a

Mass of the _____ must always equal the mass of the _____.

Balance the following:

$H_2 + O_2 \longrightarrow H_2O$

$Na + Cl_2 \longrightarrow NaCl$

$Br_2 + KI \longrightarrow I_2 + KBr$

$N_2 + H_2 \longrightarrow NH_3$

b

Complete the following sentences

The relative formula mass is the (_____) of a compound.

It is the sum of the _____ atomic masses (A_r) of the atoms.

Calculate the relative formula mass for the following. Show your working out.

A_r of C = 12
A_r of H = 1
A_r of O = 16
A_r of N = 14

Example:
CO_2
12 + (16 × 2)
12 + 32
= 44

H_2O

CH_4

NH_4NO_3

c

When a gas is produced during a reaction, why might the mass go down?

_____

_____

_____

Write the equation for when magnesium reacts with oxygen.

_____

What happens to the mass of the product from the question above?

_____

_____

_____

d

$$\% \text{ mass} = \frac{A_r \times \text{number of atoms}}{M_r \text{ of the compound}} \times 100$$

Using the equation above, calculate the % mass of sodium (Na) in NaCl.

A_r of Na = 23

A_r of Cl = 35.5

e

Use the A_r values below to calculate the molar mass of these elements. Don't forget the units.

E.g. A_r of sodium = 23, one mole = 23g

A_r of K = 39

A_r of F = 19

A_r of O = 16

A_r of Mg = 24

potassium

fluorine (Fl_2)

oxygen (O_2)

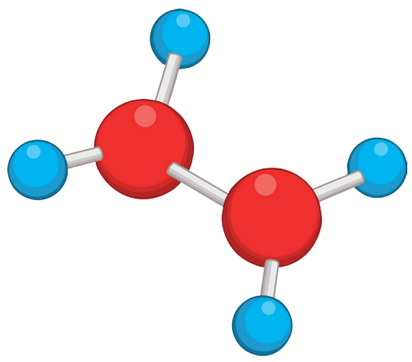
magnesium

f

What is the equation to calculate the number of moles for a pure substance.

moles = _____

Rearrange the equation to calculate the mass.



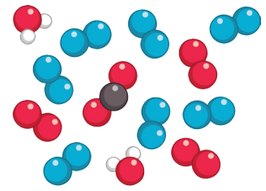
g

What unit are chemical amounts measured in?

1. cm
2. m/s
3. moles

Avogadro's constant is...

1. 6.03×10^{23} per mole
2. 6.02×10^{23} per mole
3. 6.05×10^{23} per mole

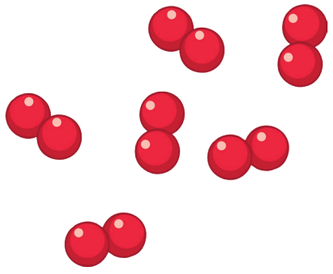


h

What mass of nitrogen is in 92g of NO_2?

A_r of N = 14

A_r of O = 16



a

Using the equation

$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2$

What mass of NaCl would be produced from 2.5 grams of sodium carbonate?

A_r of Na = 23

A_r of H = 1

A_r of Cl = 35.5

A_r of O = 16

A_r of C = 12

b

What is the mass of solute when the concentration of a solution is 4g/dm^3 and the volume is 600cm^3?

c

$$\text{concentration (gm/dm}^3\text{)} = \frac{\text{mass of solute}}{\text{volume}}$$

Using the equation above, calculate the following:

The mass of a solute is 60g and the volume is 0.5dm^3, what is the concentration?

d

Rearrange the following equation to find volume.

$$\text{concentration (mol/dm}^3\text{)} = \frac{\text{mass of solute}}{\text{volume}}$$

e

Why, in some reactions, are the reactants in excess?

To make sure that the reaction has completely finished and the other reactant has been completely used up.

f

Define concentration.

Draw a diagram to show a solution with a low concentration and a solution with a high concentration

g

Convert the following measurements in cm^3 to dm^3.

