CIE Chemistry IGCSE

Topic 4 - Stoichiometry

Flashcards

A compound contains 3 carbon atoms and 8 hydrogen atoms. Write the chemical formula of this compound

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C_3H_8

What is the chemical formula of sodium oxide, formed from Na^+ and O^{2-} ions?

(extended only)

What is the chemical formula of sodium oxide, formed from Na^+ and O^{2-} ions? (extended only)

Na_2O

Charges must balance so 2 sodium ions are required.

What is the chemical formula of magnesium hydroxide, formed from Mg^{2+} and OH^- ions?

(extended only)

What is the chemical formula of magnesium hydroxide, formed from Mg^{2+} and OH^- ions? (extended only)

$Mg(OH)_2$

Charges must balance so 2 hydroxide ions are required.

What are the state symbols used in chemical equations?

(extended only)

What are the state symbols used in chemical equations? (extended only)

(g) - gas

(aq) - aqueous

(l) - liquid

(s) - solid

What is an ionic equation?
(extended only)

What is an ionic equation? (extended only)

Ionic equations only show the reacting ions and can be written for any reaction involving ions in solution.

Write an ionic equation for the reaction between nitric acid (HNO_3) and sodium hydroxide (NaOH). Include state symbols.

(extended only)

Write an ionic equation for the reaction between nitric acid (HNO_3) and sodium hydroxide (NaOH). Include state symbols. (extended only)

$HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$

Rewrite the equation with the ions:

$H^+ + NO_3^- + Na^+ + OH^- \rightarrow Na^+ + NO_3^- + H_2O$

Cancel any ions appearing on both side to get the ionic equation:

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

Write an ionic equation for the reaction between silver nitrate and sodium chloride. Include state symbols.

(extended only)

Write an ionic equation for the reaction between silver nitrate and sodium chloride. Include state symbols. (extended only)

$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

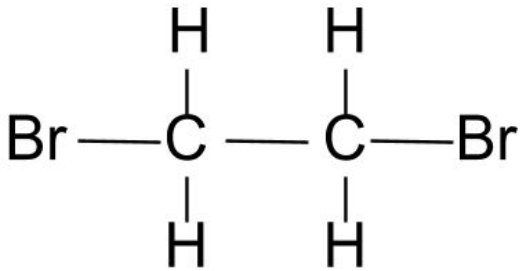
Rewrite the equation with ions:

$Ag^+ + NO_3^- + Na^+ + Cl^- \rightarrow AgCl + Na^+ + NO_3^-$

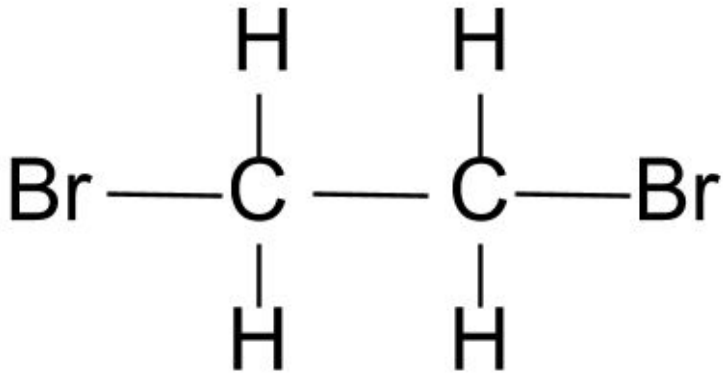
Cancel any ions appearing on both side to get the ionic equation:

$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

What is the formula for the compound shown in the diagram below?



What is the formula for the compound shown in the diagram below?



$C_2H_4Br_2$

(empirical formula is CH_2Br)

What is the word and balanced chemical equation for the reaction between sodium hydroxide and hydrochloric acid?

What is the word and balanced chemical equation for the reaction between sodium hydroxide and hydrochloric acid?

Sodium hydroxide + hydrochloric acid → water + sodium chloride

$$NaOH + HCl \rightarrow H_2O + NaCl$$

Write a balanced chemical equation for the reaction between hydrogen and chlorine to form hydrogen chloride. Include state symbols.

(extended only)

Write a balanced chemical equation for the reaction between hydrogen and chlorine to form hydrogen chloride. Include state symbols. (extended only)

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

What does the term relative atomic mass mean?

What does the term relative atomic mass mean?

The average mass of one atom of an element compared to 1/12th the mass of an atom of carbon-12.

OR

The average mass of one atom of an element on a scale where ^{12}C has a mass of exactly 12 units.

What does the term relative formula mass mean?

What does the term relative formula mass mean?

The sum of the relative atomic masses of atoms in a formula unit. Used for giant ionic structures.

What does the term relative molecular mass mean?

What does the term relative molecular mass mean?

The sum of the relative atomic masses of atoms in a molecule.

Define the mole
(extended only)

Define the mole (extended only)

The amount of any substance containing the same number of particles as there are atoms in exactly 12 g of carbon-12 (6.02×10^{23} particles).

Define the Avogadro constant (extended only)

Define the Avogadro constant (extended only)

The number of particles in one mole of a substance. This is 6.02×10^{23} particles.

What is the equation that relates moles with the Avogadro constant?

(extended only)

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(extended only)

Number of particles/atoms/ions =

moles x Avogadro's constant

What is the molar volume of gas at room temperature and pressure?

