble or chalk) are decomposed completely, then 56 grams of calcium oxide and 44 grams of carbon dioxide are obtained'. Which law of chemical combination is illustrated by this statement?

Solution 10

Law of Conservation of mass.

Question 11

What are the building blocks of matter?

Solution 11
Atoms are the building blocks of matter.

Question 12
How is the size of an atom indicated?

Solution 12
The size of an atom indicated by its radius which is called 'atomic radius'.

Question 13
Name the unit in which the radius of an atom is usually expressed.

Solution 13
The radius of an atom is usually expressed in 'nanometers'.

Question 14
Write the relation between nanometer and meter.

Solution 14
1 nanometer = 10^{-9} m

Question 15
The radius of an oxygen atom is 0.073 nm. What does the symbol 'nm' represent?

Solution 15
'nm' represents nanometer.

Question 16
Why is it not possible to see an atom even with the most powerful microscope?

Solution 16
Because they are very very small.

Question 17
State whether the following statement is true or false:

The symbol of element cobalt is CO.

Solution 17
False ; it is Co

Question 18
Define 'molecular mass' of a substance.

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.

Question 19
What is meant by saying that 'the molecular mass of oxygen is 32'?

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

Question 20
Fill in the following blanks with suitable words:
(a) In water, the proportion of oxygen and hydrogen is _____ by mass.
(b) In a chemical reaction, the sum of the masses of the reactants and the products remains unchanged. This is called _____.

Solution 20
(a) 1:8
(b) Conservation of mass

Question 21
(a) Name the element used as a standard for atomic mass scale.
(b) Which particular atom of the above element is used for this purpose?
(c) What value has been given to the mass of this reference atom?

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

Question 22

Give one major drawback of Dalton's atomic theory of matter.

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.

Question 23

Dalton's atomic theory says that atoms are indivisible. Is this statement still valid? Give reasons for your answer.

Solution 23

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

Question 24

Is it possible to see atoms these days? Explain your answer.

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.

Question 25

What is meant by the symbol of an element? Explain with examples.

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".

Question 26

(a) Give two symbols which have been derived from the 'English names' of the elements.
(b) Give two symbols which have been derived from the 'Latin names' of the elements.

Solution 26

(a)Ca, Mg
(b)Cu, Hg

Question 27

Give the names and symbols of five familiar substances which you think are elements.

Solution 27

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

Question 28

State the chemical symbols for the following elements: Sodium, Potassium, Iron, Copper, Mercury, Silver

Solution 28

Sodium - Na
Potassium - K
Iron - Fe
Copper - Cu
Mercury - Hg
Silver - Ag

Question 29

Name the elements represented by the following symbols:

Hg, Pb, Au, Ag, Sn

Solution 29

Hg - Mercury
Pb - Lead
Au - Gold
Ag - Silver
Sn - Tin

Question 30

What is meant by atomicity? Explain with two examples.

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.

Question 31

What is the atomicity of the following?
(a) Oxygen (b) Ozone (c) Neon (d) Sulphur (e) Phosphorus (f) Sodium

Solution 31

(a) Oxygen = 2
(b) Ozone = 3
(c) Neon = 1
(d) Sulphur = 8
(e) Phosphorus = 4
(f) Sodium = 1

Question 32

What is meant by a chemical formula? Write the formulae of one element and one compound.

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

Question 33
Write the formulae of the following compounds. Also name the elements present in them.
(a) Water (b) Ammonia (c) Methane (d) Sulphur dioxide (e) Ethanol

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.

Question 34
Explain the difference between 2N and N_2.

Solution 34
2N represents two separate atoms of nitrogen and N_2 represents one molecule of nitrogen.

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Question 35
What do the following abbreviations stand for?
(i) O (ii) 2O (iii) O_2 (iv) $3O_2$

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

Question 36

What do the symbols, H_2, S and O_4 mean in the formula H_2SO_4?

Solution 36

H_2 represents two atoms of hydrogen, one atom of sulphur and four atoms of oxygen.

Question 37

(a) In what form does oxygen gas occur in nature?
(b) In what form do noble gases occur in nature?

Solution 37

(a) Oxygen gas occurs as a diatomic molecule in nature.
(b) Noble gases occur as monoatomic gases in nature.

Question 38

What is the difference between 2H and H_2 ?

Solution 38

2H represents two separate atoms of hydrogen and H_2 represents one molecule of hydrogen.

