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Class 11
Chemistry

Chapter 4
stoichiometry
Handwritten Notes

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CH 4: STIOCHIOMETRY

Mole

A mole is the amount of substance that contains 6.023×10^{23} representative particles. This experimentally determined number is called Avogadro's number. Just as a dozen represent 12 identical things, a mole represents 6.023×10^{23} particles of a substance. For example, a mole of carbon is 6.023×10^{23} carbon atoms. A mole of sodium is 6.023×10^{23} Na atoms. One mole of water is 6.023×10^{23} H₂O molecules. The atomic mass, formula mass and molecular weight of a substance in grams are equal to one mole of the substance.

One mole of O atoms = 16g One mole of O₂ atoms = 32g

One mole of H₂O molecules = 18g One mole of Na⁺ ions = 23g

Molar Mass

Molar Mass is defined as the mass in grams of one mole of a substance. The term molar mass is also used to the mass of a mole of any substance. It is the atomic mass of an atom or the sum of atomic masses of all the atoms in a molecule, an ion or a formula unit.

$$\begin{aligned}\text{H}_2\text{SO}_4 &= 2\text{H} + \text{S} + 4\text{O} \\ &= (2 \times 1) + (1 \times 32) + (4 \times 16) \\ &= 2 + 32 + 64 \\ &= 98 \text{ amu (molecular mass)}\end{aligned}$$

Molar mass of sulphuric acid (H₂SO₄) = 98g/mol.

Determination of number of moles

$$\text{Number of mole (n)} = \frac{\text{Mass (grams)}}{\text{Molar Mass (g/mol)}}$$

$$\text{Number of mole (n)} = \frac{\text{Number of particles (atoms, molecules, formula units)}}{\text{Particles per mole or Avogadro's no. (mol}^{-1}\text{)}}$$

Molar Volume

The volume occupied by one mole of an ideal gas at standard temperature and pressure (STP) is called molar volume. Molar Volume is equal to 22.414 dm³ or 22414 cm³ or 22.414 L.

For example,

$$\begin{aligned}2.016 \text{ g of H}_2 &= 1 \text{ mole of H}_2 \\ &= 6.022 \times 10^{23} \text{ molecules of H}_2 \\ &= 22.414 \text{ dm}^3 \text{ volume of H}_2 \text{ at STP.}\end{aligned}$$

$$\begin{aligned}16 \text{ g of CH}_4 &= 1 \text{ mole of CH}_4 \\ &= 6.022 \times 10^{23} \text{ molecules of CH}_4 \\ &= 22.414 \text{ dm}^3 \text{ volume of CH}_4 \text{ at STP.}\end{aligned}$$

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momina_arshadd

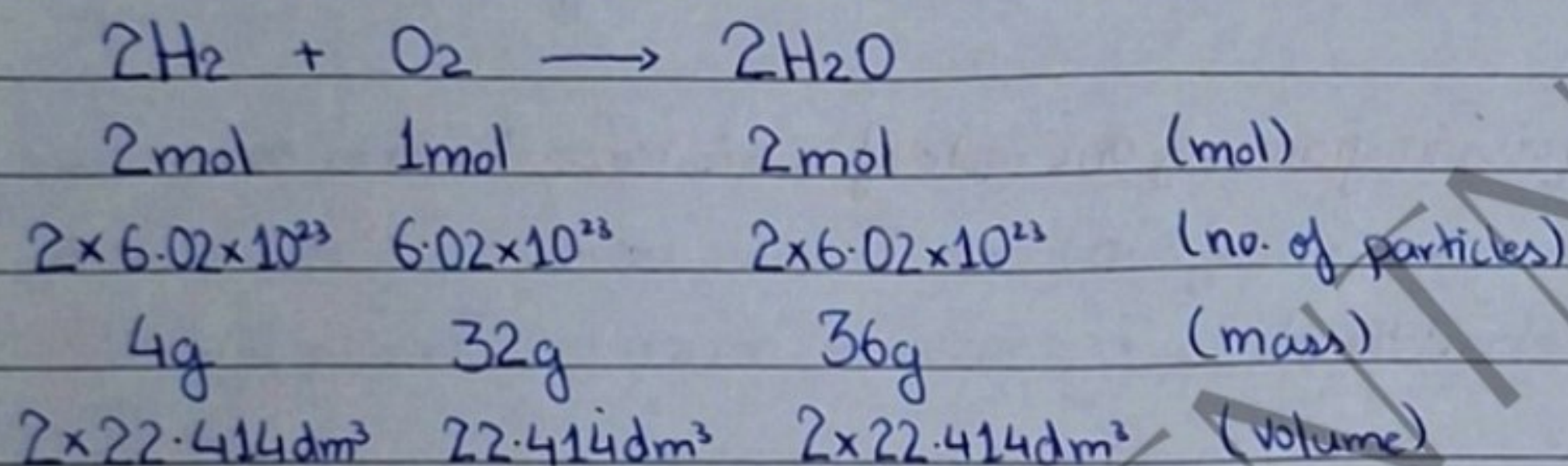
Molar Mass and Density of Gases

Density is defined as the mass per unit volume of a substance. Molar mass of all gases occupies same volume at STP. Density of a gas is depended on its molar mass. A gas having higher molar mass will have higher density and vice versa. Density can be calculated from its molar mass and molar volume.

