Relative Atomic Mass (Ar)

Relative Atomic Mass

eg.

Isotopes

Isotopes

e.g.

Calculating Ar

e.g.

e.g.

TT

Relative Molecular Mass (__) -

1 2 3 4 5

e.g.

ELEMENTS	COMPOUNDS

UNITS =

Calculating Mr

Relative Formula Mass (RFM)

RFM

e.g.

The Mole & Avogadro's Constant

TT

The Mole

e.g.

AKA -

Elements

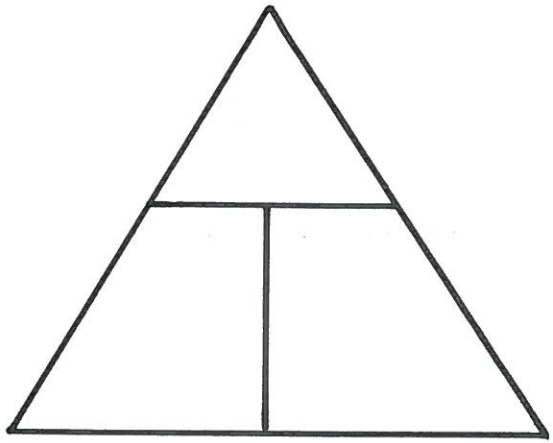
e.g.

Compounds

e.g.

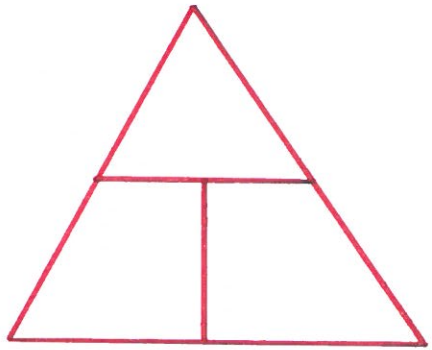
=

×



The Mole & Mass

= ———



e.g. Calculate the number of moles in:

a)

b)

c)

e.g. Calculate the mass of:

a)

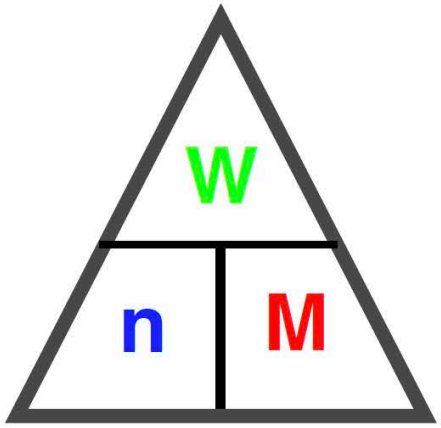
b)

c)

EXAMPLE MOLE CALCULATIONS - USING MASS

1. 0.5g of Zinc reacts with excess Hydrochloric acid to produce Zinc Chloride solution and Hydrogen gas.

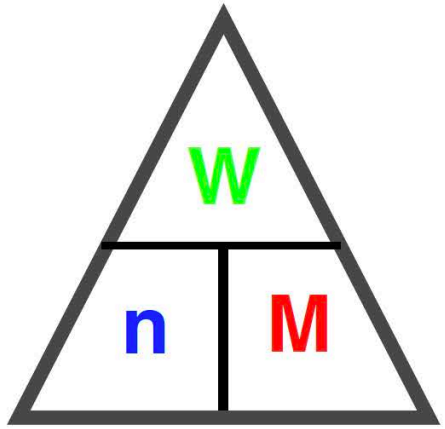
   Calculate the mass of Zinc Chloride produced.



EXAMPLE MOLE CALCULATIONS - USING MASS

2. Methane (CH_4) was burned in excess Oxygen forming Carbon Dioxide and Water. 1.5Kg of water was produced in the reaction.

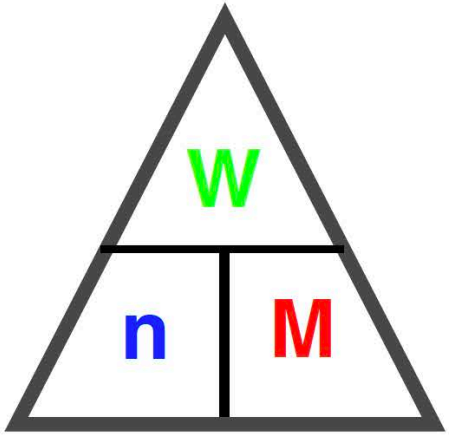
   Calculate the mass of Methane burned.