Question 39

What do the following denote?
(i) N (ii) 2N (iii) N_2 (iv) $2N_2$

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

Question 40

What is the significance of the formula of a substance?

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.

Question 41

What is the significance of the formula of H_2O?

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 6.022×10^{23} molecules of water.
4. It represents 18gm of water.

Question 42

The molecular formula of glucose is $C_6H_{12}O_6$. Calculate its molecular mass.(Atomic masses: C = 12 u ; H = 1 u ; O = 16 u)

Solution 42

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

Question 43

Calculate the molecular masses of the following:

(a) Hydrogen, H_2

(b) Oxygen, O_2

(c) Chlorine, Cl_2

(d) Ammonia, NH_3

(e) Carbon dioxide, CO_2

(Atomic masses: C = 12 u ; H = 1 u ; O = 16 u; Cl =35.5u; N =14 u)

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

Question 44

Calculate the molecular masses of the following compounds:
(a) Methane, CH_4 (b) Ethane, C_2H_6
(c)Ethene, C_2H_4 (d)Ethyne, C_2H_2
(Atomic masses : C = 12u, H= 1u)

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

Question 45

Calculate the molecular masses of the following compounds:
(a) Methanol, CH_3OH (b) Ethanol, C_2H_5OH

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

Question 46

Calculate the molecular mass of ethanoic acid, CH_3COOH.
(Atomic masses : C = 12 u; H = 1 u; O = 16 u)

Solution 46

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

Question 47

Calculate the molecular mass of Nitric acid, HNO_3.
(Atomic masses: H = 1 u; N = 14 u; O = 16 u)

Solution 47

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

Question 48

Calculate the molecular mass of chloroform($CHCl_3$).
(Atomic masses: C = 12 u; H = 1 u; Cl = 35.5 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

Question 49

Calculate the molecular mass of hydrogen bromide (HBr).
(Atomic masses: H = 1 u; Br = 80 u)

Solution 49

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

Question 50

Calculate the molecular masses of the following compounds:

(a) Hydrogen sulphide, H_2S
(b) Carbon disulphide, CS_2
(Atomic masses: H = 1 u, S = 32 u, C = 12 u)

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

Question 51

State the law of conservation of mass. Give one example to illustrate this law.

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.

Question 52

State the law of constant proportions. Give one example to illustrate this law.

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.

Question 53

(a) State the various postulates of Dalton's atomic theory of matter.
(b) Which postulate of Dalton's atomic theory can explain the law of conservation of mass?
(c) Which postulate of Dalton's atomic theory can explain 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.

Question 54

(a) What is the significance of the symbol of an element? Explain with the help of an example.
(b) Explain the significance of the symbol H.

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.

Question 55

(a) What is an atom? How do atoms usually exist ?

(b) What is a molecule? Explain with an example.
(c) What is the difference between the molecule of an element and the molecule of a compound? Give one example of each.

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 O_3 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.

Question 56

(a) Define atomic mass unit. What is its symbol?
(b) Define atomic mass of an element.
(c) What is meant by saying that 'the atomic mass of oxygen is 16'?

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.

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Question 75

Copper sulphate reacts with sodium hydroxide to form a blue precipitate of copper hydroxide and sodium sulphate. In an experiment, 15.95 g of copper sulphate reacted with 8.0 g of sodium hydroxide to form 9.75 g of copper hydroxide and 14.2 g of sodium sulphate. Which law of chemical combination is illustrated by this data? Give reason for your choice.

Solution 75

According to question-

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.

Question 77

In an experiment, 4.90 g of copper oxide was obtained from 3.92 g of copper. In another experiment, 4.55 g of copper oxide gave, on reduction, 3.64 g of copper. Show with the help of calculations that these figures verify the law of constant proportions.

Solution 77

According to question-

Reaction 1-

$$\underset{(3.92\ gm)}{2\,Cu} + \underset{(4.90-3.92 = 0.98gm)}{O_2} \rightarrow \underset{(4.90\ gm)}{2CuO}$$

So, 1 equivalent of Cu reacts with 0.25 equivalent of O_2 to form 1.25 equivalent of copper oxide.
Reaction 2-

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.

Question 78

Magnesium and oxygen combine in the ratio of 3 : 2 by mass to form magnesium oxide. What mass of oxygen gas would be required to react completely with 24 g of magnesium?

