Hazard Symbols

You can find out more about hazard symbols on www.understandthelabel.org.uk

Chemicals are labeled with pictures so that whatever language you speak you know what the dangers are with those chemicals.

1.

What do you think it means?

warning - exclamation sign

Correct answer

immediate irritant to skin / eye / resp tract

2.

What do you think it means?

have immediate + severe toxic effect

Correct answer

toxic

3.

What do you think it means?

causing skin burns / eye damage / corrosive to metals

Correct answer

corrosive

4.

What do you think it means?

toxic to aquatic wildlife

Correct answer

dangerous to environment

5.

What do you think it means?

gases stored under pressure eg. ammonia / liquid nitrogen

Correct answer

gas cylinder

6.

What do you think it means?

at risk of exploding even without exposure to air (self-reactive)

Correct answer

explosives

7.

What do you think it means?

can self-ignite when exposed to air or can emit flammable gas

Correct answer

flammable

8.

What do you think it means?

carcinogen / substance with reproductive or organ toxicity

Correct answer

health hazard

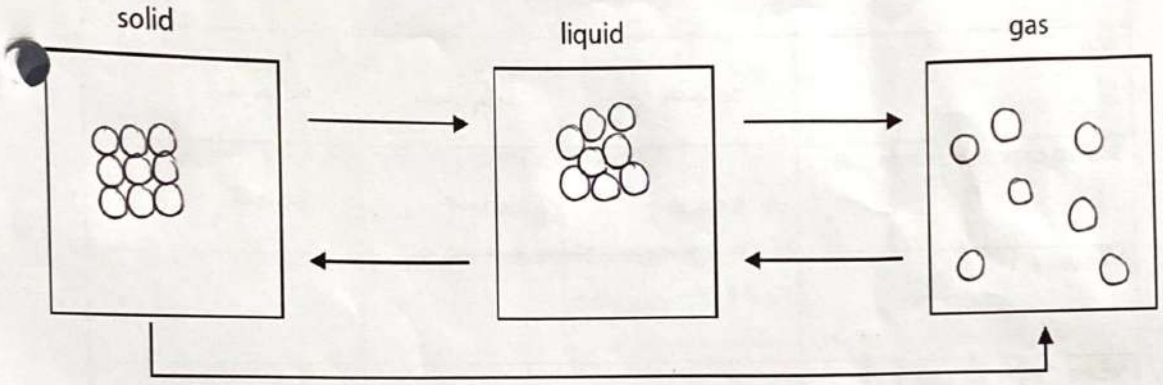
States of Matter

Learning Outcomes:

1) Describe, using particle diagrams, the three states of matter in terms of the arrangement, movement and energy of the particles
2) State the names of the interconversions between the three states of matter and describe how they are achieved
3) Identify, from making observations, a physical change

Changes of State

Add labels to the arrows that show the change of state and describe, using particle diagrams, the arrangement of the particles.



Describe the three states of matter in terms of the arrangement, movement and energy of the particles

	Solid	Liquid	Gas
Arrangement	regular	irregular	no clear arrangement
Movement	vibrate at fixed positions	flows	random
Energy	low	medium	high

Practical **Physical Changes**

△ **Safety** *Heating solids*

- Collect a labelled test-tube from the front and carefully heat for **no more** than 2 minutes. Leave to cool in a test-tube rack.
- Carefully record your observations

Substance	Appearance		
	before heating	during heating	after cooling
Ice	solid	gas	liquid
Wax	solid	liquid	solid
Sodium chloride (common salt)	solid	solid	solid
Zinc oxide			
Iodine *Teacher demo*			
Solid carbon dioxide (dry ice) *Teacher demo*			

1. Sodium chloride did nothing when heated with a Bunsen burner. What does this tell you about the melting temperature, T_m, of sodium chloride?

melting temp v. high

2. Liquid water stays liquid at room temperature but liquid wax freezes. Room temperature is about 20°C. What does this tell you about the melting temperature, T_m, of water and of wax?

melting temp of wax higher than mat of water

3. Solid carbon dioxide is called *dry ice*.
   (a) Why is solid carbon dioxide called *dry ice*?

.....

   (b) Give <u>two</u> uses of dry ice.

.....

Using State symbols

State	State symbol
Solid	(s)
Liquid	(l)
Gas	(g)

State symbols can be used to show the changes in state during physical or chemical processes.

Example: When ice is heated above its melting point.

$H_2O(s) \rightarrow H_2O(l)$

Using chemical formula and state symbols, show state changes for the below physical processes.