1. 15cm^3
2. 60cm^3
3. 90cm^3
4. 0.5cm^3

h

When a chemical reaction occurs, the amount of product made is not always equal to the amount calculated. Explain why.

i

The amount of a product obtained from a reaction is called the _____. The actual yield is compared to the maximum expected amount as a percentage. This is called the _____.

Complete the equation below:

$$\text{\% yield} = \frac{\text{\_\_\_\_\_}}{\text{expected mass of product}} \times \text{\_\_\_\_\_}$$

j

A chemist carried out a reversible reaction. She had expected to make 14.50kg of product, but only obtained 12.75kg. Calculate the percentage yield.

k

What is atom economy?

l

The equation below is used to calculate the _____ of a reaction.

$$\frac{\text{relative formula mass of desired product}}{\text{sum of relative formula masses of all reactants}} \times 100$$

$CaCO_3 \longrightarrow CaO + CO_2$

In the reaction above, calcium oxide is a useful product and carbon dioxide is a waste product.

Calculate the atom economy of the reaction.

a

You are asked to prepare 100cm^3 of sodium hydroxide solution (NaOH) with a concentration of 0.5mol dm $^{-3}$.
Calculate the amount of solute in grams.
Show your working.

b

What is the name of this piece of equipment?

_____

Name three other pieces of equipment required to carry out a titration reaction.

_____

c

A titration was carried out and 25.00cm^3 sulfuric acid was reacted with 2.0mol/dm^3 sodium hydroxide. 34.00cm^3 sodium hydroxide was required to neutralise the sulfuric acid. Calculate the concentration of sulfuric acid in mol/dm^3.

$2H_2SO_4 + NaOH \longrightarrow Na_2SO_4 + 2H_2O$

d

The volume of one mole of any gas at room temperature and pressure (20°C and 1 atmosphere pressure) is _____.

e

Calculate the volume of 0.25mol carbon dioxide at room temperature (rtp) using this equation: volume of gas at rtp = number of moles × 24

Calculate the number of moles of hydrogen which occupy 9dm^3 at rtp.

f

I understand the following topic:

I need to work on the following topic:

a

Mass of the **product** must always equal the mass of the **reactants**.

Balance the following:

$2H_2 + O_2 \longrightarrow 2H_2O$

$2Na + Cl_2 \longrightarrow 2NaCl$

$Br_2 + 2KI \longrightarrow I_2 + 2KBr$

$N_2 + 3H_2 \longrightarrow 2NH_3$

b

Complete the following sentences

The relative formula mass is the (M_r) of a compound.

It is the sum of the **relative** atomic masses (A_r) of the atoms.

Calculate the relative formula mass for the following. Show your working out.

A_r of C = 12
A_r of H = 1
A_r of O = 16
A_r of N = 14

Example:
CO_2
12 + (16 × 2)
12 + 32
= 44

H_2O
(1 × 2) + 16
2 + 16
= 18

CH_4
12 + (1 × 4)
12 + 4
= 16

NH_4NO_3
14 + (1 × 4) + 14 + (16 × 3)
14 + 4 + 14 + 48
= 80

c

When a gas is produced during a reaction, why might the mass go down?

The gas may be released into the environment.

Write the equation for when magnesium reacts with oxygen.

$2Mg + O_2 \longrightarrow 2MgO$

What happens to the mass of the product from the question above?

The mass increases because oxygen is added from the environment.

d

$$\% \text{ mass} = \frac{A_r \times \text{number of atoms} \times 100}{M_r \text{ of the compound}}$$

Using the equation above, calculate the % mass of sodium (Na) in NaCl.

A_r of Na = 23

A_r of Cl = 35.5

$$\% \text{ mass} = \frac{23 \times 1 \times 100}{23 + 35.5}$$

$$= \frac{2300}{58.5}$$

= 39.3% (to 1d.p.)

e

Use the A_r values below to calculate the molar mass of these elements. Don't forget the units.