$$\text{Density} = \frac{\text{Molar Mass}}{\text{Molar Volume}}$$

$$\text{Molar Mass} = \text{Density} \times \text{Molar Volume (V}_m\text{)}$$

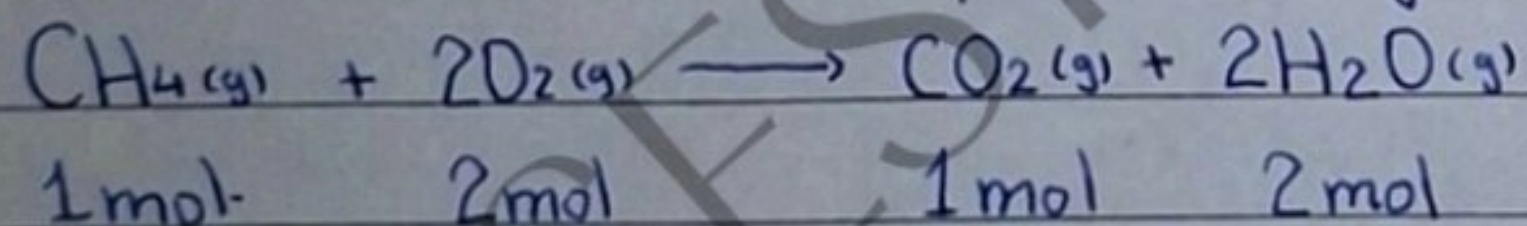
Stoichiometric Calculations and Mole Ratio



The amounts of the reactants or the products as given by the balanced chemical equation are called stoichiometric amounts.

Mole-Mole Calculation

In balanced chemical equation, the coefficient used are taken as mole that indicates the stoichiometric relationship in terms of moles.



Solution Stoichiometry

In solution the most common concentration unit is molarity. The molarity of a solution is simply the numerical value of its concentration in mol/dm^3 . Molarity is the concentration unit in which amount of solute is expressed in moles and quantity of solution in dm^3 .

Molarity is expressed in mol dm^{-3} or M. Molarity can be defined as the number of moles of solute dissolved per dm^3 of solution.

$$\text{Molarity} = \frac{\text{Moles of solute}}{\text{dm}^3 \text{ of solution}}$$

Limiting and Non-Limiting Reactants

A reactant which is completely consumed earlier leaving behind the other reactant in excess is called limiting reactant. lesser than stoichiometric amount. Controls the chemical reaction. Controls the amount of product. Gives least amount of product. The reactant that is unreacted

after the completion of reaction is called non-limiting or excess reactant.

Theoretical, Actual and Percent yield

The amount of the product calculated from balanced chemical equation or produced as a result of chemical reaction is known as yield. The types of yield are • theoretical yield and • Actual yield.

Theoretical yield: The amount of product calculated from the balanced chemical equation is called theoretical yield. It is the maximum amount of product that should be produced according to the balanced chemical equation.

Actual yield: The amount of the product obtained experimentally as a result of chemical reaction is called actual yield. It is also called practical or experimental yield. Actual yield is mostly less than theoretical yield.

Percentage yield: The ratio of actual yield to theoretical yield multiplied by 100 gives us percentage yield. A chemist is usually interested in the efficiency of a reaction. The efficiency of the reaction is expressed in the form of percentage yield.

$$\% \text{ yield} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$$

Questions

49g each of H_2SO_4 and H_3PO_4 have same number of molecules but having different number of atoms.

Both H_2SO_4 and H_3PO_4 have same number of molecules because both have the same number of moles (0.5 mol). But their chemical composition differ because, Sulphuric acid (H_2SO_4) contains 2 hydrogen, 1 sulphur and 4 oxygen atoms, so the total atoms per molecule are 7 and Phosphoric acid (H_3PO_4) contains 3 hydrogen, 1 phosphorus and 4 oxygen atoms, so the total atoms per molecule are 8. The difference in no. of atoms leads to distinct chemical properties and behaviours.

Different gases having different masses occupy equal volume at STP.

At Standard Temperature and Pressure (STP), equal volumes of different gases occupy the same space because of Avogadro's law. This law states that at the same temperature and pressure, equal volumes of gases contain the same number of molecules. So, even though gas particles have different masses, they still fill the same volume due to this fundamental principle.

One mole of Na and Al has equal no. of atoms but size of atoms are different.

