Atoms, Elements and Compounds

Everything around you is built from atoms — understanding elements, compounds and how they combine is the foundation of KS3 chemistry and GCSE Science.

(c) Draw a line from each of the **substances** below to the **group** that it belongs to.
Draw only **three** lines.

Draw a line from each **group** to the correct **description**.
Draw only **three** lines.

substance	group	description
seawater	compound	It contains two or more types of atoms or molecules which can be physically separated.
salt	mixture	It contains only one type of atom.
oxygen	element	Two or more types of atoms are chemically joined together.

KS3 Science SATs, Tier 3-6, Paper 1 (2009) - Q14(c)

(c) Gemstones called rubies are made from an aluminium compound with the formula Al_2O_3.

The chemical symbol for aluminium is Al.

(i) Give the name of the element that is combined with aluminium in this compound.

_____

(ii) Suggest the name of the compound with the formula Al_2O_3.

_____

(iii) How many atoms are there in the formula Al_2O_3?

_____

KS3 Science SATs, Tier 3-6, Paper 2 (2008) - Q12(c)

(a) From the substances in experiments A, B and C, opposite, give the name of:

(i) **one** metallic element;

_____

(ii) **one** non-metallic element;

_____

(iii) **two** compounds.

_____ and _____

(b) In experiment B, the iron filings weighed 2.0 g at the beginning of the experiment and the iron sulphide produced weighed 2.8 g.

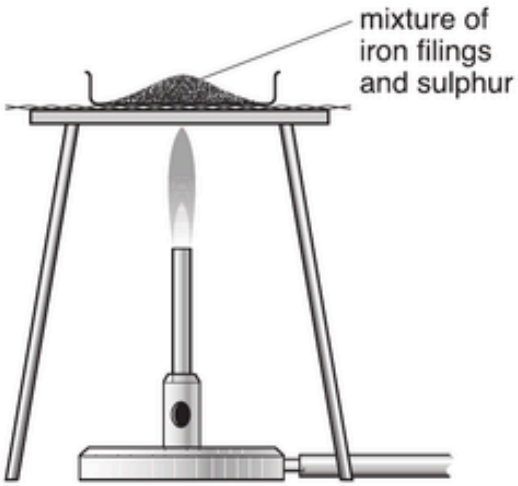
Explain this increase in mass.

_____

_____

KS3 Science SATs, Tier 3-6, Paper 2 (2006) - Q12(a)-(c)

14. A teacher mixed iron filings with sulphur on a metal tray.
She heated the mixture in a fume cupboard.
Sulphur is yellow. Iron filings are grey.



The mixture glowed very brightly. The teacher turned off the bunsen burner.
The glow spread through the mixture.
When the mixture cooled, a black solid called iron sulphide was left.

(a) From this information, give **one** way you can tell that a chemical reaction took place.

_____

_____

14a
1 mark

(b) What type of substance is each of the chemicals involved in this reaction?
Choose from:

metallic element	mixture	non-metallic element	compound

iron _____

sulphur _____

iron sulphide _____

14b
1 mark

14b

Modern Tuition

12. (a) The chemical formula for hydrochloric acid is HCl.
The chemical formula for sodium hydroxide is NaOH.

When they react together, two products are formed.
The chemical formula for one product is NaCl.

12ai 1 mark (i) Complete the word equation below with the **names** of both products.

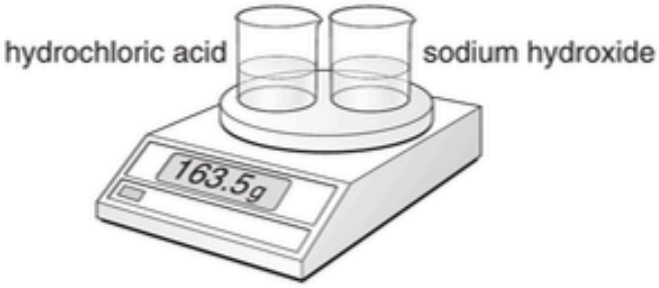
12ai 1 mark (ii) **On the dotted line**, give the chemical formula of the other product.