E.g. A_r of sodium = 23, one mole = 23g

A_r of K = 39

A_r of F = 19

A_r of O = 16

A_r of Mg = 24

potassium (39 × 1) 39g/mol

fluorine (19 × 2) 38g/mol

oxygen (16 × 2) 32g/mol

magnesium (24 × 1) 24g/mol

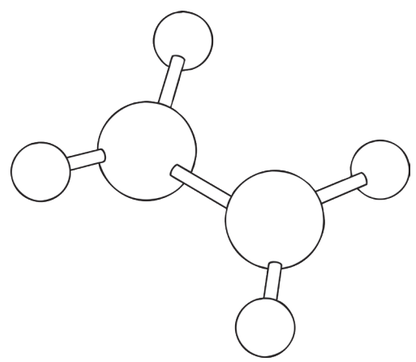
f

What is the equation to calculate the number of moles for a pure substance.

$$\text{moles} = \frac{\text{mass in g}}{M_r}$$

Rearrange the equation to calculate the mass.

mass = moles × M_r



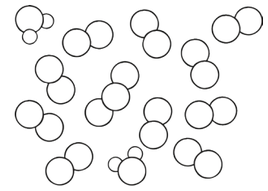
g

What unit are chemical amounts measured in?

1. cm
2. m/s
3. **moles**

Avogadro's constant is...

1. 6.03×10^{23} per mole
2. **6.02×10^{23} per mole**
3. 6.05×10^{23} per mole



h

What mass of nitrogen is in 92g of NO_2?

A_r of N = 14

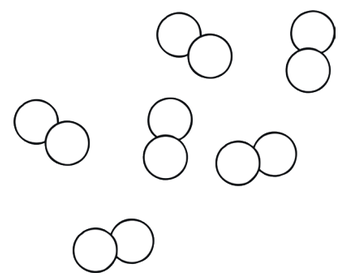
A_r of O = 16

M_r = 14 + (16 × 2) = 46

N = 14

$\frac{14}{46}$ = 0.304

0.304 × 92 = 28g



a

Using the equation

$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2$

What mass of NaCl would be produced from 2.5 grams of sodium carbonate?

A_r of Na = 23

A_r of H = 1

A_r of Cl = 35.5

A_r of O = 16

A_r of C = 12

M_r of NaCl = 58.5
M_r of Na_2CO_3 = 106

$\frac{2.5}{106}$ = 0.0236 moles (to 3 significant figures)

0.0236 × 2 = 0.0472 (1:2 ratio)

0.0472 × 58.5 = 2.76 grams of NaCl

b

What is the mass of solute when the concentration of a solution is 4g/dm³ and the volume is 600cm³?

Convert 600cm³ to dm³ = 0.6dm³

mass = concentration × volume

4 × 0.6dm³ = 2.4g

c

concentration (gm/dm³) = $\frac{\text{mass of solute}}{\text{volume}}$

Using the equation above, calculate the following:

The mass of a solute is 60g and the volume is 0.5dm³, what is the concentration?

Concentration = $\frac{60}{0.5}$

= 120g/dm³

d

Rearrange the following equation to find volume.

concentration (mol/dm³) = $\frac{\text{mass of solute}}{\text{volume}}$

volume = $\frac{\text{mass of solute}}{\text{concentration}}$

e

Why, in some reactions, are the reactants in excess?

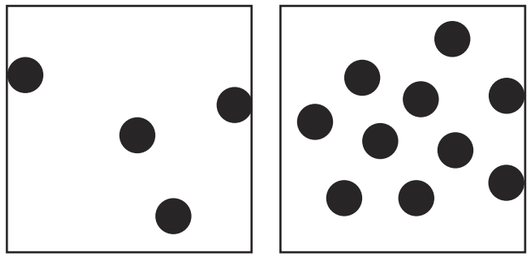
To make sure that the reaction has completely finished and the other reactant has been completely used up.

f

Define concentration.

The amount of a substance in a certain volume of a solution is called its concentration.