(extended only)

What is the molar volume of gas at room temperature and pressure? (extended only)

$24\ dm^3$

What is RTP?
(extended only)

What is RTP? (extended only)

Room temperature and pressure:

- 20ºC
- 1 atmosphere

What equation links molar volume at RTP and moles?

(extended only)

What equation links molar volume at RTP and moles? (extended only)

Volume of gas at RTP (dm^3) = moles x 24

How many moles of oxygen are in 72 dm^3 at RTP?

(extended only)

How many moles of oxygen are in 72 dm^3 at RTP? (extended only)

Moles = volume / 24

= 72 / 24

= 3 moles

What equation links moles, mass and relative atomic mass?

(extended only)

What equation links moles, mass and relative atomic mass? (extended only)

Mass (g) =

Moles x Relative atomic mass (Mr)

How many moles are in 2.35 g of aluminium? (extended only)

How many moles are in 2.35 g of aluminium?
(extended only)

Moles = mass / relative atomic mass

= 2.35 / 27

= 0.0870 (3.s.f)

How many moles are in 5.44 g of sodium chloride?

(extended only)

How many moles are in 5.44 g of sodium chloride? (extended only)

Relative atomic mass of NaCl = 23 + 35.5 = 58.5

Moles = mass / relative atomic mass

= 5.44 / 58.5

=0.0930 (3.s.f)

How can concentration be calculated in g/dm^3?

(extended only)

How can concentration be calculated in g/dm^3?
(extended only)

Concentration (g/dm^3) =

Mass (g) / Volume (dm^3)

How can concentration be calculated in mol/dm^3?

(extended only)

How can concentration be calculated in mol/dm^3?
(extended only)

Concentration =

Moles / Volume (dm^3)

5.00 g of NaCl is dissolved in 25 cm^3 of water. Calculate the concentration of the solution in mol/dm^3.

(extended only)

5.00 g of NaCl is dissolved in 25 cm^3 of water. Calculate the concentration of the solution in mol/dm^3. (extended only)

Moles of NaCl = 5 / 58.5 = 0.0855

Volume in dm^3 = 25 / 1000 = 0.025

Concentration in mol/dm^3 = 0.0855 / 0.025

= 3.42 mol/dm^3

What is a limiting reagent?
(extended only)

What is a limiting reagent? (extended only)

The reactant that is not in excess in a chemical reaction. It will be completely used up first, preventing the reaction continuing and limiting the amount of product that can form.

0.953 g of magnesium reacts fully with chlorine: $Mg + Cl_2 \rightarrow MgCl_2$
What mass of magnesium chloride is formed?

(extended only)

0.953 g of magnesium reacts fully with chlorine according to the following equation. What mass of magnesium chloride would be formed?

$Mg + Cl_2 \rightarrow MgCl_2$ (extended only)

Moles of Mg = 0.953 / 24 = 0.0397

Ratio of moles of Mg:$MgCl_2$ is 1:1 so $MgCl_2$ also has 0.0397 moles.

Mass of $MgCl_2$ = 0.0397 x (24 + 35.5 +35.5) = 3.77 g (3.s.f)

What is meant by the term empirical formula?

(extended only)

What is meant by the term empirical formula? (extended only)

The smallest whole number ratio of the atoms of each element in a compound.

What is the empirical formula of Fe_2O_4?
(extended only)

What is the empirical formula for Fe_2O_4?
(extended only)

FeO_2

What is meant by the term molecular formula?

(extended only)

What is meant by the term molecular formula? (extended only)

The actual number of atoms of each element in a compound.

A molecule has the empirical formula $C_4H_3O_2$ and a relative molecular mass of 166. What is the molecular formula?

(extended only)

A molecule has the empirical formula $C_4H_3O_2$ and a relative molecular mass of 166.What is the molecular formula? (extended only)

Empirical mass = 4(12) + 3(1) + 2(16) = 83

Relative molecular mass = 166

Compare molecular mass with empirical mass = 166 / 83 = 2

So the molecular formula is double the empirical formula: $C_8H_6O_2$

What is meant by the term theoretical yield?

(extended only)

What is meant by the term theoretical yield? (extended only)

The maximum amount of product that would be collected under perfect reaction conditions.

How can percentage yield be calculated?
(extended only)

How can percentage yield be calculated? (extended only)

Percentage yield =

(Actual yield ÷ Theoretical yield) x 100

What is the percentage yield of NH_3 if 40.5 g of NH_3 is produced from 20.0 mol H_2 and excess N_2?

(extended only)

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(extended only)

Equation: $N_2 + 3H_2 \rightarrow 2NH_3$

Moles of ammonia = 20/1.5 = 13.3 moles

Mass of ammonia = 13.3 x (14+1+1+1) = 227 g

Percentage yield = (40.5/227) x 100 = 17.9%

Why might the actual yield of product be less than expected?

(extended only)

Why might the actual yield of product be less than expected? (extended only)

- Incomplete reaction.
- Unwanted side reactions.
- Practical losses, for example some solid may get lost when being transferred between beakers.

How can the percentage purity of a sample be calculated?

(extended only)

How can the percentage purity of a sample be calculated? (extended only)

Percentage purity =

(Mass of the pure substance / Mass of the sample) x 100