One mole of both sodium (Na) and aluminium (Al) contains the same number of atoms (6.02×10^{23}) but their atomic sizes differ significantly due to position in the periodic table.

Limiting reactant is always in lesser quantity in reaction mixture or not.

The limiting reactant is always present in lesser quantity in the reaction mixture. It determines the maximum amount of product that can be formed. The other reactant, called the excess reactant, remains unreacted after the reaction.

Amount of product obtained through balance chemical equation is greater than the amount obtained experimentally.

The amount of product obtained through balanced chemical equation (theoretical yield) is greater than the amount obtained experimentally (practical yield) due to following reasons:

- Side reaction/competing reaction
- Reversible reaction
- Incomplete reaction
- Inexperienced worker
- Mechanical Loss of products during separation by solvent extraction, filtration, distillation and crystallization etc.

Actual yield may be lesser due to inefficiency during the washing and drying of crystals.

What are the basic assumption in Stoichiometric calculations?

The basic assumptions in stoichiometric calculations are:

- All the reactants are completely converted into products.
- No side reaction occurs.
- The law of conservation of mass and the law of definite proportions are obeyed.

18g of steam has Avogadro's number of molecules but 58.5g of NaCl has not

The difference lies in the molecular composition of the substances:

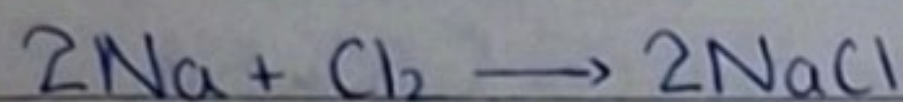
Steam (H_2O) water vapour has a molecule formula of H_2O . The molar mass of water (H_2O) is approximately 18 g/mol. Avogadro's number (6.022×10^{23}) represents the number of molecules in 1 mole of any substance. So, 18g of steam contains avogadro's number of water molecules.

Sodium Chloride (NaCl) is an ionic compound. Its molar mass is approximately 58.5g/mol. However, 58.5g of NaCl does not contain avogadro's no. of molecules. This is because NaCl exists as a crystals lattice, where each formula unit represents a repeating pattern of Na^+ and Cl^- ions, rather than individual molecules.

In short, the concept of avogadro's no. applies differently to molecular substances (like water) and ionic compounds (NaCl).

Why 2 moles of Na react with 1 mole of chlorine gas to produce 1 mole of NaCl?

The balanced chemical equation for the reaction between sodium (Na) and chlorine (Cl_2) to form sodium chloride (NaCl) is as follows:



In this equation:

2 moles of Na reacts with 1 mole of Cl_2 . The product is 2 moles of NaCl. This balanced equation ensures that the law of conservation of mass is satisfied, meaning that the total number of atoms of each element remains the same before and after the reaction.

Sodium (Na) donates one electron to chlorine (Cl), resulting in the formation of the ionic compound sodium chloride (NaCl).

Mass in gram of 0.74 mol KMnO_4

$$\begin{aligned}\text{Molar Mass of } \text{KMnO}_4 &= 39 + 55 + 16 \times 4 \\ &= 158 \text{ g/mol}\end{aligned}$$

$$\text{Moles of } \text{KMnO}_4 = 0.74 \text{ mol}$$

$$\begin{aligned}\text{Mass in grams} &= \text{Moles} \times \text{Molar mass} \\ &= 0.74 \text{ mol} \times 158 \text{ g/mol} \\ &= 116.92 \text{ g}\end{aligned}$$

Moles of O atoms in 9.22g $\text{Mg}(\text{NO}_3)_2$

$$\begin{aligned}\text{Molar Mass of } \text{Mg}(\text{NO}_3)_2 &= 24 + 14 \times 2 + 16 \times 6 \\ &= 148 \text{ g/mol}\end{aligned}$$

$$\text{Mass of } \text{Mg}(\text{NO}_3)_2 = 9.22 \text{ g}$$

$$\begin{aligned}\text{Moles of } \text{Mg}(\text{NO}_3)_2 &= \frac{\text{Mass of } \text{Mg}(\text{NO}_3)_2}{\text{Molar mass of } \text{Mg}(\text{NO}_3)_2} \\ &= \frac{9.22}{148} \\ &= 0.0623 \text{ mol}\end{aligned}$$

1 mole of $\text{Mg}(\text{NO}_3)_2$ has O mol = 6 mol of oxygen atoms

$$\begin{aligned}0.0623 \text{ mol of } \text{Mg}(\text{NO}_3)_2 \text{ has O} &= 0.0623 \times 6 \\ &= 0.374 \text{ mol}\end{aligned}$$

