OCR
Oxford Cambridge and RSA

F

Friday 9 June 2017 – Morning

GCSE GATEWAY SCIENCE
CHEMISTRY B

B741/01 Chemistry modules C1, C2, C3 (Foundation Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 15 minutes

* B 7 4 1 0 1 *

* 6 8 7 5 5 8 3 7 9 1 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

SECTION A – Module C1

1 This question is about pigments in paints.

Pigments give paints their colour.

Look at the table. It shows information about some pigments used in paints.

Pigment	Colour	Effect of increasing the temperature	Effect of light
A	green	no change	no change
B	purple	colour fades	colour fades
C	pink	changes to yellow	colour fades
D	blue	no change	absorbs light and later gives off light

(a) (i) Which pigment is **least** resistant to fading from exposure to light **and** to high temperatures?

Explain how you can tell.

.....

.....

..... **[2]**

(ii) Which pigment is **thermochromic**?

Explain how you can tell.

.....

.....

..... **[2]**

(b) Paints also contain a **solvent** and a **binding medium**.

What are the jobs of the solvent and of the binding medium?

.....

.....

.....

..... **[2]**

2 This question is about esters.

(a) Esters are made by reacting an acid with another type of compound.

Complete the word equation.

acid + ... → ester + water **[1]**

(b) Esters have a pleasant smell.

Write down **one** use of esters based on their smell.

..... **[1]**

(c) Esters can be used to dissolve stains.

Complete the links to show the meaning of the words insoluble, solute and solution.

You should draw **only three** straight lines.

insoluble	a solid dissolved in a liquid
solute	a solid that does not dissolve
solution	a mixture of a solid and a liquid that does not separate out

[2]

(d) Esters can be used to make cosmetics.

New cosmetics need to be tested before they can be used.

Explain **two** reasons why.

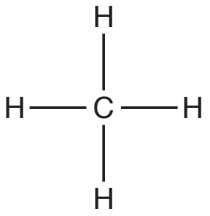
.....

.....

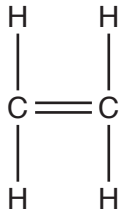
.....

..... **[2]**

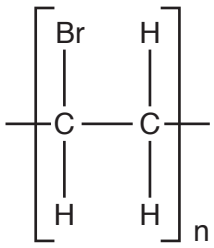
3 Look at the displayed formulas of some carbon compounds.



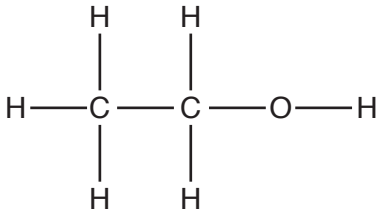
A



B



C



D

(a) Which compound is an alkene?

.....

[1]

(b) Which compound is an alkane?

.....

[1]

(c) Which compound will decolourise bromine water?

.....

[1]

(d) Which compound is a polymer?

.....

[1]

(e) Waste polymers are a problem.

They have to be disposed of.

Write about the ways of disposing of waste polymers.

.....

.....

.....

.....

..... **[3]**

4 Look at the table. It shows information about three fuels.

Fuel	Energy value per kg in megajoules	Cost per kg in £	How long the supply will last in years	Pollution
A	45	0.80	20	makes carbon dioxide
B	30	0.33	50	makes carbon dioxide and large amounts of sulfur dioxide
C	38	1.30	8	makes carbon dioxide

An energy company is choosing a fuel to use in a power station.

The table lists some factors to be considered when choosing a fuel.

Write down **two other** factors the energy company should consider.

Which fuel is the best choice? Explain your answer.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