1) Water is cooled below 0°C. $H_2O_{(l)} \rightarrow H_2O_{(s)}$

2) Liquid bromine (Br_2) is vaporised. $Br_{2(l)} \rightarrow Br_{2(g)}$

3) Nitrogen gas (N_2) is cooled below its boiling point of -196°C

$N_{2(g)} \rightarrow N_{2(l)}$

4) Carbon dioxide (CO_2) changes directly from a solid to a gas when heated.

$CO_{2(s)} \rightarrow CO_{2(g)}$

2019-20

Atomic Structure

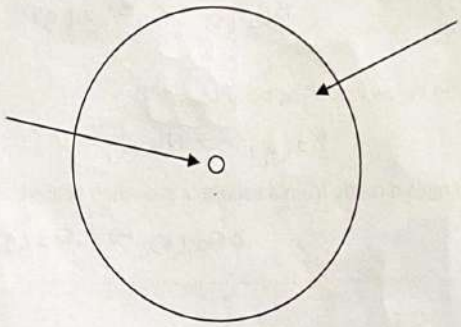
Learning Outcomes:

1) Define the terms atom, atomic number and mass number
2) Describe the structure of an atom
3) Deduce the number of protons, electrons and neutrons from an atom's atomic number and mass number
4) Describe how elements are arranged in the Periodic Table

All substances are made up of atoms. There are over 100 different sorts of atoms. A substance which consists of only one type of atom is called an **element**.

Key definition
An **atom** is the smallest part of an element

Structure of a atom



Subatomic particles

Particle	Position	Charge	Relative mass
Proton	nucleus	+1 / pos.	1
Neutron	nucleus	neutral / no charge	1
Electron	shell	−1 / neg.	1/1836

Use the following words to complete the word fill: electrons, energy levels, neutrons, nucleus, protons, and shells. *(Words can be used more than once).*

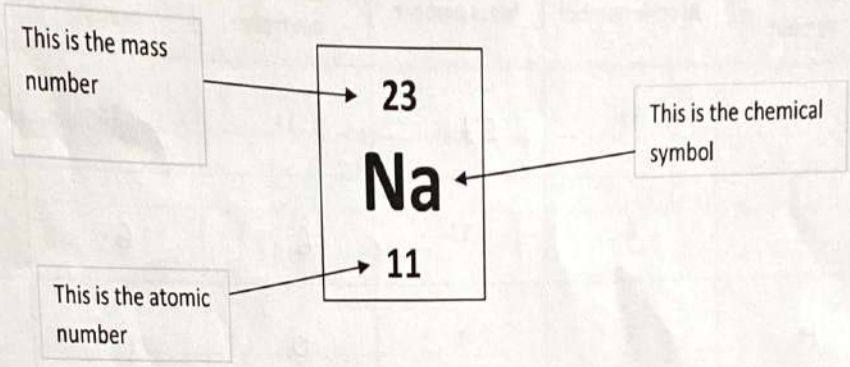
An atom consists of a central ...nucleus..., composed of ....protons.... and .....neutrons..

This is surrounded by ....electrons., orbiting in ...shells..... (.energy... ...levels).

Atoms are neutral because the numbers of ...protons..... and ...electrons. are equal.

Using the periodic table the number of protons, electrons and neutrons of an atom can be deduced.

Example - sodium (Na):



Key definition

Atomic number: The number of protons in an atom.

Mass number: The number of protons and neutrons in an atom.

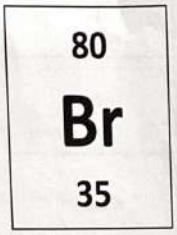
For an electrically neutral atom, **the number of electrons equals the number of protons**.

Again, this makes sense from the table above, since the total positive charge from all the protons balances the total negative charge from the electrons.

So, by looking at the symbol on the periodic table we know that this sodium atom has:

- **11 protons** (number of protons = atomic number)
- **12 neutrons** (number of neutrons = mass number − atomic number = 23 - 11 = 12)
- **11 electrons** (number of electrons = number of protons)

For an atom of bromine, deduce the number of protons, neutrons and electrons.