Number of O atoms in 0.037g $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

$$\begin{aligned}\text{Molar Mass of } \text{CuSO}_4 \cdot 5\text{H}_2\text{O} &= 63.5 + 32 + 4 \times 16 + 5 \times 18 \\ &= 249.5 \text{ g/mol}\end{aligned}$$

$$\text{Mass of } \text{CuSO}_4 \cdot 5\text{H}_2\text{O} = 0.037 \text{ g}$$

$$\begin{aligned}\text{Moles of } \text{CuSO}_4 \cdot 5\text{H}_2\text{O} &= \frac{\text{Mass of } \text{CuSO}_4 \cdot 5\text{H}_2\text{O}}{\text{Molar mass of } \text{CuSO}_4 \cdot 5\text{H}_2\text{O}} \\ &= \frac{0.037}{249.5}\end{aligned}$$

$$= 1.48 \times 10^{-4} \text{ mol}$$

1 mole of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ has 9 mol of oxygen atoms

$$1.48 \times 10^{-4} \text{ mol of } \text{CuSO}_4 \cdot 5\text{H}_2\text{O} \text{ has } 0 = 1.48 \times 10^{-4} \times 9$$

$$= 0.00134 \text{ mol}$$

Number of O atoms

$$= 0.00134 \times 6.02 \times 10^{23} \text{ atoms}$$

$$= 8.06 \times 10^{20} \text{ atoms.}$$

Mass in kg of 2.6×10^{20} molecules of SO_3

$$\text{Number of } \text{SO}_3 \text{ molecules} = 2.6 \times 10^{20}$$

$$\text{Molar Mass of } \text{SO}_3 = 80 \text{ g/mol}$$

$$\text{Mass of } \text{SO}_3 \text{ molecules} = \frac{\text{Molar Mass}}{N_A} \times \text{Number of molecules}$$

$$= \frac{80}{6.02 \times 10^{23}} \times 2.6 \times 10^{20}$$

$$= 0.03455 \text{ g}$$

$$= 3.455 \times 10^{-2} \text{ kg}$$

$$= 3.455 \times 10^{-5} \text{ kg}$$

Total number of ions in 14.3g CaBr_2

$$\text{Molar mass of } \text{CaBr}_2 = 40 + 2 \times 79.9$$

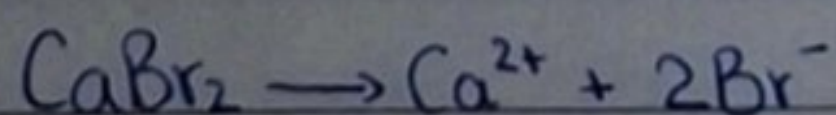
$$= 199.8 \text{ g/mol}$$

$$\text{Mass of } \text{CaBr}_2 = 14.3 \text{ g}$$

$$\text{Moles of } \text{CaBr}_2 = \frac{\text{Mass of } \text{CaBr}_2}{\text{Molar mass of } \text{CaBr}_2}$$

$$= \frac{14.3}{199.8}$$

$$= 0.0716 \text{ mol}$$



$$\text{Total no. of ions} = 3 \times 0.0716 \times 6.02 \times 10^{23} = 1.29 \times 10^{23} \text{ ions.}$$

Mass in ^{mg} of 0.45 mol of $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$

$$\begin{aligned}\text{Molar Mass of } \text{CuCl}_2 \cdot 2\text{H}_2\text{O} &= 63.5 + 2 \times 35.5 + 18 \\ &= 152.5 \text{ g/mol}\end{aligned}$$

$$\text{Moles of } \text{CuCl}_2 \cdot 2\text{H}_2\text{O} = 0.45 \text{ mol}$$

$$\begin{aligned}\text{Mass in grams} &= \text{Molar mass} \times \text{Moles} \\ &= 0.45 \times 152.5 \\ &= 68.625 \text{ g} \\ &= 68.625 \times 1000 \text{ mg} \\ &= 68625 \text{ mg}\end{aligned}$$

Mass in grams of 2.78×10^{21} molecules of N_2O_4

$$\text{Number of } \text{N}_2\text{O}_4 \text{ molecules} = 2.78 \times 10^{21}$$

$$\text{Molar mass of } \text{N}_2\text{O}_4 = 92 \text{ g/mol}$$

$$\begin{aligned}\text{Mass of } \text{N}_2\text{O}_4 \text{ molecules} &= \frac{\text{No. of molecules}}{N_A} \times \text{Molar Mass} \\ &= \frac{2.78}{6.02 \times 10^{23}} \times 92 \\ &= 0.425 \text{ g}\end{aligned}$$

Volume of SO_2 at STP of 4.8×10^{23} molecules of SO_2

$$\text{Number of } \text{SO}_2 \text{ molecules} = 4.8 \times 10^{23}$$

$$\text{Molar Volume of } \text{SO}_2 \text{ at STP} = 22.414 \text{ dm}^3$$

$$\begin{aligned}\text{Volume of } \text{SO}_2 \text{ molecules} &= \frac{\text{Number of molecules}}{N_A} \times \text{Molar Volume} \\ &= \frac{4.8 \times 10^{23}}{6.02 \times 10^{23}} \times 22.414 \\ &= 17.87 \text{ dm}^3\end{aligned}$$