Solution 78

According to question-

i.e. three equivalents of Mg reacts with 2 equivalents of O_2 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

Chapter - Exercise

Solution

Solution

Solution

Solution

Solution

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Question 79

When 5 g of calcium is burnt in 2g of oxygen, then 7 g of calcium oxide is produced. What mass of calcium oxide will be produced when 5 g of calcium is burnt in 20 g of oxygen? Which law of chemical combination will govern your answer?

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.

Question 80

A liquid compound X of molecular mass 18 u can be obtained from a number of natural sources. All the animals and plants need liquid X for their survival. When an electric current is passed through 200 grams of pure liquid X under suitable conditions, then 178 grams of gas Y and 22 grams of gas Z are produced. Gas Y is produced at the positive electrode whereas gas Z is obtained at the negative electrode. Moreover, gas Y supports combustion whereas gas Z burns itself causing explosions.
(a) Name (i) liquid X, (ii) gas Y and (iii) gas Z.
(b) What is the ratio of the mass of element Z to the mass of element Y in the liquid X?
(c) Which law of chemical combination is illustrated by this example?

(d) Name two sources of liquid X.
(e) State an important use of Y in our life.

Solution 80

According to question-

(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.

Question 81

One of the forms of a naturally occurring solid compound P is usually used for making the floors of houses. On adding a few drops of dilute hydrochloric acid to P, brisk effervescence are produced. When 50 g of reactant P was heated strongly, then 22 g of a gas Q and 28 g of a solid R were produced as products. Gas Q is the same which produced brisk effervescence on adding dilute HCl to P. Gas Q is said to cause global warming whereas solid R is used for white-washing.
(a) What is (i) solid P; (ii) gas Q, and (iii) solid R?
(b) What is the total mass of Q and R obtained from 50 g of P?
(c) How does the total mass of Q and R formed compare with the mass of P taken?
(d) What conclusion do you get from the comparison of masses of products and reactant?
(e) Which law of chemical combination is illustrated by the example given in this problem?

Solution 81

According to question-

(a) Solid P - Calcium Carbonate ($CaCO_3$)
Gas Q - Carbon dioxide (CO_2)
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.

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Question 1

What do we call those particles which have more or less electrons than the normal atoms?

Solution 1

Ions

Question 2

What do we call those particles which have :
(a) more electrons than the normal atoms?
(b) less electrons than the normal atoms?

Solution 2

(a). Anions ; (b). Cations

Question 3

Define 'formula mass' of a compound.

Solution 3

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.

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Question 4

What do we call those particles which are formed:
(a) by the gain of electrons by atoms?

(b) by the loss of electrons by atoms?

Solution 4

(a) Anions are formed by the gain of electrons by atoms

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

Question 5

State whether the following statements are true or false:

(a) A sodium ion has positive charge because it has more protons than a neutral atom

(b) A chloride ion has negative charge because it has more electrons than a neutral atom.

Solution 5

(a) False

(b) True

Question 6

Write down the formulae for the following compounds:

(a) Calcium oxide (b) Magnesium hydroxide

Solution 6

(a). Calcium oxide - CaO

(b). Magnesium hydroxide - $Mg(OH)_2$

Question 7

An element Z has a valency of 3. What is the formula of oxide of Z ?

Solution 7

Valency of element Z = 3

Valency of oxygen = 2

So, formula of oxide of element = Z_2O_3

Question 8

What is the name of a particle which contains 10 electrons, 11 protons and 12 neutrons?

Solution 8

Its Na^+, the sodium ion.

Question 9

Name the particle which has 18 electrons, 18 neutrons and 17 protons in it.

Solution 9

Its Cl^-, the chloride ion.

Question 10

Fill in the following blanks with suitable words:
(a) The particle which is formed by the gain of electrons by an atom is called _____.

(b) The particle which is formed by the loss of electrons by an atom is called _____.
(c) The particle which is formed by the loss or gain of electrons by an atom is called _____.
(d) A potassium ion has positive charge because it contains less _____ than _____.
(e) A sulphide ion has negative charge because it contains less _____ than _____.

Solution 10

(a) Anion
(b) Cation
(c) Ion
(d) Electrons ; protons
(e) Protons ; electrons

Question 11

Name the element water is made of. What are the valencies of these elements ? Work out the chemical formula for water.

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 H_2O.

Question 12

If the valency of hydrogen is 1 and that of nitrogen is 3, work out formula for ammonia.