Number of protons = 35

Number of neutrons = 45

Number of electrons = 35

Check out these resources:

- *Tyler DeWitt - https://www.youtube.com/watch?v=NSAgLvKOPLQ*
- *Brian Cox - https://www.youtube.com/watch?v=-FWxd78sOZ8*

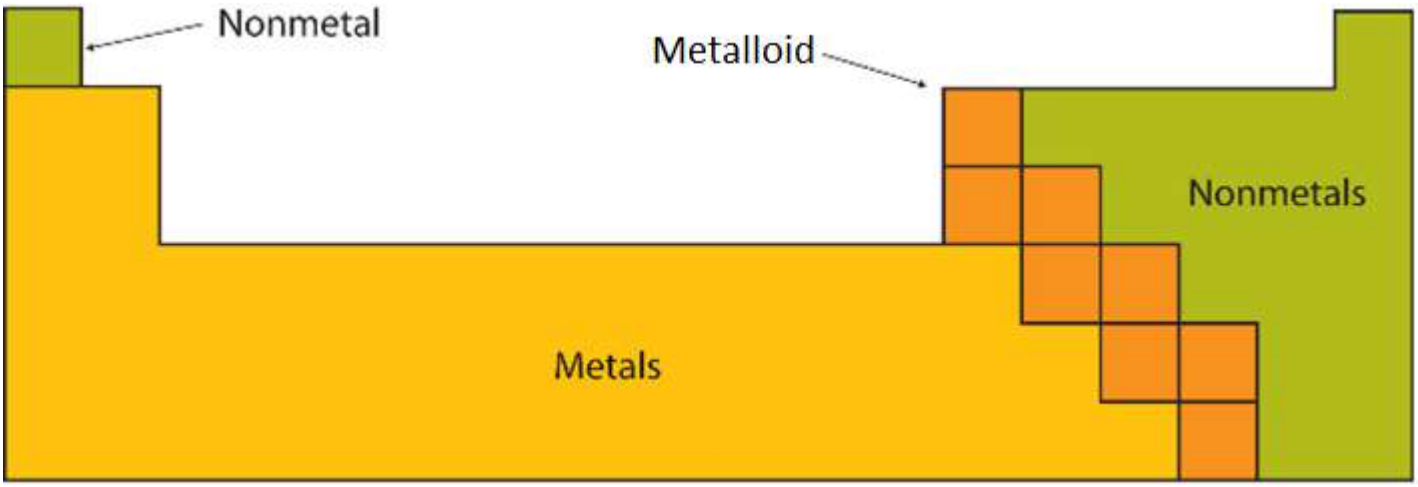
Using the periodic table complete the table

Chemical symbol	Atomic number	Mass number	Number of neutrons	Number of protons	Number of electrons
Al	13	27	14	13	13
C	6	12	6	6	6
H	1	1	0	1	1
O	8	16	8	8	8
N	7	14	7	7	7
Na	11	23	12	11	11
S	16	32	16	16	16
P	15	31	16	15	15
Pb	82	207	125	82	82
Au	79	197	118	79	79
I	53	127	74	53	53
Pm	61	144	83	61	61
Fr	87	223	136	87	87

Properties of metals and non-metals

Property	Metal	Non-metal
Appearance at room temperature	Mostly silvery sold, lustrous but often tarnished	Gaseous, mostly colourless or dull or often coloured solid
Electrical conductivity	Good conductivity	Non-conductive / Poor conduction
Mechanical strength	Strong, Malleable	Brittle
Feel	Cool, dense	Warm, light

Position of metals and non-metals in the periodic table



Task: Tick the elements in the table below which are metals:

calcium ✔	*sulfur*	*silicon*
manganese ✔	*magnesium* ✔	*potassium* ✔
carbon	*francium* ✔	*argon*
mercury ✔	*iodine*	*hydrogen*

- *Tom Lehrer song https://www.youtube.com/watch?v=SmwlzwGMMwc*
- *How elements get their names http://www.bbc.co.uk/science/0/24460393*
- *University of Nottingham Periodic Table http://periodicvideos.com/*

2019-20

Compounds

Learning Outcomes:

1) Define the term compound
2) Identify, using particle diagrams, an element, compound or mixture
3) Name different compounds
4) Define the term exothermic reaction

Key definition

A **compound** is a substance formed when 2 or more elements (different types of atoms) are chemically joined together.

The compound, iron sulfide, is made by heating a mixture of iron and sulfur.

Substance	iron	sulfur	iron and sulfur mixture	iron sulfide compound
Appearance				
With magnet				
In water				
With acid				
Particle model				

Results

What happens when the iron and sulfur are heated together?