EXAMPLE MOLE CALCULATIONS - USING MASS

3. 0.5g of Calcium$_{(s)}$ reacted with 2.5g of Copper Chloride$_{(aq)}$ in a displacement reaction to form Calcium Chloride$_{(aq)}$ and Copper$_{(s)}$.

   Calculate the maximum mass of Copper that could be produced.



Finding x in H_2O

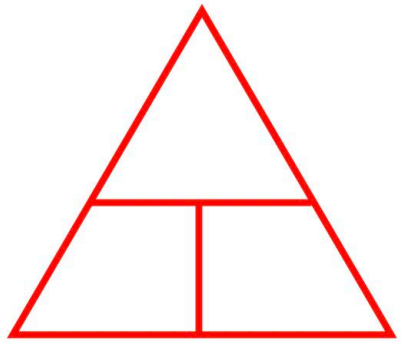
e.g.

Objective

Example

The Moles & Solutions

e.g. 1.0 $mol.dm^{-3}$ $HCl_{(aq)}$, 0.5 $mol.dm^{-3}$ $NaOH_{(aq)}$



e.g. Calculate the number of moles in:

a) 25 cm^3 of 0.1 $mol.dm^{-3}$ HCl

b) 100 cm^3 of 2.0 $mol.dm^{-3}$ NaOH

e.g. Calculate the concentration of a solution that contains:

a) 0.12 moles in 0.25 dm^3

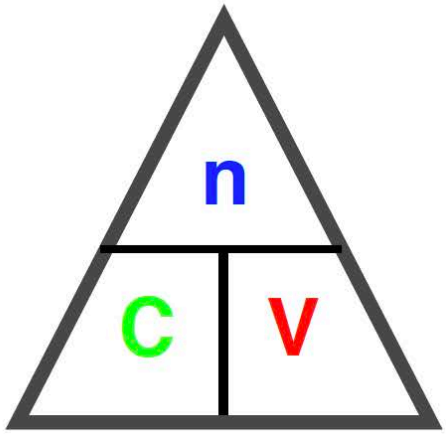
b) 0.4 moles in 40 cm^3

EXAMPLE MOLE CALCULATIONS - USING CONCENTRATION

1. 2.0g Copper Oxide reacted with Sulfuric Acid to produce Copper Sulfate and Water.

$$CuO_{(s)} + H_2SO_{4(aq)} \rightarrow CuSO_{4(aq)} + H_2O_{(l)}$$

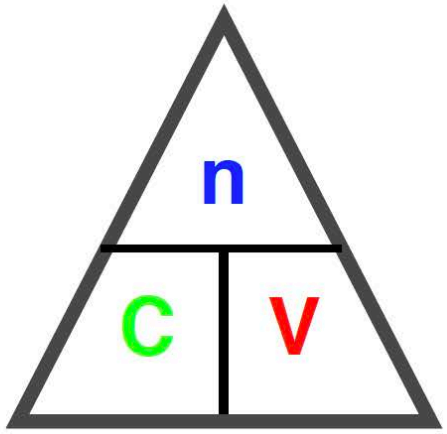
Calculate what volume of $0.1 mol.dm^{-3}$ $H_2SO_{4(aq)}$ would be required to completely react the Copper Oxide.



EXAMPLE MOLE CALCULATIONS - USING CONCENTRATION

2. A titration was carried out to determine the concentration of a sample of Sodium Hydroxide solution. It was found that a mean titre of 22.4cm^3 of 0.1 mol.dm^{-3} $HCl_{(aq)}$ was required to neutralise 25cm^3 of the $NaOH_{(aq)}$.

   Calculate the concentration of the Sodium Hydroxide solution.

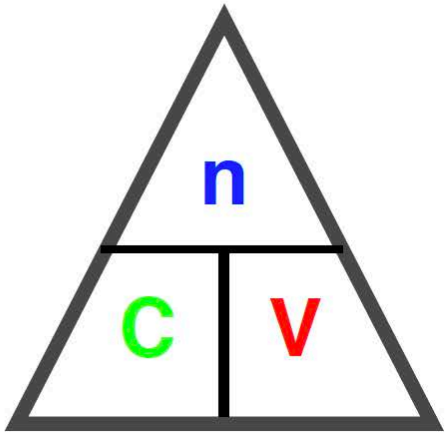


EXAMPLE MOLE CALCULATIONS - USING CONCENTRATION

3. 8.2 g of Iron (III) Chloride ($FeCl_3$)was dissolved in 250cm^3 of water. When it dissolves it dissociates into it's ions as follows:

$$FeCl_{3(s)} \rightarrow Fe^{3+}{}_{(aq)} + 3Cl^-{}_{(aq)}$$

Calculate the concentration of Chloride ions present in the solution.

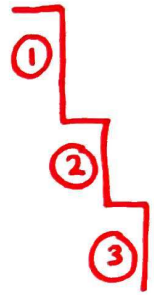


Calculations & Stoichiometry

1 2 3 4 5

Iron is produced by reacting Iron(III) Oxide with Carbon Monoxide. What mass of Iron is produced from kg of Iron(III) Oxide?

+ → +



1

2

3

cm^3 of KOH was needed to neutralise cm^3 of $mol.dm^{-3}$ H_2SO_4. Calculate the concentration of the KOH.

+ → +

1

2

3

Finding the Limiting Reagent

1 : 1 Ratio

1 : 2 Ratio

★

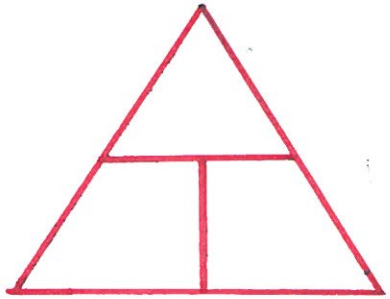
Molar Gas Volume

1 2 3 4 5

TT

Molar Gas Volume

= ×



e.g. ___g of $Mg_{(s)}$ was reacted with excess $HCl_{(aq)}$ at room temperature and pressure. Calculate the volume of $H_{2(g)}$ produced in cm^3.

+ ⟶ +

①

②

③

The Ideal Gas Equation

Links:

Key Assumptions: ①

②

=

=

=

=

=

→ conversion

→ conversion

Rearrangements

EXAMPLE MOLE CALCULATIONS - IDEAL GAS LAW

1. Calcium Carbonate can undergo thermal decomposition according to the following equation:

Calculate the mass in Kg, of calcium carbonate that produced $998.9dm^3$ of $CO_{2(g)}$ at 840°C and 100kPa pressure.

(The Gas Constant R = 8.31 J K^{-1} mol^{-1})

EXAMPLE MOLE CALCULATIONS - IDEAL GAS LAW

2. Solid sodium azide (NaN_3) is used in airbags. It decomposes to rapidly produce nitrogen that fills the airbag as follows:

$$2NaN_{3(s)} \longrightarrow 2Na_{(s)} + 3N_{2(g)}$$

13.56g of NaN_3 is used to generate the $50dm^3$ of nitrogen gas that is required to fill an airbag at 30kPa pressure.
Calculate the temperature in °C, at which this occurs.

(The Gas Constant R = 8.31 J K^{-1} mol^{-1})

EXAMPLE MOLE CALCULATIONS - IDEAL GAS LAW

3. Boron trichloride (BCl_3) is a gas that can be produced by reacting boron oxide with excess carbon and chlorine:

$$B_2O_{3(s)} + 3C_{(s)} + 3Cl_{2(g)} \longrightarrow 2BCl_{3(g)} + 3CO_{(g)}$$

The two gases produced occupied a total volume of $10000cm^3$ at a pressure of 100kPa and a temperature of 298K.

Calculate the mass of boron oxide that reacted.

(The Gas Constant R = 8.31 J K^{-1} mol^{-1})

Percentage Composition by Mass

i.e.

$$= \frac{\qquad\qquad}{\qquad\qquad} \times 100$$

e.g. Malachite

% by mass of Cu

% by mass of H

Empirical & Molecular Formulae

1 2 3 4 5

Empirical Formulae

Empirial Formulae

e.g.

e.g.

Molecular Formulae

Molecular Formulae

Percentage Atom Economy -

$= \dfrac{\qquad\qquad}{\qquad\qquad} \times$

e.g. $+ \rightarrow +$

e.g. $+ \rightarrow +$

e.g. $+ \rightarrow$

TT
Percentage Yield

Percentage Yield

1 2 3 4 5

= _____ x

e.g. → +

= ____ x =

What mass of $CaCO_3$ must be decomposed to produce ____ g of CaO?