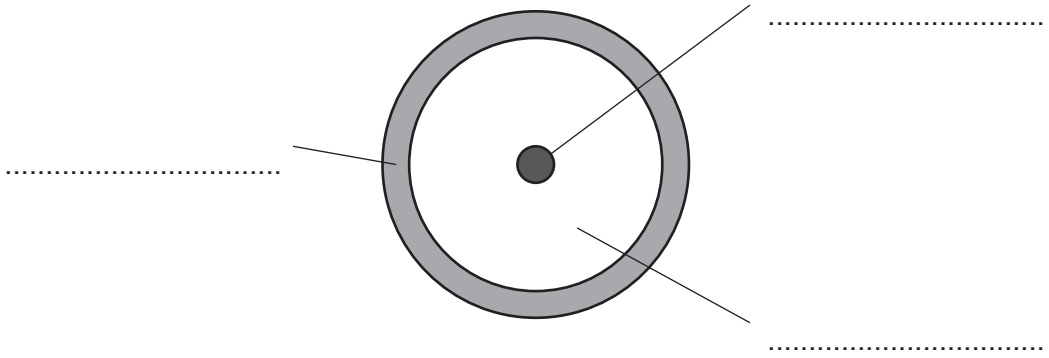
..... **[6]**

SECTION B – Module C2

5 This question is about the structure of the Earth.

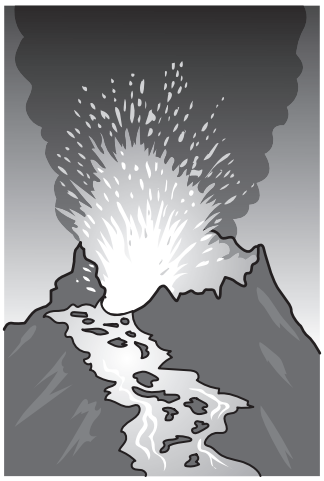
(a) Look at a diagram of the Earth.

Complete the labels on the diagram.



[2]

(b) In April 2015 the Calbuco volcano in Chile erupted.



People living within 20 km of the volcano had to move out of their homes.

Explain why some people choose to live near volcanoes.

.....

.....

..... **[2]**

(c) Many scientists have published theories about the structure of the Earth.

Explain **how** and suggest **why** scientists publish their work.

.....

.....

..... **[2]**

6 Helen reacts ammonia with sulfuric acid.

Ammonium sulfate is made.

(a) Write a **word equation** for this reaction.

..... **[1]**

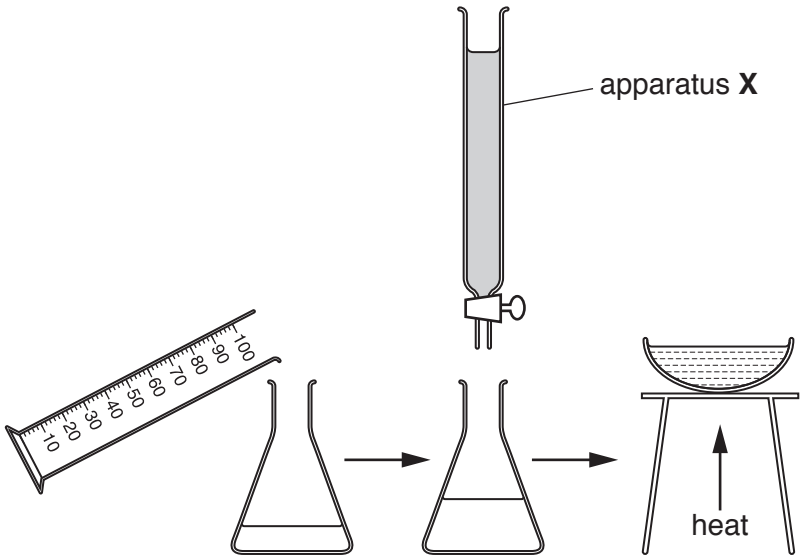
(b) In another experiment, Helen reacts potassium hydroxide with nitric acid.

Write down the **name** of the salt made.

..... **[1]**

(c) Look at the diagrams.

They show the apparatus Helen uses in her experiments.



What is the name of apparatus **X**?

Choose from the list.

burette

filter funnel

measuring cylinder

pipette

..... **[1]**

(d) An ammonium salt has the formula $NH_4H_2PO_4$.

Complete the table to show the number of each **different type of atom** in the formula $NH_4H_2PO_4$.

Atom	Number
N	.....
H	.....
P	.....
O	.....

[2]

7 Ammonia is made in the Haber process.

Nitrogen and hydrogen react in a **reversible** reaction.

$$\text{nitrogen} + \text{hydrogen} \rightleftharpoons \text{ammonia}$$

(a) Describe how the nitrogen and hydrogen are obtained for the Haber process.

.....

.....

..... **[2]**

(b) What is meant by a reversible reaction?

..... **[1]**

(c) Ammonia is used to manufacture fertilisers.

Write down **one other** use of ammonia.

..... **[1]**

(d) Look at the table.

It gives some information about the percentage yield of ammonia at different temperatures and pressures.

Pressure in atmospheres	**Percentage yield (%) of ammonia at**				
	100 °C	**200 °C**	**300 °C**	**400 °C**	**500 °C**
25	92	64	27	9	3
50	95	74	40	15	6
100	97	82	53	25	11
200	98	89	67	39	30
400	99	95	80	55	32

Use the table to decide the **best** conditions for making ammonia.

Pressure ..... atmospheres

Temperature ..... °C **[1]**

8 Brass is an alloy made of copper and zinc.

Look at the table.

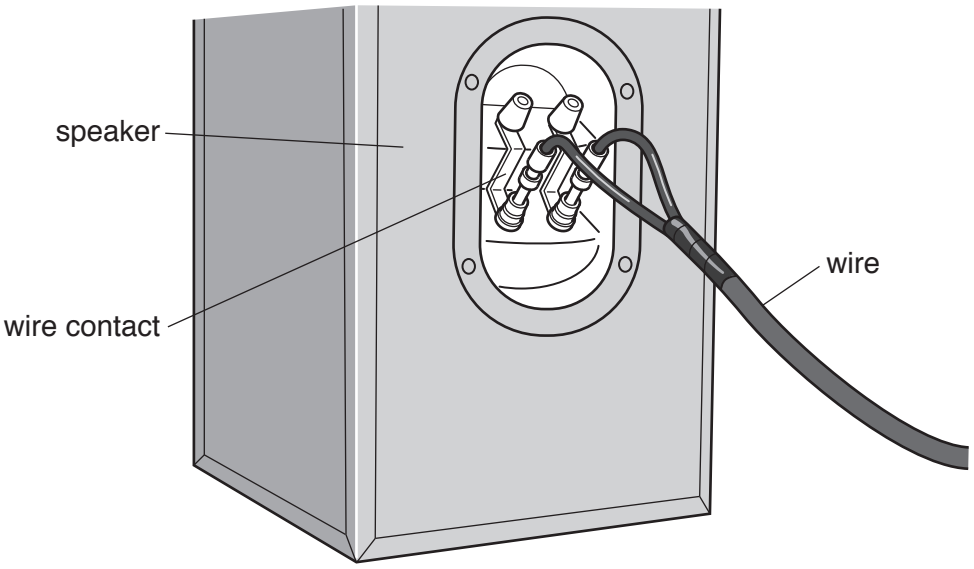
It gives information about different types of brass.

Type of brass	Relative strength	Relative ductility	Relative electrical conductivity
A	18	55	45
B	20	65	35
C	21	70	28
D	27	45	25
E	28	20	24

(a) Which type of brass is the **strongest** alloy in the table?

..... **[1]**

(b) Brass is often used to make the wire contacts for music speakers.



Phil thinks that brass **B** would be the best type of brass to use.

Is he right?

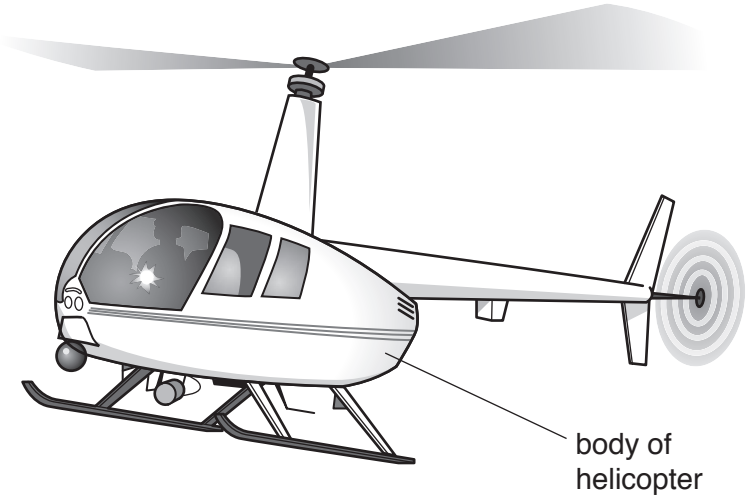
Use information from the table to explain your answer.

.....

.....

..... **[2]**

(c) The body of a helicopter can be made from either aluminium or steel.



Look at the table.

It shows some of the properties of aluminium and steel.

Property	Aluminium	Steel
Corrosion in moist conditions	does not corrode	rusts slowly
Density (1 = low, 10 = high)	3	8
Hardness (1 = soft, 10 = hard)	5	8
Strength (1 = weak, 10 = strong)	4	9
Electrical conductivity (1 = poor, 10 = good)	8	7
Other properties	malleable and a good conductor of heat	malleable and a good conductor of heat

Suggest the properties needed by the metal used to make the body of a helicopter.

Explain, with reasons, whether aluminium or steel is the best metal for this use.

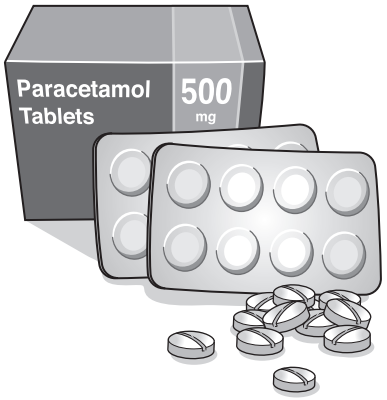
Use information from the table to help you.

The quality of written communication will be assessed in your answer to this question.

.... [6]

SECTION C – Module C3

9 Paracetamol is a painkiller used to treat pain and fevers.



(a) The molecular formula for paracetamol is $C_8H_9NO_2$.

Calculate the **relative formula mass, M_r**, of paracetamol.

The relative atomic masses, A_r, of C = 12, of H = 1, of N = 14 and of O = 16.

relative formula mass = ... **[1]**

(b) A pharmaceutical company investigates different ways of making paracetamol.

They try four different methods.

Look at their results.

Method	Atom economy	Percentage yield
A	38%	95%
B	54%	75%
C	52%	70%
D	57%	95%

Which method should they use to make paracetamol?

Explain your choice.

.....

.....

..... **[2]**

(c) One of the costs involved in making paracetamol is the cost of the raw materials.

Write about two **other** costs involved in making paracetamol.

.....

.....

..... **[2]**

(d) It is important that pharmaceutical drugs are as pure as possible.

Explain why.

.....

..... **[1]**

10 Trevor needs to find a fuel to use in a camping stove.

He decides to investigate the energy given out by four different fuels.

He uses the energy given out to heat water.

Look at the table. It shows Trevor's results.

Fuel	Temperature of water at start in °C	Temperature of water at end in °C	Mass of fuel burned in grams
A	18	38	1.2
B	22	42	0.6
C	18	38	0.8
D	25	45	1.0

(a) Describe, using a **labelled** diagram, the experiment Trevor did to obtain these results.

.....

.....

.....

.....

.....

.....

..... **[3]**

(b) Trevor decides that fuel **B** is the best fuel to use in his camping stove.

Is this a sensible choice?

Use the information in the table to explain your answer.

.....

.....

..... **[2]**

(c) Burning fuels is an **exothermic** reaction.

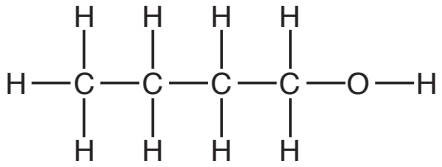
What is meant by an exothermic reaction?

.....

..... **[1]**

(d) Fuel **D** is butanol.

Look at the displayed formula for butanol.



Complete the table to show the number of each type of atom in a molecule of butanol.

Atom	Number
C	.....
H	.....
O	.....

[2]

11 Harry and Ann investigate the reaction between marble chips (calcium carbonate) and hydrochloric acid.

Carbon dioxide is given off during the reaction. Calcium chloride and water are also made.

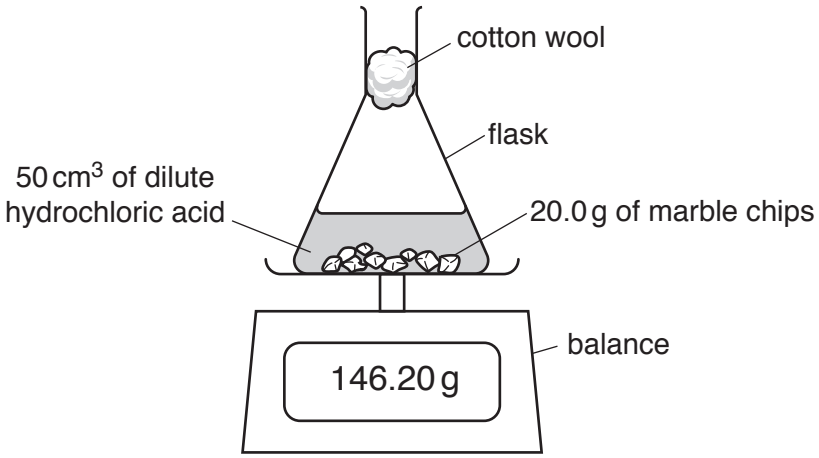
(a) Write a **word equation** for the reaction.

[1]

(b) Harry and Ann use 20.0 g of marble chips and 50 cm^3 of dilute hydrochloric acid.

The temperature of the acid is 25 °C.

Look at the diagram. It shows the apparatus they use.



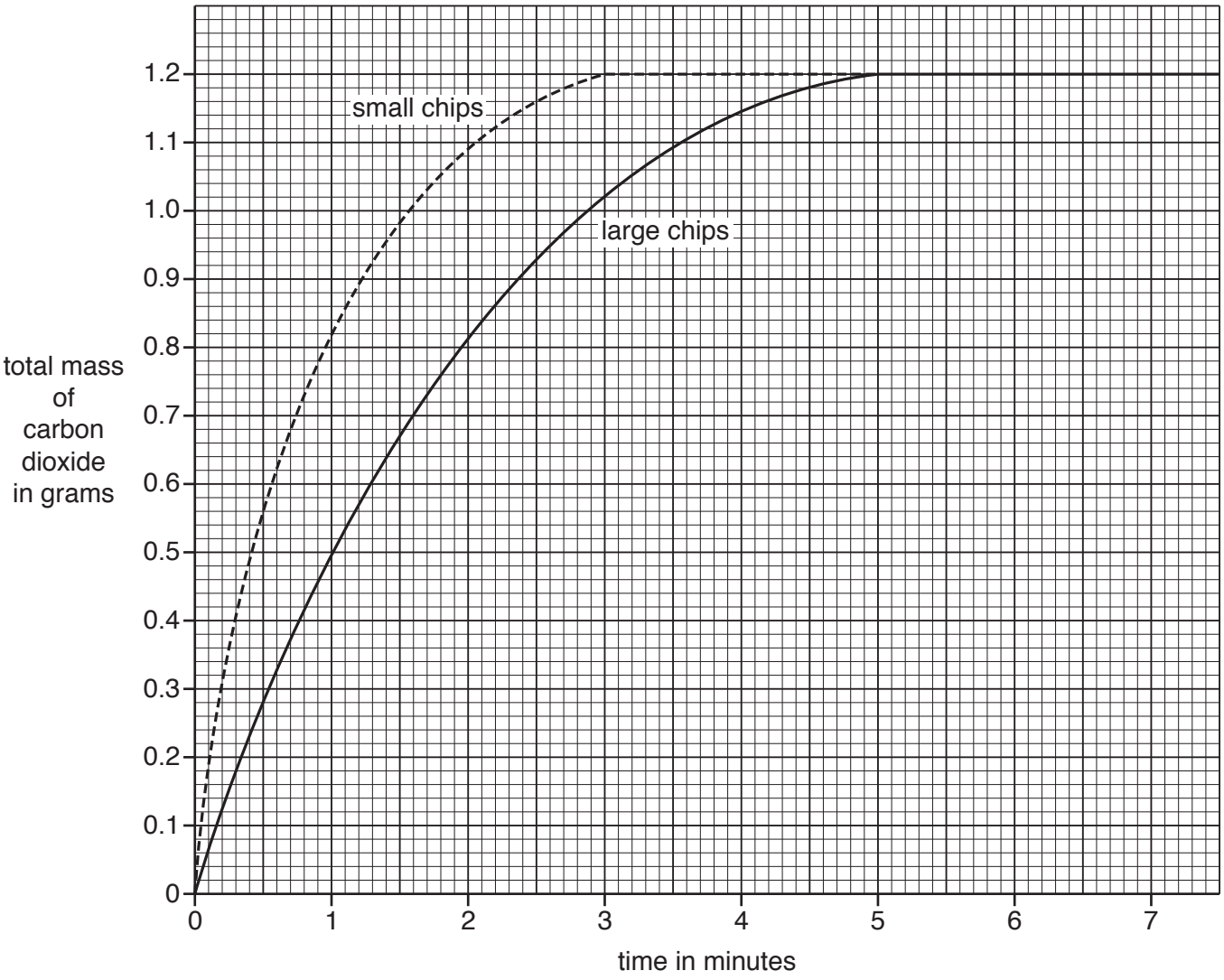
Harry and Ann measure the mass every minute until the reaction stops.

They calculate the total mass of carbon dioxide made.

They do the experiment again. They use the same volume of dilute acid and the same mass of marble.

This time they use **smaller** marble chips.

Look at the graph. It shows their results.



(i) Look at the graph for the **large** marble chips.

What is the total mass of carbon dioxide made after 1 minute?

..... g **[1]**

(ii) Look at the curve for the **small** marble chips.

How long does it take for the reaction to finish?

..... minutes **[1]**

(iii) The reaction using small marble chips is faster than the reaction using large marble chips.

How can you tell from the **two curves**?

.....

..... **[1]**

(c) Powdered marble chips react even faster than small marble chips.

Harry reads on the internet that fine powders in factories, such as custard powder or flour, can be dangerous.

Explain why.

.....

..... **[1]**

(d) The rate of reaction between marble chips and hydrochloric acid can be increased by using smaller chips.

Another method of changing the rate of a reaction is by adding a catalyst.

Describe and explain, using the reacting particle model, **two other** ways that the rate of reaction could be **increased**.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.