Word equation

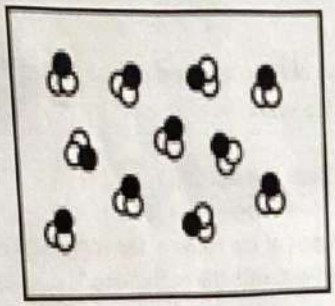
Fe iron + sulfur → iron sulfide

Chemical equation

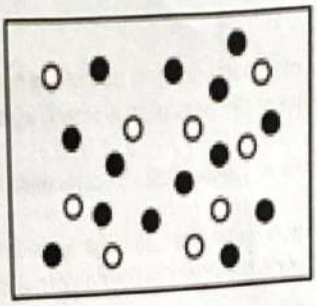
$Fe + S_8 \rightarrow FeS_8$

Particle diagram

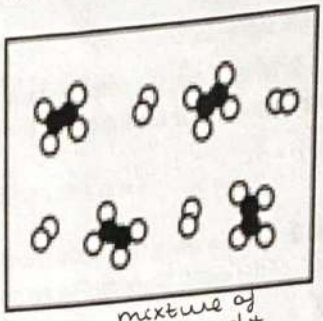
Identify whether the particle diagram represents an element, compound or mixture



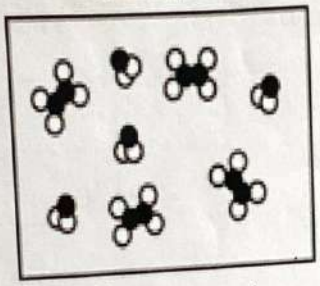
1) compound



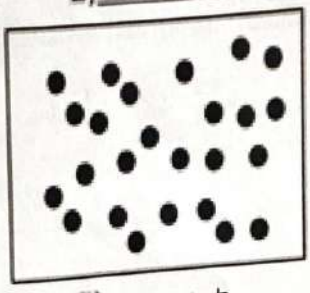
2) mixture



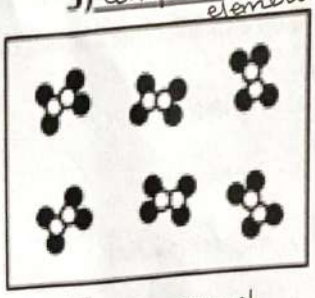
3) mixture of compound + elements



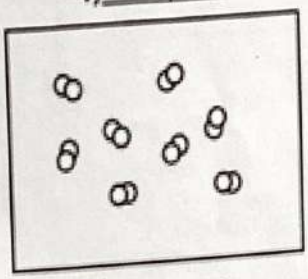
4) compound



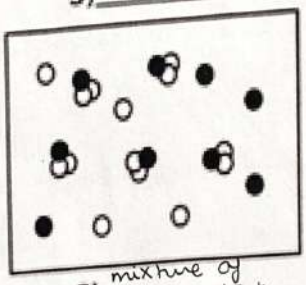
5) element



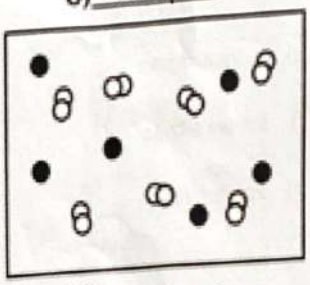
6) compound



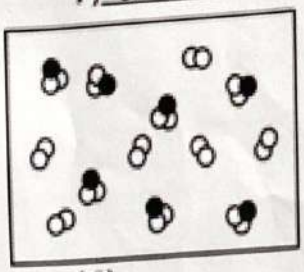
7) element



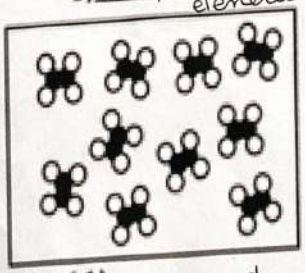
8) mixture of compounds + elements



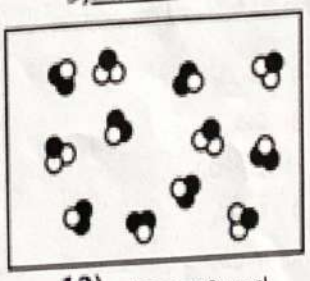
9) mixture



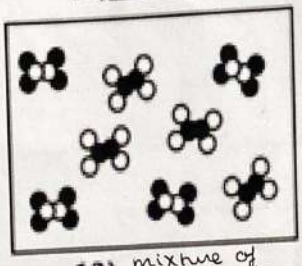
10) _____



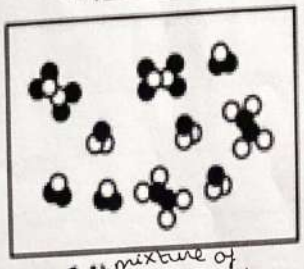
11) compound



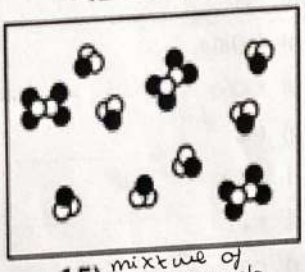
12) compound



13) mixture of compounds



14) mixture of compounds



15) mixture of compounds

Naming compounds

Rule 1: When a metal is combined with a non-metal, the first part of the name of the compound is the name of the metal element. The second part is the name of the non-metal element, with the suffix "-ide."

e.g. iron + sulfur = iron sulfide (FeS) compound of iron & sulfur ONLY

Rule 2: When a metal is combined with a non-metal and also oxygen, the first part of the name of the compound is the name of the metal element. The second part is the name of the non-metal element, with the suffix "-ate."

e.g. iron + sulfur + oxygen = iron sulfate ($FeSO_4$) compound of iron, sulfur & oxygen

Name the elements in the following compounds. The first has been done for you.

a) iron chloride — iron and chlorine

b) zinc bromide — zinc + bromine

c) magnesium sulfate — magnesium, sulfur + oxygen

d) lead phosphide — lead + phosphorus

e) sodium nitrate — sodium, nitrogen + oxygen

f) lithium nitride — lithium + nitrogen

g) iron iodate — iron, iodine + oxygen