12aii 1 mark

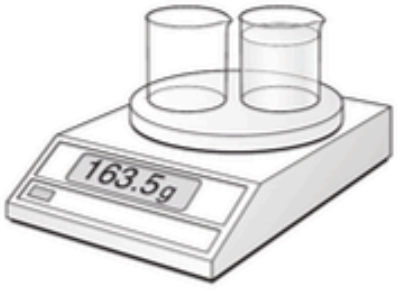
sodium hydroxide NaOH + hydrochloric acid HCl ⟶ _____ + _____

NaCl

(b) In experiment 1, Molly put two beakers on a balance.
One contained 20 cm^3 of hydrochloric acid.
The other contained 20 cm^3 of sodium hydroxide solution.
The total mass was 163.5 g.



She poured the acid onto the sodium hydroxide. They reacted.



Why did the reading on the balance **not** change?

Modern Tuition

(b) Joe bought some fertiliser for his plant.
The names and formulae of four different fertilisers are shown below.



(i) Give the letter of **one** box of fertiliser, A, B, C or D, that would provide each of the minerals in the table below.
Write the letters in the table.

mineral	letter of fertiliser
magnesium	
nitrogen	
phosphorus	
potassium	

(ii) Easy Grow is ammonium nitrate, NH_4NO_3.

How many different elements are present in ammonium nitrate?

_____

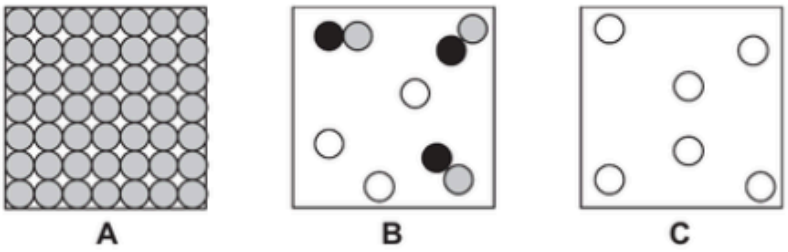
(iii) How many atoms are present in the formula of ammonium nitrate?

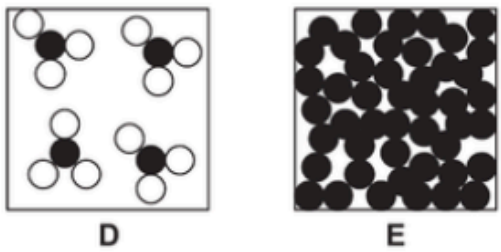
_____

Modern Tuition

11. (a) The diagrams below show the arrangement of atoms or molecules in five different substances A, B, C, D and E.

Each of the circles ○, ○ and ● represents an atom of a different element.





Give the letter of the diagram which represents:

(i) a mixture of gases;

_____

(ii) a single compound.

_____

Modern Tuition

(c) Diagram **C** shows what happened to the molecules after the gas was compressed more.

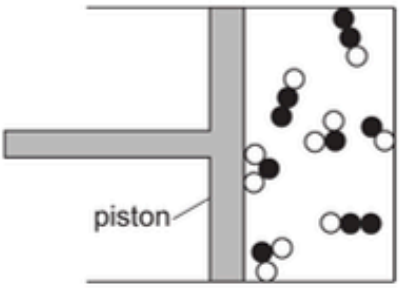


diagram C

(i) How can you tell that a chemical reaction happened when the gas was compressed?

_____

_____

1 mark

(ii) The mass of the gas in both diagrams **B** and **C** was 0.3 g.

Why did the mass of the gas **not** change when it was compressed?

_____

_____

1 mark

(iii) Complete the table below with the correct chemical formula of each substance. Use the key to help you.

substance	formula
●○	
●●○	
●○	

Key
● nitrogen
○ oxygen

1 mark

(iv) What is the **name** of the substance represented by the symbol ●○ ?

_____

Modern Tuition

11. (a) The fire extinguisher below contains a compound called sodium hydrogencarbonate.



contains sodium hydrogencarbonate powder

The formula for sodium hydrogencarbonate is $NaHCO_3$.

When sodium hydrogencarbonate is heated it breaks down to produce carbon dioxide, water and a compound with the formula Na_2CO_3.

This is shown in the equation below.

(i) Complete the word equation below.

sodium hydrogencarbonate → carbon dioxide + water + _____

(Na_2CO_3)

(ii) Complete the table below to show the mass of water produced when 168 g of sodium hydrogencarbonate breaks down completely.

compound	reactant or product	mass (g)
sodium hydrogencarbonate	reactant	168
carbon dioxide	product	44
water	product	
Na_2CO_3	product	106

(iii) How much carbon dioxide is produced when 336 g of sodium hydrogencarbonate breaks down completely?

_____ g

Modern Tuition