OCR
Oxford Cambridge and RSA

F

Monday 19 June 2017 – Morning

GCSE GATEWAY SCIENCE
FURTHER ADDITIONAL SCIENCE B

B761/01 Further Additional Science modules B5, C5, P5 (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 6 1 0 1 *

* 6 7 5 5 4 6 0 1 3 0 *

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 (✎).
- A list of equations can be found on page 2.
- 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.

EQUATIONS

$$\text{energy} = \text{mass} \times \begin{matrix}\text{specific}\\ \text{heat}\\ \text{capacity}\end{matrix} \times \begin{matrix}\text{temperature}\\ \text{change}\end{matrix}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{efficiency} = \frac{\text{useful energy output } (\times 100\%)}{\text{total energy input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{power} = \text{force} \times \text{speed}$$

$$KE = \frac{1}{2}mv^2$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$GPE = mgh$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$I_e = I_b + I_c$$

$$\frac{\begin{matrix}\text{voltage across}\\ \text{primary coil}\end{matrix}}{\begin{matrix}\text{voltage across}\\ \text{secondary coil}\end{matrix}} = \frac{\begin{matrix}\text{number of}\\ \text{primary turns}\end{matrix}}{\begin{matrix}\text{number of}\\ \text{secondary turns}\end{matrix}}$$

$$\text{power loss} = (\text{current})^2 \times \text{resistance}$$

$$V_pI_p = V_sI_s$$

Answer **all** the questions.

SECTION A – Module B5

1 **(a)** Damaged body parts can be replaced with **biological** or **mechanical** parts.

Some replacement parts are put **inside** the body but some have to be used **outside** the body.

Put **two** ticks (✓) in each row of the table to describe each type of replacement part.

The first row has been done for you.

Replacement body part	Biological	Mechanical	Inside body	Outside body
blood donation	✓		✓	
artificial heart valve				
heart and lung machine				
kidney dialysis machine				
ovary transplant				

[4]

(b) During childbirth a mother may lose a lot of blood and need a blood donation.

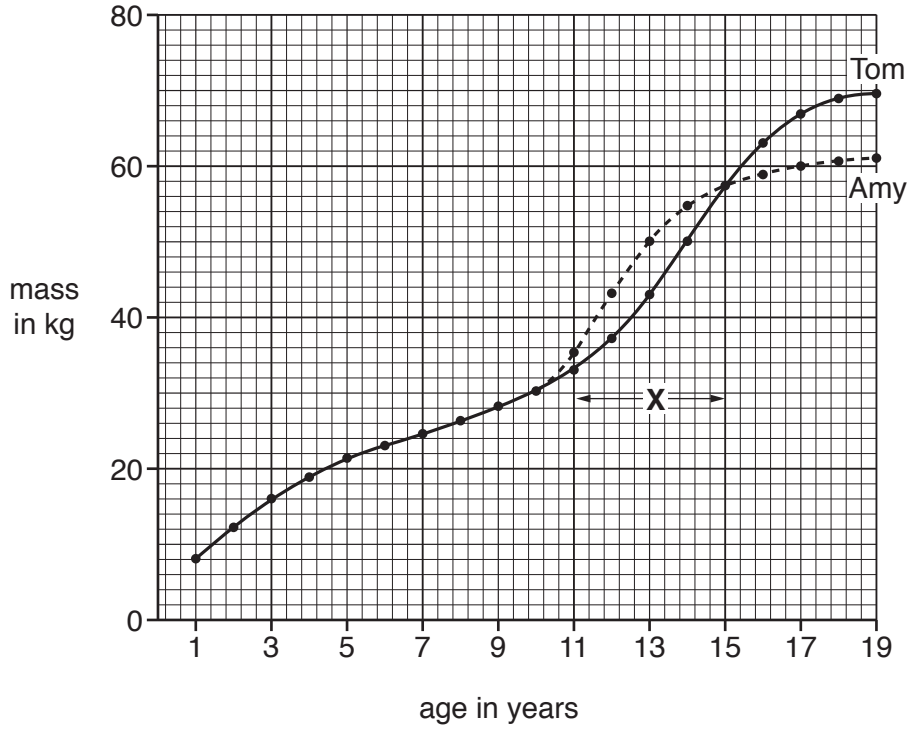
Suggest **one other** reason why someone would need a blood donation.

.....

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

2 Tom and Amy are twins.

Look at the graph. It shows their growth curves.



(a) Which stage of growth is shown by **X** on the graph?

Put a (ring) around the correct answer.

adolescence **adulthood** **childhood** **infancy** **old age**

[1]

(b) Describe the **differences** between the two growth curves.

Include data from the graph in your answer.

.....

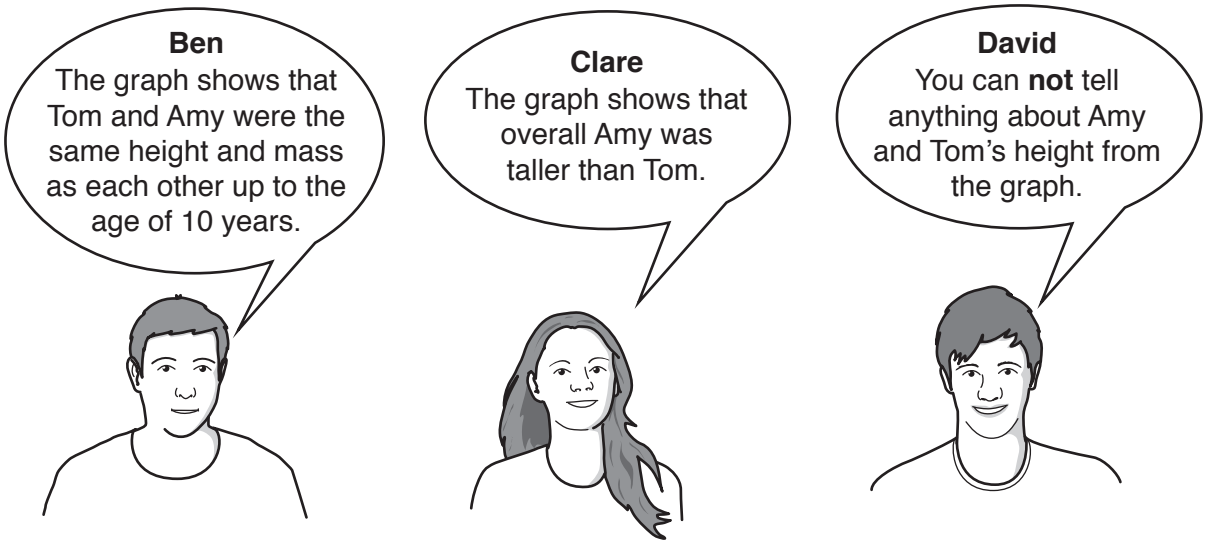
.....

.....

.....

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

(c) Some students are discussing the graph.



One of the students has made a **correct** conclusion.

Which student? .....