h) barium carbonate — barium, carbon + oxygen

Name the following compounds:

i) $CaCO_3$ — calcium carbonate

j) CdS — cadmium sulfide

k) $Ca_3(PO_4)_2$ — calcium phosphate

l) Mg_3N_2 — magnesium nitride

m) Mn_2O_5 — manganese oxide

n) $HgCl_2$ — mercury chloride

o) $Sn(NO_3)_4$ — tin nitrate

p) $K_2Cr_2O_7$ — potassium chromate

q) HCl — hydrogen chloride

r) H_2SO_4 — hydrogen sulfate

s) NaH — sodium hydride

t) CaC — calcium carbide

Name the following molecules:

1) CO_2 Carbon Dioxide

2) CO Carbon Monoxide

3) SiO_2 Silicon Dioxide

4) SO_2 Sulphur dioxide

5) SO_3 Sulphur Trioxide

6) H_2S Hydrogen Sulphide

7) H_2O water

8) TiO_2 Titanium Dioxide

9) NH_3 Ammonia

10) CH_4 Methane

Chemical formula

The chemical formula of a compound tells you how many atoms of each element the compound contains. The number of atoms of each element is written as a subscript and when only a single atom of an element is present, the subscript is omitted.

Example: Ammonia has the chemical formula NH_3. Therefore there is 1 nitrogen atom and 3 hydrogen atoms.

Some formulae have brackets in them.

Example: Magnesium hydroxide has the formula $Mg(OH)_2$. The 2 outside the brackets tells you that you must multiple the total number of each atom inside the bracket by 2. So in $Mg(OH)_2$ you have one magnesium atom, two oxygen atoms and two hydrogen atoms.

Compound	formula	carbon atoms	sulfur atoms	nitrogen atoms	hydrogen atoms	oxygen atoms	iron atoms
carbon dioxide	CO_2	1	0	0	0	2	0
hydrogen sulfide	H_2S	0	1	0	2	0	0
iron hydroxide	$Fe(OH)_3$	0	0	0	3	3	1
iron nitrate	$Fe(NO_3)_3$	0	0	3	0	9	1
ammonium sulfate	$(NH_4)_2SO_4$	0	1	2	8	4	0
hydrated iron sulfate	$FeSO_4.7H_2O$	0	1	0	14	11	1

$O_4 + 7O$
(5)
(11)

Relative formula mass - M_r

Using the Periodic table and its values for relative atomic mass it is possible to work out the relative formula mass of any compound given its chemical formula. It is calculated by adding up the relative atomic masses (A_r) of all the atoms present in the formula.

Example:

The relative formula mass (M_r) for water (H_2O) is 18.