Mass in gram of $\text{Ca}(\text{NO}_3)_2$ having 2×10^{21} ions of Nitrate

$$\begin{aligned}\text{Molar mass of } \text{Ca}(\text{NO}_3)_2 &= 40 + 14 \times 2 + 16 \times 6 \\ &= 164 \text{ g/mol}\end{aligned}$$

$$\text{Number of nitrate ions} = 2 \times 10^{21}$$

$$\text{Each } \text{Ca}(\text{NO}_3)_2 \text{ produces} = 2 \text{ Nitrate ions}$$

OR,

2 Nitrate ions are present in 1 formula unit of $\text{Ca}(\text{NO}_3)_2$

2×10^{21} Nitrate ions are present in $\text{Ca}(\text{NO}_3)_2 = \frac{1}{2} \times 2 \times 10^{21}$ formula units.

$= 1 \times 10^{21}$ formula units.

Mass of $\text{Ca}(\text{NO}_3)_2 = \frac{\text{Formula units}}{N_A} \times \text{Molar Mass}$

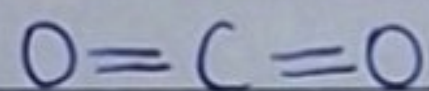
N_A

$= 0.27 \text{ g}$

Covalent Bonds in 22 gram of dry ice

Molar Mass of dry ice (CO_2) = 44 g/mol

Mass of dry ice (CO_2) = 22 g



1 molecule of CO_2 have covalent bonds = 4 bonds

Moles of dry ice = $\frac{\text{Mass of dry ice}}{\text{Molar mass}}$

Molar mass

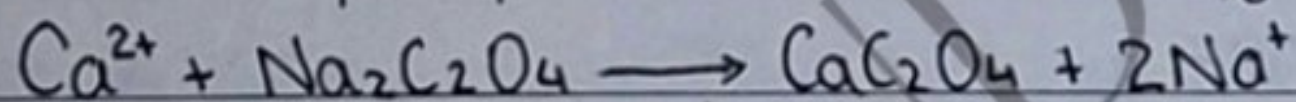
$= 0.5 \text{ mol}$

No. of covalent bonds = $4 \times 0.5 \times 6.022 \times 10^{23}$

$= 12.04 \times 10^{23}$

$= 1.204 \times 10^{24}$ bonds

Calcium ion can be precipitated from solution by sodium oxalate.

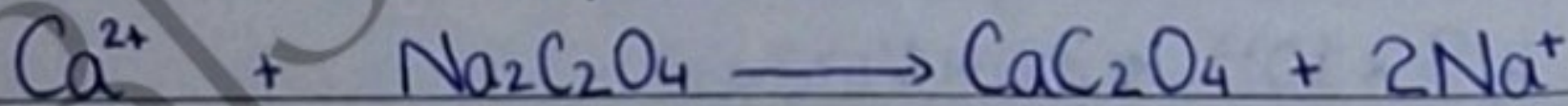


Is 15 g Ca^{2+} can be completely precipitated by 15 g of sodium oxalate? If Ca^{2+} ions are left in the solution, calculate how many Ca^{2+} ions are left in the solution.

Mass of $\text{Ca}^{2+} = 15 \text{ g}$

Mass of $\text{Na}_2\text{C}_2\text{O}_4 = 15 \text{ g}$

No. of Ca^{2+} ions left unreacted = ?



40 g

134 g

$\frac{40}{134} \text{ g}$

1 g

$\frac{40}{134} \times 15 \text{ g}$

$1 \times 15 \text{ g}$

4.48 g

15 g

For 15 g sodium oxalate only 4.48 g Ca^{2+} ions are required. Hence Ca^{2+} ions are in excess and sodium oxalate is limiting reactant.

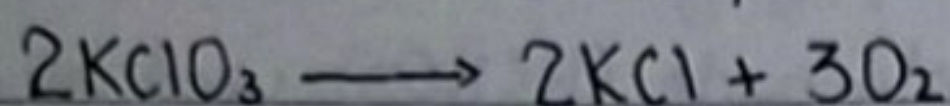
Amount of Ca^{2+} ions unreacted = $15 - 4.48 = 10.52 \text{ g}$

Number of Ca^{2+} ions left unreacted = $\frac{10.52}{40} \times 6.02 \times 10^{23}$

40

$= 1.58 \times 10^{23}$ ions.

0.5 mol of potassium chlorate heated for a time and 0.015 mol left. How much KCl produced, also calculated molecules of O_2 produced?

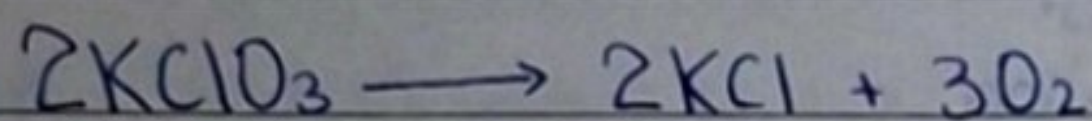


Amount of KCl produced:

No. of moles of potassium chlorate = 0.05 mol

No. of moles of potassium chlorate left unreacted = 0.015 mol

No. of moles of potassium chlorate consumed = $0.05 - 0.015$
= 0.035 mol



2 mol

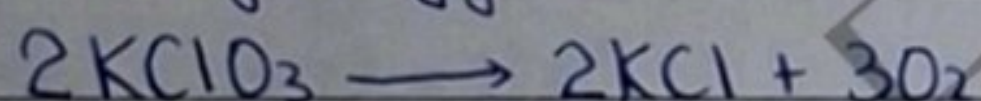
2 mol

0.035 mol

0.035 mol

Amount of potassium chloride produced = 0.035×74.5
= 2.61 g

Number of Molecules of Oxygen:



2 mol

3 mol

0.035 mol

$\frac{3}{2} \times 0.035$ mol

0.0525 mol

Number of molecules of oxygen produced = $0.0525 \times 6.02 \times 10^{23}$
= 0.316×10^{23}
= 3.16×10^{22} molecules.

Calculate number of moles of water produced by 5×10^{24} molecules of H_2SO_4 and 20g of NaOH

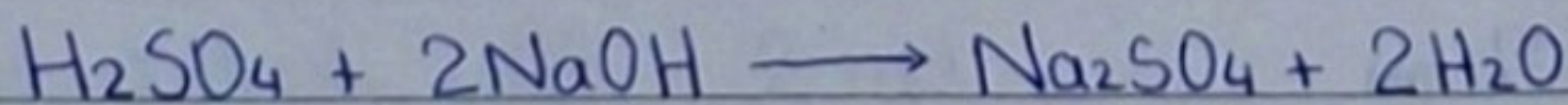
Number of molecules of H_2SO_4 = 5×10^{24}

Mass of NaOH = 20g

No. of moles of water produced = ?

No. of moles of H_2SO_4 = $\frac{5 \times 10^{24}}{6.02 \times 10^{23}}$ = 8.3 mol

No. of moles of NaOH = $\frac{20}{40}$ = 0.5 mol



1 mol

2 mol

2 mol

8.3 mol of H_2SO_4 produces water = 2×8.3 = 16.6 mol

0.5 mol of NaOH produces water = 0.5 mol

Limiting reactant is NaOH.

Number of moles of water produced = 0.5 mol

Formalin is an aqueous solution of formaldehyde (HCHO), used as a preservative for biological specimens. A biologist wants to prepare 1 dm^3 of 11.5M formaline. What mass of formaldehyde he requires?

Molarity of formaline = 11.5M

Volume of formalin = 1 dm^3

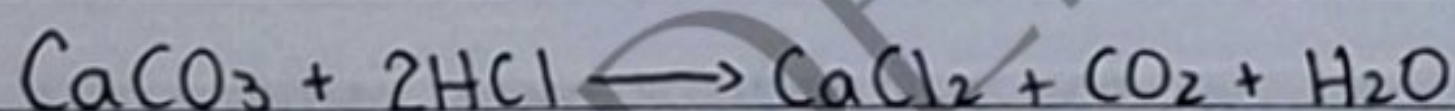
Molar mass of formaldehyde (HCHO) = 30 g/mol

Moles of solute = Molarity $\times$ dm^3 of solution

No. of moles (HCHO) = 11.5×1
= 11.5 mol

Mass of formaldehyde (HCHO) = 11.5×30
= 345g

What mass of CaCO_3 would you use to add to 100 cm^3 of 0.5M HCl to completely neutralize acid?