Draw a diagram to show a solution with a low concentration and a solution with a high concentration



g

Convert the following measurements in cm³ to dm³.

1. 15cm³
2. 60cm³
3. 90cm³
4. 0.5cm³

Divide by 1000

1. 0.015dm³
2. 0.06dm³
3. 0.09dm³
4. 0.0005dm³

h

When a chemical reaction occurs, the amount of product made is not always equal to the amount calculated. Explain why.

Some of the product is lost when it is being collected from the reacting mixture. Not all the reactants make products because the reaction is reversible. Some reactants may react differently to what is expected.

i

The amount of a product obtained from a reaction is called the **yield**. The actual yield is compared to the maximum expected amount as a percentage. This is called the **percentage yield**.

Complete the equation below:

% yield= $\frac{\text{actual mass of product made}}{\text{expected mass of product}} \times 100$

j

A chemist carried out a reversible reaction. She had expected to make 14.50kg of product, but only obtained 12.75kg. Calculate the percentage yield.

(12.75 ÷ 14.50) × 100 = 87.93%

k

What is atom economy?

A measure of how many starting atoms are used to make the useful products.

l

The equation below is used to calculate the **atom economy** of a reaction.

$\frac{\text{relative formula mass of desired product}}{\text{sum of relative formula masses of all reactants}} \times 100$

$CaCO_3 \longrightarrow CaO + CO_2$

In the reaction above, calcium oxide is a useful product and carbon dioxide is a waste product.

Calculate the atom economy of the reaction.

RFM of calcium oxide: 40 + 16 = 56

RFM of carbon dioxide: 12 + (16 × 2) = 44

(56 ÷ (56 + 44)) × 100 = 56%

a

You are asked to prepare 100cm^3 of sodium hydroxide solution (NaOH) with a concentration of 0.5mol dm^{-3}. Calculate the amount of solute in grams.
Show your working.

amount in mol = volume in dm^3 × concentration in mol/dm^3

volume = 100cm^3 ÷ 1000 = 0.1dm^3

= 0.1 × 0.5 = 0.05mol

RFM of NaOH: 22 + 16 + 1 = 39

0.05mol × 39 = 1.95g

b

What is the name of this piece of equipment?

burette

Name three other pieces of equipment required to carry out a titration reaction.

conical flask, pipette filler, pipette

c

A titration was carried out and 25.00cm^3 sulfuric acid was reacted with 2.0mol/dm^3 sodium hydroxide. 34.00cm^3 sodium hydroxide was required to neutralise the sulfuric acid. Calculate the concentration of sulfuric acid in mol/dm^3.

$2H_2SO_4 + NaOH \longrightarrow Na_2SO_4 + 2H_2O$

volume of acid: 25.00cm^3, concentration of acid: ?

volume of alkali: 34.00cm^3, concentration of alkali: 2.0mol/dm^3

volume of acid: 25.00cm^3 ÷ 1000 = 0.025dm^3

volume of alkali: 34.00cm^3 ÷ 1000 = 0.034dm^3

amount in mol = volume in dm^3 × concentration in mol/dm^3

amount in mol (alkali): 0.034 × 2.0 = 0.068mol

from the equation: 1mol alkali (NaOH) : 2mol acid ($2H_2SO_4$)

amount in mol (acid): 0.068mol × 2 = 0.136mol

concentration in mol/dm^3 = amount in mol ÷ volume in dm^3

0.136 ÷ 0.025 = 5.44mol/dm^3

d

The volume of one mole of any gas at room temperature and pressure (20°C and 1 atmosphere pressure) is 24dm^3.

e

Calculate the volume of 0.25mol carbon dioxide at room temperature (rtp) using this equation: volume of gas at rtp= number of moles × 24

volume = 0.25 × 24 = 6dm^3

Calculate the number of moles of hydrogen which occupy 9dm^3 at rtp.

moles = volume ÷ 24

moles = 9 ÷ 24 = 0.375mol

f

I understand the following topic:

I need to work on the following topic: