

Science

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(Chapter – 3) (Atoms and Molecules)

(Class – IX)

Exercises

Question 1:

A 0.24 g sample of compound of oxygen and boron was found by analysis to contain 0.096 g of boron and 0.144 g of oxygen. Calculate the percentage composition of the compound by weight.

Answer 1:

Mass of boron = 0.096g (Given)

Mass of oxygen = 0.144g (Given)

Mass of sample = 0.24g (Given)

Thus, percentage of boron by weight in the compound = $\frac{0.096 \times 100}{0.24} \%$

= 40%

Thus, percentage of oxygen by weight in the compound = $\frac{0.144 \times 100}{0.24} \%$

= 60 %

Question 2:

When 3.0 g of carbon is burnt in 8.00 g oxygen, 11.00 g of carbon dioxide is produced. What mass of carbon dioxide will be formed when 3.00 g of carbon is burnt in 50.00 g of oxygen? Which law of chemical combinations will govern your answer?

Answer 2:

Carbon + Oxygen → Carbon dioxide

3g of carbon reacts with 8 g of oxygen to produce 11g of carbon dioxide. If 3g of carbon is burnt in 50g of oxygen, then 3g of carbon will react with 8 g of oxygen. The remaining 42 g of oxygen will be left un-reactive. In this case also, only 11g of carbon dioxide will be formed. The above answer is governed by the law of constant proportions.

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Question 3:

What are polyatomic ions? Give examples?

Answer 3:

A polyatomic ion is a group of atoms carrying a charge (positive or negative).

For example, ammonium ion (NH_4^+), hydroxide ion (OH^-), carbonate ion (CO_3^{2-}), sulphate ion (SO_4^{2-}).

Question 4:

Write the chemical formula of the following:

- (a) Magnesium chloride
- (b) Calcium oxide
- (c) Copper nitrate
- (d) Aluminium chloride
- (e) Calcium carbonate

Answer 4:

- (a) Magnesium chloride $\rightarrow MgCl_2$
- (b) Calcium oxide $\rightarrow CaO$
- (c) Copper nitrate $\rightarrow Cu(NO_3)_2$
- (d) Aluminium chloride $\rightarrow AlCl_3$
- (e) Calcium carbonate $\rightarrow CaCO_3$

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Question 5:

Give the names of the elements present in the following compounds:

- (a) Quick lime
- (b) Hydrogen bromide
- (c) Baking powder
- (d) Potassium sulphate.

Answer 5:

Compound	Chemical formula	Elements present
Quick lime	CaO	Calcium, oxygen
Hydrogen bromide	HBr	Hydrogen, bromine
Baking powder	NaHCO ₃	Sodium, hydrogen, carbon, oxygen
Potassium sulphate	K ₂ SO ₄	Potassium, sulphur, oxygen

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Question 6:

Calculate the molar mass of the following substances:

- (a) Ethyne, C_2H_2
- (b) Sulphur molecule, S_8
- (c) Phosphorus molecule, P_4 (atomic mass of phosphorus = 31)
- (d) Hydrochloric acid, HCl
- (e) Nitric acid, HNO_3

Answer 6:

- (a) Molar mass of ethyne, C_2H_2 = $2 \times 12 + 2 \times 1 = 28g$
- (b) Molar mass of sulphur molecule, S_8 = $8 \times 32 = 256g$
- (c) Molar mass of phosphorus molecule, P_4 = $4 \times 31 = 124g$
- (d) Molar mass of hydrochloric acid, HCl = $1 + 35.5 = 36.5g$
- (e) Molar mass of nitric acid, HNO_3 = $1 + 14 + 3 \times 16 = 63g$

Question 7:

What is the mass of

- (a) 1 mole of nitrogen atoms?
- (b) 4 mole of aluminium atoms (Atomic mass of aluminium = 27)?
- (c) 10 moles of sodium sulphite (Na_2SO_3)?

Answer 7:

- (a) The mass of 1 mole of nitrogen atoms is 14g.
- (b) The mass of 4 moles of aluminium atoms is $(4 \times 27)g = 108g$
- (c) The mass of 10 moles of sodium sulphite (Na_2SO_3) is $10 \times [2 \times 23 + 32 + 3 \times 16]g$
 $= 10 \times 126g = 1260g$

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Question 8:

Convert into mole.

- (a) 12g of oxygen gas
- (b) 12g of water
- (c) 22g of carbon dioxide

Answer 8:

(a) 32 g of oxygen gas = 1 mole

Then, 12g of oxygen gas = $12/32$ mole = 0.375 mole

(b) 18g of water = 1 mole

Then, 20 g of water = $20/18$ mole = 1.11 moles (approx.)

(c) 44g of carbon dioxide = 1 mole

Then, 22g of carbon dioxide = $22/44$ mole = 0.5 mole

Question 9:

What is the mass of:

- (a) 0.2 mole of oxygen atoms?
- (b) 0.5 mole of water molecules?

Answer 9:

(a) Mass of one mole of oxygen atoms = 16g

Then, mass of 0.2 mole of oxygen atoms = $0.2 \times 16\text{g} = 3.2\text{g}$

(b) Mass of one mole of water molecule = 18g

Then, mass of 0.5 mole of water molecules = $0.5 \times 18\text{g} = 9\text{g}$

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Question 10:

Calculate the number of molecules of sulphur (S_8) present in 16g of solid sulphur.

Answer 10:

1 mole of solid sulphur (S_8) = $8 \times 32\text{g} = 256\text{g}$

i.e., 256g of solid sulphur contains = 6.022×10^{23} molecules

Then, 16g of solid sulphur contains $\frac{6.022 \times 10^{23}}{256} \times 16$ molecules

= 3.76×10^{22} molecules (approx)

Question 11:

Calculate the number of aluminium ions present in 0.051g of aluminium oxide.

(Hint: The mass of an ion is the same as that of an atom of the same element. Atomic mass of Al = 27u)

Answer 11:

1 mole of aluminium oxide (Al_2O_3) = $2 \times 27 + 3 \times 16 = 102\text{g}$

i.e., 102g of $Al_2O_3 = 6.022 \times 10^{23}$ molecules of Al_2O_3

Then, 0.051 g of Al_2O_3 contains = $\frac{6.022 \times 10^{23}}{102} \times 0.051$ molecules

= 3.011×10^{20} molecules of Al_2O_3

The number of aluminium ions (Al^{3+}) present in one molecules of aluminium oxide is 2.

Therefore, The number of aluminium ions (Al^{3+}) present in

3.11×10^{20} molecules (0.051g) of aluminium oxide (Al_2O_3) = $2 \times 3.011 \times 10^{20}$

= 6.022×10^{20}