Water = H_2O

Atoms present = (2 x H) + (1 x O)

M_r = (2 x 1) + (1 x 16) = 18

Hydrogen chloride - HCl	**Calcium hydroxide - $Ca(OH)_2$**	**Hydrated copper sulfate - $CuSO_4.5H_2O$**
Atoms = (1 x H) + (1 x Cl) M_r = (1 x 1) + (1 x 35.5) = 36.5	Atoms = (1 x Ca) + (2 x O) + (2x H) M_r = (1 x 40) + (2 x 16) + (2 x 1) = 74	Atoms = (1 x Cu) + (1 x S) + (4 x O) + (5 x H_2O) M_r = (1 x63.5) + (1x 32) + (4 x 16) + (5 x 18) = 249.5

Calculate the relative formula mass (M_r) for the following elements or compounds:

1. CO_2

C = 12 $O_2 = 16 \times 2 = 32$

$12 + 32 = \underline{44}$

2. CH_4

C = 12 $H_4 = 1 \times 4 = 4$

$12 + 4 = \underline{16}$

3. I_2

$I_2 = 127 \times 2 = \underline{254}$

4. NaCl

Na = 23 Cl = 35.5

$23 + 35.5 = 58.5$

5. SO_2

S = 32 $O_2 = 32$

$32 + 32 = \underline{64}$

6 $MgCl_2$

Mg = 24 $Cl_2 = 35.5 \times 2 = 71$

$24 + 71 = \underline{95}$

7. $CuSO_4$

Cu = 63.5 S = 32 $O_4 = 16 \times 4 = 64$

$63.5 + 32 + 64 = \underline{149.5}$

8 Na_2CO_3

$Na_2 = 23 \times 2 = 46$ C = 12 $O_3 = 16 \times 3 = 48$

$46 + 12 + 48 = \underline{100}$

9. C_2H_5OH

$C_2 = 12 \times 2 = 24$ $H_5 = 1 \times 5 = 5$ O = 16 H = 1

$24 + 5 + 16 + 1 = \underline{46}$

10. $Fe(OH)_2$

Fe = 56 $O_2 = 16 \times 2 = 32$ $H_2 = 1 \times 2 = 2$

$56 + 32 + 2 = \underline{90}$

11. $(NH_4)_2CO_3$

$N_2 = 14 \times 2 = 28$ $H_8 = 8$ C = 12 $O_3 = 16 \times 3 = 48$

$28 + 8 + 12 + 48 = \underline{96}$

12. $Al(NO_3)_3$

Al = 27 $N_3 = 14 \times 3 = 42$ $O_9 = 16 \times 9 = 144$

$27 + 42 + 144 = \underline{213}$

13. $C_3H_5(NO_3)_3$

$C_3 = 12 \times 3 = 36$ $H_5 = 5$ $N_3 = 14 \times 3 = 42$ $O_9 = 144$

$36 + 5 + 42 + 144 = \underline{227}$

14. $MgSO_4.7H_2O$

$MgSO_4$	$7H_2O$
Mg = 24	$H_2O = (2 \times 1) + 16 = 18$
S = 32	$7H_2O = 18 \times 7 = 126$
$O_4 = 16 \times 4$	
$24 + 32 + 64 = 120$	24

$120 + 126 = \underline{246}$

Work out the Relative Formula Mass (Mr) of the following:

Name	Formula	M_r
Fluorine	F_2	$19 \times 2 = 38$
Phosphorus	P_4	$31 \times 4 = 124$
Ozone	O_3	$16 \times 3 = 48$
Ethane	C_2H_6	$(2 \times 12) + (6 \times 1) = 24 + 6 = 30$
Sulfuric acid	H_2SO_4	$(2 \times 1) + 32 + (16 \times 4) = 2 + 32 + 64 = 98$
Iron hydroxide	$Fe(OH)_3$	$56 + 3 \times (16+1) = 56 + 51 = 107$
Calcium carbonate	$CaCO_3$	$40 + 12 + (3 \times 16) = 40 + 12 + 48 = 100$
Ammonia	NH_3	$14 + (3 \times 1) = 17$
Ammonium iron sulfate	$NH_4Fe(SO_4)_2$	$14 + 4 + 56 + [2 \times (32 + 64)] = 266$
Glucose	$C_6H_{12}O_6$	$(6 \times 12) + 12 + (16 \times 6) = 72 + 12 + 96 = 180$
Hydrated colbalt chloride	$CoCl_2.6H_2O$	$59 + 71 = 130$ $H_2O = 18$ $6H_2O = 18 \times 6 = 108$ $130 + 108 = 238$
Hydrated vanadium bromide	$VBr_2.4H_2O$	$V = 51$ $Br_2 = 160$ $51 + 160 = 211$ $H_2O = 18$ $4H_2O = 18 \times 4 = 72$ $211 + 72 = 283$
Hydrated copper arsenate	$Cu_3(AsO_4)_2.4H_2O$	$Cu_3 = 63.5 \times 3 = 190.5$ $(AsO_4)_2 = 75 + (4 \times 16) = 139 \times 2 = 278$ $190.5 + 278 = 468.5$ $H_2O = 18$ $4H_2O = 72$ $468.5 + 72 = 540.5$

Chemical reactions

Learning Outcomes:

1) Accurately use a mass balance to record mass changes in chemical reactions
2) Accurately make and record observation in chemical reactions
3) Identify a synthesis and decomposition reaction from mass changes
4) Define the term exothermic and endothermic reaction

Practical 1 **Mass changes**

△ **Safety** *Heating solids, take great care that crucibles have cooled before weighing.*

1. Collect a metal crucible and add 1 spatula measure of the solid.
2. Weigh the crucible and solid and record the mass
3. Heat strongly
4. Allow crucible to cool and then reweigh
5. Carefully record your observations.

Substance	Mass (g)			Observation
	before heating	after heating	change	
Copper – Cu → 1	2.65	3.40	(+0.75) + oxygen	colour change orange-brown to black
Sodium hydrogen carbonate – $NaHCO_3$ → 3	4.50	3.35	(-1.15) - gas	gas produced from solid
Zinc oxide – ZnO	3.40	3.40	±0	stays the same colour
Zinc nitrate – $Zn(NO_3)_2$ → 3	4.26	3.72	(-0.54) losing - oxygen + gas	gas produced and tested with glowing splint → oxygen

Conclusion

There are three possible results when heating a solid:

1. There is no change because the solid does not react.
2. The solid gets heavier because it takes something from the air. It usually reacts with oxygen to make an oxide. This is a chemical reaction in which the substance builds up: Synthesis.
3. The solid gets lighter because it loses something to the air; gases like carbon dioxide or water.

   This is a chemical reaction in which the substance is broken down by heat: Thermal Decomposition.

copper + _____ → _____

sodium hydrogen carbonate → _____ + _____ + _____

zinc oxide → _____

zinc nitrate → _____ + _____ + _____

$Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + KNO_3$

Practical 2 **Mass conservation**

1. Collect the conical flask containing potassium iodide (KI) and lead nitrate ($Pb(NO_3)_2$)
2. Weigh the conical flask and record the mass
3. Placing your thumb over the bung, invert the conical flask so that the two solution mix
4. Reweigh the conical flask and record the mass
5. Carefully record your observations

Substance	Mass (g)			Observation
	before mixing	after mixing	change	
potassium iodide (KI) and lead nitrate → 2 ($Pb(NO_3)_2$)			0	yellow solid (ppt) forms

Conclusion

1) When potassium iodide (KI) and lead nitrate ($Pb(NO_3)_2$) were reacted, how do know that a chemical reaction had occurred?

2) Comment on the mass change for this reaction

Further Questions

The table below gives the results of another experiment in which some more substances were heated.

Substance	Mass before heating (g)	Mass after heating (g)
Zinc	6.01	10.02
Sodium chloride	5.49	5.49
Potassium permanganate	4.47	4.08
Ammonium carbonate	5.73	0.00

a) Which of these substances does not react when heated in air? sodium chloride

I know this because the mass does not change

b) Which of these substances decomposes to form a mixture of gases only? ammonium carbonate

I know this because mass after heating decreases to 0

c) Which of these substances decomposes to form a gas and a solid? potassium permanganate

I know this because mass after heating is slightly lower.

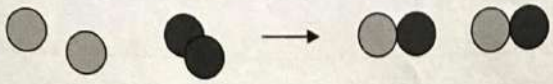
copper + oxygen → copper oxide

(2) sodium hydrogen carbonate → sodium oxide (s) + water (g) + carbon dioxide (g)

zinc oxide → zinc oxide

(4) zinc nitrate → oxygen (g) + zinc oxide (s) + nitrogen dioxide (g)

magnesium + oxygen → magnesium oxide



hydrogen + oxygen → water

$2H_2 + O_2 \rightarrow 2H_2O$

Balancing chemical equations practice

Balance the equations by inserting numbers as necessary.

1. calcium + oxygen → calcium oxide

   $2Ca + O_2 \rightarrow 2CaO$

2. nitrogen + oxygen → nitrogen oxide

   $N_2 + O_2 \rightarrow 2NO$

3. magnesium + hydrochloric acid → magnesium chloride + hydrogen

   $Mg + 2HCl \rightarrow MgCl_2 + H_2$

4. nitrogen + hydrogen → ammonia

N_2 + 3 H_2 → 2 NH_3

5. hydrogen + sulfur → hydrogen sulfide

8 H_2 + S_8 → 8 H_2S

6. potassium + oxygen → potassium oxide

4 K + O_2 → 2 K_2O

7. hydrogen + chlorine → hydrogen chloride

H_2 + Cl_2 → 2 HCl

8. aluminium + iron oxide → aluminium oxide + iron

2 Al + Fe_2O_3 → Al_2O_3 + 2 Fe

9. magnesium + iron oxide → magnesium oxide + iron

3 Mg + Fe_2O_3 → 3 MgO + 2 Fe

10. chlorine oxide → chlorine + oxygen

2 Cl_2O_7 → 2 Cl_2 + 7 O_2

11. ethane + oxygen → carbon dioxide + water

$C_2H_6 + 7O_2 \rightarrow 2CO_2 + 3H_2O$

2C 6H 14O 2C 4O 6H 3O

12. aluminium oxide + sulfuric acid → aluminium sulfate + water

$Al_2O_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2O$

2Al 3O 2H 1S 4O 2Al 3S 12O 2H 1O

13. copper(II) nitrate → copper(II) oxide + nitrogen dioxide + oxygen

$Cu(NO_3)_2 \rightarrow CuO + 2NO_2 + \frac{1}{2}O_2$

2 2 or 4 1

1Cu 2N 6O 1Cu 1O 1N×2 2O×2 20

14. calcium phosphate + silicon dioxide + carbon → calcium silicate + phosphorous + carbon monoxide

$2Ca_3(PO_4)_2 + 6SiO_2 + 10C \rightarrow 6CaSiO_3 + P_4 + 10CO$ (or halves)

3Ca×2 2P×2 8O×2 1Si×6 20×6 1C×10 1Ca×6 1Si×6 3O×6 4P 1C×10 10×B10

16 + 12 = 28O 180

15. sulfur + nitric acid → sulfuric acid + nitrogen dioxide + water

$S + 6HNO_3 \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$

1S 1H×8 1N×8 3O×8 2H 1S 4O 1N 2O 2H×3 1O×3

12O 4O 8O

1S 1H×4 1N×4 3O×4 = 120 ∴ H = 6 N = 6 O = 18

1S 4H 1N×4 ∴ leaves = 130 so $2H_2O$ ∴ O = 15 H = 6

70 32 H = 6 N = 6 O = 18

16. When pentane (C_5H_{12}) completely combusts (combines with oxygen) the reaction produces water and carbon dioxide only. Write the word equation and the chemical equation with state symbols.

Pentane + Oxygen → Water + Carbon Dioxide

$C_5H_{12(l)} + 8O_{2(g)} \rightarrow 6H_2O_{(l)} + 5CO_{2(g)}$

17. Fluorine (F_2) reacts violently with calcium bromide ($CaBr_2$). This is a halogen displacement reaction. The products are bromine (Br_2) and calcium fluoride (CaF_2). Write the word equation and the chemical equation.

Fluorine + Calcium Bromide → Bromine + Calcium Fluoride

$F_2 + CaBr_2 \rightarrow Br_2 + CaF_2$

18. When one molecule of propanoic acid (C_2H_5COOH) reacts with one molecule of ethanol (C_2H_5OH) the reaction produces one molecule of an ester called ethyl propanoate ($C_2H_5COOC_2H_5$) and one other common molecule. Write the word equation and the chemical equation.

Propanoic acid + Ethanol → Ethyl Propanoate + Water

$C_2H_5COOH + C_2H_5OH \rightarrow C_2H_5COOC_2H_5 + H_2O$

19. A white precipitate (solid) of barium sulfate ($BaSO_4$) and one other product (which is soluble) are produced when solutions of potassium sulfate (K_2SO_4) and barium nitrate ($Ba(NO_3)_2$) are mixed in a beaker. Write the word equation and the chemical equation with state symbols.

Potassium Sulphate + Barium Nitrate → Barium Sulphate + Potassium Nitrate

$K_2SO_{4(aq)} + Ba(NO_3)_{2(aq)} \rightarrow BaSO_{4(s)} + 2KNO_{3(aq)}$