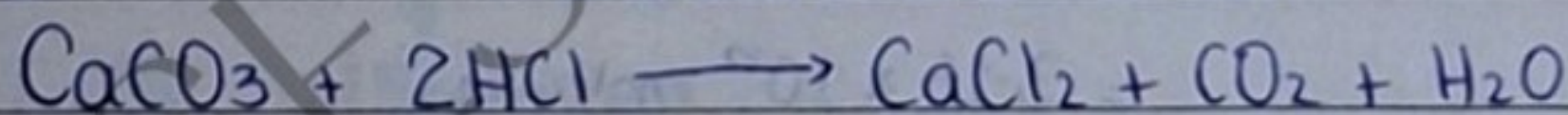


Molarity of HCl solution = 0.5M

Volume of HCl solution = $100\text{ cm}^3 = 0.1\text{ dm}^3$

Molar Mass of CaCO_3 = 100 g/mol

Moles of HCl = $0.5 \times 0.1 = 0.05\text{ mol}$



1 mol 2 mol

2 mol of HCl consumes $\text{CaCO}_3 = 1\text{ mol}$

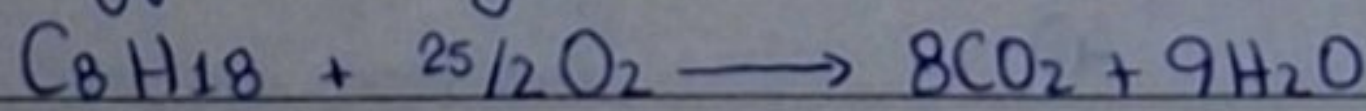
0.05 mol of HCl consumes $\text{CaCO}_3 = \frac{1}{2} \times 0.05 = 0.025\text{ mol}$

Mass of CaCO_3 used by HCl = $0.025 \times 100 = 2.5\text{ g}$

Calculate mass of oxygen required for complete combustion of 1 mole of gasoline (C_8H_{18}).

Mole of gasoline = 1 mol

Molar mass of oxygen = 32 g/mol



1 mol $\frac{25}{2}\text{ mol}$

1 mol of gasoline requires oxygen = $\frac{25}{2}\text{ mol} = 12.5\text{ mol}$

Mass of oxygen consumed by gasoline = 12.5×32
= 400g

Graphite is a crystalline form of carbon used in 'lead' pencil.

(a) How many moles are present in 315 mg graphite.

(b) How many carbon atoms are in it?

(a) Atomic mass of graphite (C) = 12 g/mol

Mass of graphite (C) = 315 mg

Moles of graphite (C) = ?

Mass of graphite in grams = 0.315 g

Number of moles of graphite = 0.0263 mol $(0.315/12)$

(b) Number of atoms of graphite = ?

No. of atoms of graphite = $0.0263 \times 6.02 \times 10^{23}$
 $= 1.58 \times 10^{22}$ atoms.

Magnese is transition metal essential for growth of strong bones. Calculate mass of 3.22×10^{20} atoms found in 1 kilogram of bone.

Atomic mass of Mn = 56 g/mol

No. of atoms of Mn = 3.22×10^{20}

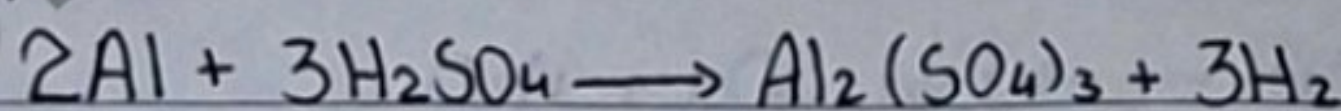
Mass of Mn = ?

No. of moles of Mn = $\frac{3.22 \times 10^{20}}{6.02 \times 10^{23}}$
 $= 0.00535$ mol

Mass of Mn = 0.005635×56

$= 0.299 \approx 0.3$ g

How much mass of excess reactant left after 40.5g of Aluminium metal reacts with 196g of H_2SO_4 ?



Mass of Al = 40.5g

Mass of H_2SO_4 = 196g

Mass of excess reactant left behind = ?

No. of moles of Al = $\frac{40.5}{27} = 1.5$ mol

No. of moles of H_2SO_4 = $\frac{196}{98} = 2$ mol

3 mol of H_2SO_4 requires = 2 mol of Al

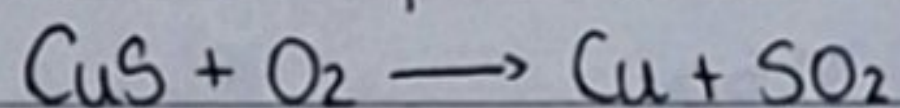
2 mol of H_2SO_4 requires = $\frac{2}{3} \times 2 = 1.33$ mol of Al.

Hence Al is in excess and H_2SO_4 is limiting reactant.

$$\begin{aligned}\text{No. of moles of excess reactant (Al) left behind} &= 1.5 - 1.33 \\ &= 0.17 \text{ mol}\end{aligned}$$

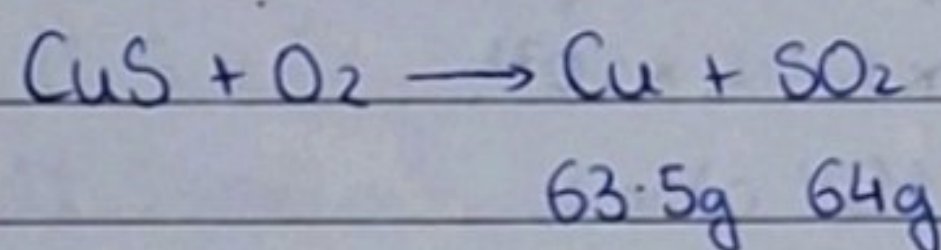
$$\begin{aligned}\text{Mass of excess reactant left behind} &= 0.17 \times 27 \\ &= 4.59 \text{ g}\end{aligned}$$