Solution 12

So, chemical formula of ammonia is NH_3.

Question 13

Work out the formula for sulphur dioxide. (Valencies : S = 4; O = 2)

Solution 13

Chemical formula of sulphur dioxide is SO_2.

Question 14

If the valency of carbon is 4 and that of sulphur is 2, work out the formula of the compound formed by the combination of carbon with sulphur. What is the name of compound?

Solution 14

According to question-

Name and formula of the resulting compound is Carbon disulphide; CS_2.

Question 15

An element X has a valency of 4 whereas another element Y has a valency of 1. What will be the formula of the compound formed between X and Y?

Solution 15

As the valency of element X is 4 and that of Y is 1, so the resulting formula is XY_4.

Question 16

An element B shows valency of 4 and 6. Write the formulae of its two oxides.

Solution 16

When the valency shown by B is 4, then-

The resulting compound is BO_2.

When the valency shown by B is 6, then-

The resulting compound is BO_3.

Question 17

An element X of valency 3 combines with another element Y of valency 2. What will be the formula of the compound formed.

Solution 17

Thus, the resulting compound is X_2Y_3.

Question 18

Work out the formula for magnesium hydrogen carbonate.

Solution 18

Thus, the resulting compound is $Mg(HCO_3)_2$

Question 19

An element X has a Valency of 2. Write the simplest formula for:

(a) Bromide of the element

(b) oxide of the element

Solution 19

(a). Bromide of element-

As valency of bromine is -1 and that of element X is +2 so, the resulting compound is XBr_2.

(b). Oxide of element-

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

Question 20

Work out the formulae for the following compounds :
(a) Sodium oxide (b) Calcium carbonate

Solution 20

(a). Sodium oxide-

Thus, the formula of sodium oxide is Na_2O.
(b). Calcium carbonate-

Thus, the resulting compound is $CaCO_3$.

Question 21

Calculate the formula masses of the following compounds:
(i) Sodium oxide, Na_2O
(ii) Aluminium oxide, Al_2O_3
(Given : Atomic masses : Na =23 u ; O=16 u; Al = 27 u)

Solution 21

(a).Molecular mass of Na_2O = (2 x Na) + (1 x O) = (2 x 23) + (1 x 16) = 62u
(b). Molecular Mass of Al_2O_3 = (2 x Al) + (3 x O) = (2 x 27) + (3 x 16) = 102u

Question 23

Write the cations and anions present, if any, in the following:
(a) CH_3COONa (b) NaCl (c) H_2 (d) NH_4NO_3

Solution 23

(a). CH_3COONa : Na^+ (cation) and CH_3COO^- (anion)
(b). NaCl : Na^+ (cation) and Cl^- (anion)
(c). H_2 : It is a covalent molecule. So, cation and anion are not present.

(d). NH_4NO_3 : NH_4^+ (cation) and NO_3^- (anion)

Question 24

Give the formulae of the compounds formed from the following sets of elements:

(a) calcium and fluorine (b) hydrogen and sulphur

(c) nitrogen and hydrogen (d) carbon and chlorine

(e) sodium and oxygen (f) carbon and oxygen

Solution 24

Question 25

What are (i) ionic compounds, and (ii) molecular compounds ? Give two examples of each type of compounds.

Solution 25

i. Ionic compounds- The compounds which are formed by combination of metals and non-metals are called ionic compounds. For ex: $CaCl_2$ and $CaCO_3$.

ii. Molecular compounds- These compounds are formed by the combination between two non-metal elements. For ex. HCl and H_2S.

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Question 27

(a) What is the difference between a cation and anion ? Explain with examples.

(b) The valencies (or Charges) of some of the ions given below:

Ion	Valency (charge)	Ion	Valency (charge)
Sodium ion	1 +	Nitrate ion	1 -
Copper ion	2 +	Sulphide ion	2 -

Using this information, write down the formulae of:

(i) Sodium sulphide
(ii) Copper nitrate

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). Na_2S
(ii). $Cu(NO_3)_2$

Question 28

Explain the formation of (i) sodium ion, and (ii) chloride ion, from their respective atoms giving the number of protons and number of electrons in each one of them. What is the reason for positive charge on a so ion and negative charge on a chloride ion?

Solution 28

(i).

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

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

Question 29

(a) Write the symbols/formulae of two simple ions and two compound ions (or polyatomic ions).
(b) An element Y has a valency of 4. Write the formula for its:
(i) chloride (ii) oxide (iii) sulphate (iv) carbonate (v) nitrate

Solution 29

(a). Simple ions: Br^- and Na^+ ; Compound ions: NH_4^+ and Al^{+3}
(b). (i). YCl_4 (ii). YO_2 (iii). $Y(SO_4)_2$ (iv). $Y(CO_3)_2$ (v). $Y(NO_3)_4$

Question 30

(a) Define 'formula unit' of an ionic compound. What is the formula unit of (i) sodium chloride, and
(ii) magnesium chloride ?
(b) Calculate the formula masses of the following compounds:
(i) Calcium chloride (ii) Sodium carbonate
(given : Atomic Masses : Ca = 40 u; Cl = 35.5 u; Na = 23 u; C = 12 u; O = 16 u)

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 - $MgCl_2$
(b).
(i). Formula Mass of Calcium chloride ($CaCl_2$) = 1xCa + 2xCl = (40+71) u = 111 u
(ii). Formula Mass of Sodium carbonate (Na_2CO_3) = 2xNa + 1xC + 3xO= (2x23 + 1x12 + 3x16) u = 106 u

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Question 46

An element A forms an oxide A_2O_5.
(a) What is the valency of element A?
(b) What will be the formula of chloride of A?

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 ACl_5.

Question 47
An element X forms the following compounds with hydrogen, carbon and oxygen:

State the three valencies of element X which are illustrated by these compounds.

Solution 47
Valency of X -

(i). In H_2X : -2
(ii).In CX_2 : -2
(iii).In XO_2 : +4
(iv).In XO_3 : +6

Question 48
If the aluminium salt of an anion is Al_2X_3, what is the valency of X? What will be the formula of the magnesium salt of X?

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.

Question 49
The formula of carbonate of a metal M is $M_2 CO_3$.
(a) What will be the formula of its iodide?
(b) What will be the formula of its nitride?
(c) What will be the formula of its phosphate?

Solution 49

According to formula M_2CO_3, valency of M is +1.
(a). formula of iodide = MI (as valency of iodine is -1)
(b). formula of nitride = M_3N (as valency of nitrogen is -3)
(c). formula of phosphate = M_3PO_4

Question 50

The atom of an element X contains 17 protons, 17 electrons and 18 neutrons whereas the atom of an element Y contains 11 protons, 11 electrons and 12 neutrons.
(a) What type of ion will be formed by an atom of element X? Write the symbol of ion formed.
(b) What will be the number of (i) protons (ii) electrons, and (iii) neutrons, in the ion formed from X?
(c) What type of ion will be formed by an atom of element Y? Write the symbol of ion formed.
(d) What will be the number of (i) protons (ii) electrons, and (iii) neutrons, in the ion formed from Y?
(e) What is the atomic mass of (i) X, and (ii) Y?
(f) What could the elements X and Y be?

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).

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Question 2

What name is given to the amount of substance containing 6.022×10^{23} particles (atoms, molecules or ions) of a substance?

Solution 2

1 mole

Question 3

What is the numerical value of Avogadro number?

Solution 3

6.022×10^{23}

Question 4

How many atoms are present in one gram atomic mass of a substance?

Solution 4

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

Question 5

How many molecules are present in one gram molecular mass of a substance?

Solution 5

6.022×10^{23}

Question 6

What name is given to the number $6.022 \text{ X } 10^{23}$?

Solution 6

Avogadro number

Question 7

Convert 12 g of oxygen gas into moles.

Solution 7

Given mass of oxygen = 12g
Molar mass of oxygen = 32g

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

Question 8

How many moles are 3.6 g of water?

Solution 8

No. of moles = 3.6g / 18g = 0.2 mole

Question 9

What is the mass of 0.2 mole of oxygen atoms?

Solution 9

Mass of 0.2 moles of oxygen atoms = 0.2 x 16 = 3.2g

Question 10

Find the mass of 2 moles of nitrogen atoms?

Solution 10

Mass of 2 moles of nitrogen atoms = 2 x 14 = 28g

Question 11

Fill in the following blank:
(a) 1 mole contains _____ atoms, molecules or ions of a substance.
(b) A mole represents an _____ number of particles of a substance.
(c) 60 g of carbon element are _____ moles of carbon atoms.
(d) 0.5 mole of calcium element has a mass of _____
(e) 64 of oxygen gas contains _____ moles of oxygen atoms.

Solution 11

(a). 6.022×10^{23}
(b). Avogadro
(c). 60/12 = 5
(d). 0.5 x 40 g = 20 g
(e). 64g/16g = 4

Question 12

(a) How many atoms are there in exactly 12 g of carbon-12 element? (C = 12 u)
(b) What name is given to this number?
(c) What name is given to the amount of substance containing this number of atoms?

Solution 12

(a). 6.022×10^{23} atoms

(b). One Mole
(c). Avogadro's number

Question 13

Calculate the mass of 12.044×10^{25} molecules of oxygen (O_2).

Solution 13

One mole of O_2 = 32 gm
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

Question 14

What is the number of molecules in 1.5 moles of ammonia?

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

$= 9.033 \times 10^{23}$ molecules of ammonia.

Question 15

How many moles of calcium carbonate ($CaCO_3$) are present in 10 g of the substance? (Ca = 40 u; C = 12 O = 16 u)

Solution 15

Given mass of $CaCO_3$ = 10g
Molar mass of $CaCO_3$ = 1xCa + 1xC + 3xO = (40+12+48)gm = 100gm
So, no. of moles of $CaCO_3$ = Given mass/Molar mass = 10/100 = 0.1 moles

Question 16

How many moles of O_2 are there in 1.20×10^{22} oxygen molecules?

Solution 16

One mole of O_2 contains = 6.022×10^{23} molecules of oxygen
So, 1 molecule 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

Question 17

If one mole of nitrogen molecules weighs 28 g, calculate the mass of one molecule of nitrogen in grams.

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

Question 18

How many moles are there in 34.5 g of sodium? (Atomic mass of Na = 23 u)

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.

Question 19

What is the number of zinc atoms in a piece of zinc weighing 10 g?
(Atomic mass of Zn=65 u)

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

Question 20

Calculate the mass of 3.011×10^{24} atoms of carbon.

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

Question 21

If 16 g of oxygen contains 1 mole of oxygen atoms, calculate the mass of one atom of oxygen.

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.

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Question 22

How many atoms are there in 0.25 mole of hydrogen?

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.

Question 24

Calculate the number of molecules present in a drop of chloroform ($CHCl_3$) weighing 0.0239 g. (Atomic masses : C = 12 u ; H = 1 u; Cl = 35.5 u)

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 = $0.0002 \times 6.022 \times 10^{23}$

$= 12.044 \times 10^{19}$ molecules

Question 25

What is the mass of 5 moles of sodium carbonate (Na_2CO_3)?

(Atomic masses : Na = 23 u; C = 12 u; O = 16 u)

Solution 25

1 mole of Na_2CO_3 = 106g

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

Question 26

Calculate the number of molecules in 4 g of oxygen.

Solution 26

32 g of oxygen (1 mole of oxygen) has = 6.022 x 10^{23} molecules of oxygen
So, 4 g of oxygen will have = 6.022 x 10^{23} x 4/32 = 7.528 x 10^{22} molecules of oxygen.

Question 27

How many moles are represented by 100 g of glucose, $C_6H_{12}O_6$? (C = 12 u, H = 1 u, O = 16 u)

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

Question 28

Calculate the mass in grams of 0.17 mole of hydrogen sulphide, H_2S.
(Atomic masses: H = 1 u, S = 32 u)

Solution 28

1 mole of H_2S weighs = 34 g
So, 0.17 mole of H_2S will weigh = 34 x 0.17 g = 5.78 g

Question 29

Show by means of calculations that 5 moles of CO_2 and 5 moles of H_2O do not have the same mass. How much is the difference in their masses?

Solution 29

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

Question 30

Calculate the mole ratio of 240 g of calcium and 240 g of magnesium . (Ca = 40 u; Mg =24 u)

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

Question 31

(a) Define mole. What are the two things that a mole represents.
(b) What weight of each element is present in 1.5 moles of sodium sulphite, Na_2SO_3?

(Atomic masses: Na = 23 u ; S = 32 u; O = 16 u)

Solution 31

(a). A group of 6.022×10^{23} particles (atoms, molecules or ions) of a substance is called a mole of that substance. One mole represents the amount 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 mole of S and 4.5 moles of O.
Thus, mass of sodium = 3 x 23 g = 69g
Mass of sulphur = 1.5 x 32 = 48g
Mass of oxygen = 4.5 x 16 g = 72g

Question 32

(a) What is meant by 'a mole of carbon atoms'?
(b) Which has more atoms, 50 g of aluminium or 50 g of iron? Illustrate your answer with the help of calculations.
(Atomic masses: Al = 27 u; Fe = 56 u)

Solution 32

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

(b) 1 mole of aluminium weighing 27g has = 6.022×10^{23} atoms of Al

So, 1g of Al has = 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.

Question 33

(a) Define gram atomic mass of a substance . How much is the gram atomic mass of oxygen?

(b) How many moles of oxygen atoms are present in one mole of the following compounds ?

(i) Al_2O_3 (ii) CO_2 (iii) Cl_2O_7 (iv) H_2SO_4 (V) $Al_2(SO_4)_3$

Solution 33

(a). The amount of substance whose mass in grams is numerically equal to its atomic mass, is called gram atomic mass of that substance.

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

Question 34

(a) Define gram molecular mass of a substance . How much is the gram molecular mass of oxygen ?
(b) If sulphur exists as S_8 molecules, calculate the number of moles in 100 g of sulphur. (S = 32 u)

Solution 34

(a). The amount of substance whose mass in grams is numerically equal to its molecular mass is called gram molecular mass of that substance.

Gram molecular mass of the oxygen is 32g.
(b). Given mass of sulphur = 100g
Molar mass of S_8 = 32 x 8 g = 256g
No. of moles = Given mass / Molar mass = 100/ 256 = 0.39 moles.

Question 35

(a) What is meant by the 'molar mass' of a substance? State the unit in which molar mass is usually expressed.
(b) Calculate the molar masses of the following substances. Write the results with proper units.
(i) Ozone molecule, O_3 (ii) Ethanoic acid, CH_3COOH

Solution 35

(a). The molar mass of the substance is the mass of 1 mole of that substance. Molar mass is generally expressed in grams or 'g'.
(b).
(i). Molar mass of ozone (O_3) = 3 x gram atomic mass of O = 3 x 16 g = 48 g/ mole
(ii). Molar mass of Ethanoic acid (CH_3COOH) = 2xC + 4xH + 2xO
= (24 + 4 + 32)u = 60 g/ mole

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Question 43

If 1 gram of sulphur dioxide contains x molecules, how many molecules will be present in 1 gram of oxygen? (S =32 u; O = 16 u)

Solution 43

1 mole of SO_2 = Mass of S + 2 x Mass of O = 64 grams
64 g 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.
32 g of oxygen = 1 mole
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 x 64/32 = 2x molecules

Question 44

The mass of one molecule of a substance is 4.65×10^{-23} g. What is its molecular mass? What could the substance be?

Solution 44

Mass of one molecule 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 = 28 u
The substance is Nitrogen with molecular mass 28 u.

Question 45

Which contains more molecules, 10 g of sulphur dioxide (SO_2) or 10 g of oxygen (O_2)?
(Atomic masses : S = 32 u ; O = 16 u)

Solution 45

Molar mass of SO_2 = (32 + 2x16) 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.

Question 46

What weight of oxygen gas will contain the same number of molecules as 56 g of nitrogen gas ? (O =16= N u; 14 u)

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 susbtances 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 x 16g = 64 g

Question 47

What mass of nitrogen, N_2, will contain the same number of molecules as 1.8 g of water, H_2O? (Atom masses : N =14 u; H = 1 u ; O = 16 u)

Solution 47

Given mass of water = 1.8g
Molar mass of water = 18g
No. of moles of water = 1.8g/18g = 0.1 moles
Equal number of moles of all the susbtances 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 x 28 g = 2.8 g

Question 48

If one gram of sulphur contains x atoms, calculate the number of atoms in one gram of oxygen element (Atomic masses: S = 32 u; O = 16 u)

Solution 48

32 g of S = 1 mole
So, 1 g 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.
16 g of oxygen = 1 mole
So, 1 g of oxygen = 1/16 mole
Now, 1/32 mole of oxygen contains = x atoms
So, 1/16 mole of oxygen will contain = x x 32/16 = 2x atoms

Question 49

How many grams of magnesium will have the same number of atoms as 6 grams of carbon?

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 susbtances 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 mole of magnesium = 0.5 x 24g = 12g

Question 50

The mass of one atom of an element X is 2.0×10^{-23} g.
(i) Calculate the atomic mass of element X.

(ii) What could element X be ?

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.