Calculate mass of SO_2 that will be produced with 155 g of Cu from the roasting of CuS.



$$\text{Mass of Cu} = 155 \text{ g}$$

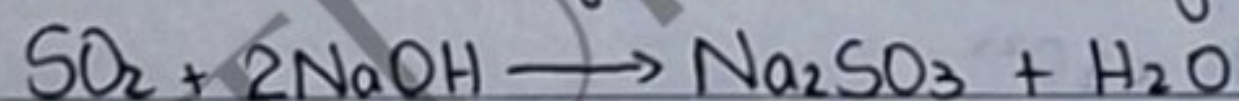
$$\text{Mass of } \text{SO}_2 \text{ produced} = ?$$



$$63.5 \text{ g is produced along with } \text{SO}_2 = 64 \text{ g}$$

$$\begin{aligned}155 \text{ g Cu is produced along with } \text{SO}_2 &= 64 \times 155 \\ &= 156.2 \text{ g}\end{aligned}$$

SO_2 is air pollutant it contributes to acid rain, its emission is controlled by absorbing it into a base (NaOH). Calculate mass of SO_2 absorbed by 33 g of NaOH .

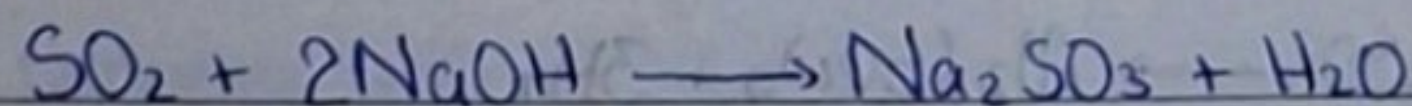


$$\text{Mass of NaOH} = 33 \text{ g}$$

$$\text{Mass of } \text{SO}_2 \text{ absorbed} = ?$$

$$\text{Number of moles of NaOH} = \frac{33}{40}$$

$$= 0.825 \text{ mol}$$

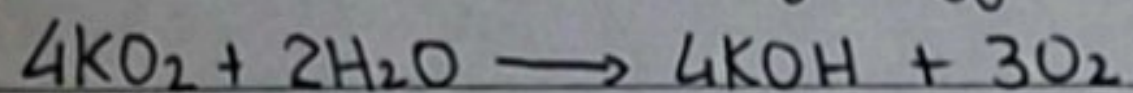


$$2 \text{ mol of NaOH absorbs } \text{SO}_2 = 1 \text{ mol of } \text{SO}_2$$

$$\begin{aligned}0.825 \text{ mol of NaOH absorbs } \text{SO}_2 &= \frac{1}{2} \times 0.825 \\ &= 0.4125 \text{ mol}\end{aligned}$$

$$\begin{aligned}\text{Mass of } \text{SO}_2 \text{ absorbed} &= 0.4125 \times 64 \text{ g} \\ &= 26.4 \text{ g}\end{aligned}$$

Potassium super oxide (KO_2) is used as source of oxygen in re-breathing mask.

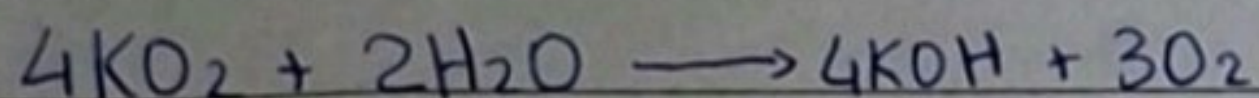


Identify limiting reactant in each of each of the following reactant mixture.

(i) 6.4 mol KO_2 and 2.1 mol H_2O .

(ii) 8.4 mol KO_2 and 1.5 mol H_2O .

(i) 6.4 mol KO_2 and 2.1 mole H_2O



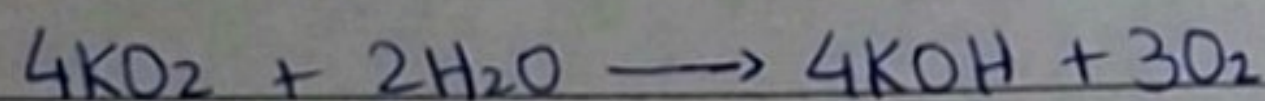
4 mol 2 mol

6.4 mol $\frac{2}{4} \times 6.4 \text{ mol}$

6.4 mol 3.2 mol > 2.1 mol (given)

Hence, KO_2 is excess reactant and limiting reactant is H_2O .

(ii) 8.4 mol KO_2 and 1.5 mol H_2O .



4 mol 2 mol

8.4 mol $\frac{2}{4} \times 8.4 \text{ mol}$

8.4 mol 4.2 > 1.5 mol (given)

Hence, KO_2 is excess reactant and limiting reactant is H_2O .

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