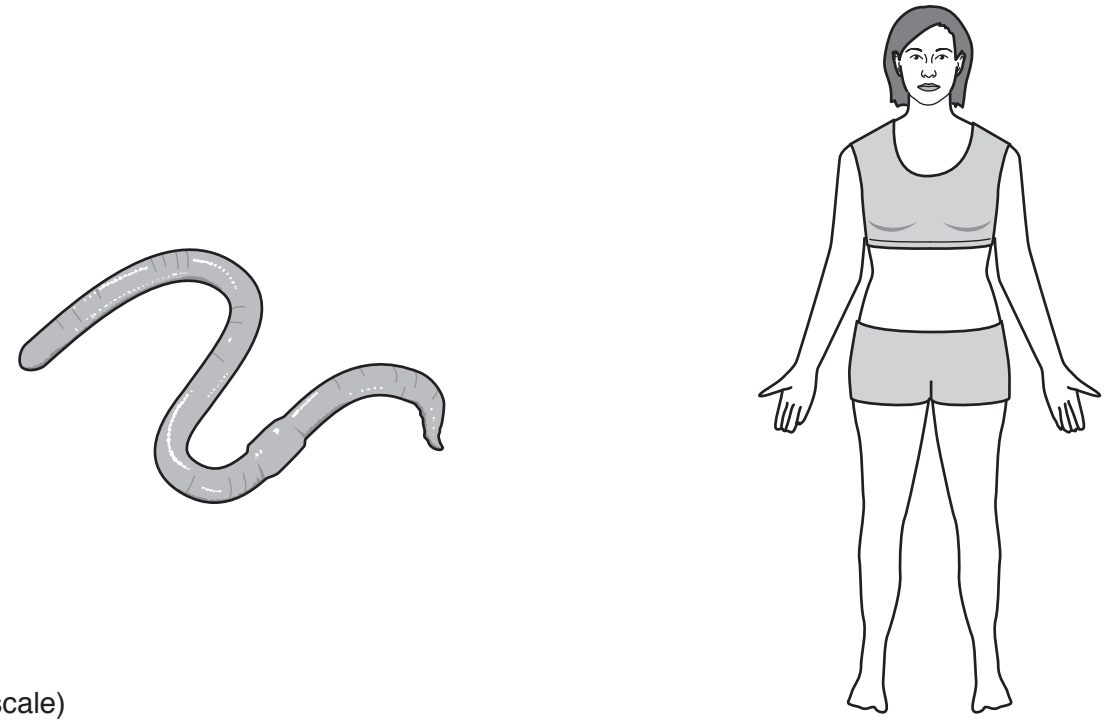
Explain your answer.

.....

.....

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

3 The diagram shows an earthworm and a human.



(not to scale)

(a) Earthworms and humans have different types of **respiratory** systems for gas exchange.

Describe the **differences** and **similarities** between their respiratory systems.

Include ideas about:

- the gases that are exchanged
- how these gases are exchanged.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

(b) Earthworms have a circulatory system made up of five main blood vessels.

They do **not** have a heart like humans do.

Instead, some of their blood vessels can squeeze to pump the blood.

Write down the name of the **type** of circulatory system earthworms have.

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

(c) Earthworms do **not** have a skeleton made of hard material.

Humans have an internal skeleton.

Which type of living tissue is found in humans but **not** in an earthworm?

Put a (ring) around the correct answer.

cartilage

muscle

nervous

skin

[1]

4 Betty's heart rate is too slow and irregular.

Her doctor says this is a problem, and Betty should be given an artificial pacemaker.

(a) Explain why it is a problem if Betty's heart rate is too slow and irregular.

.....

.....

.....

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

(b) The artificial pacemaker does the job of the natural pacemaker cells in the heart.

Explain what the artificial pacemaker does to the heart.

.....

.....

.....

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

(c) Betty takes a drug called aspirin.

Aspirin makes it **less likely** she will have coronary heart disease or a heart attack.

Explain why.

.....

.....

.....

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

BLANK PAGE

Question 5 begins on page 10

PLEASE DO NOT WRITE ON THIS PAGE

SECTION B – Module C5

5 Medicines are often solutions.

The solution must be the correct **concentration**.

(a) What is the unit for concentration?

Choose from the list.

cm^3

dm^3

g

g/mol

g/dm^3

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

(b) Medicines are often diluted before they are used.

(i) Describe how a concentrated medicine can be diluted.

.....

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

(ii) Explain why medicines are often diluted before they are used.

.....

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

6 Nick tests two unknown solutions, **A** and **B** with some indicators.

Look at his table of results.

Indicator	Colour with solution A	Colour with solution B
red litmus paper	stays red	stays red
phenolphthalein solution	colourless	colourless
universal indicator paper	yellow	green

Nick makes two conclusions.

- Solution **A** is an alkali.
- Solution **B** is neutral.

Do Nick's results support **each** of these conclusions?

Explain your answer.

.....

.....

.....

.....

.....

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

7 Sulfamic acid reacts with sodium nitrite.

Look at the balanced symbol equation for this reaction.

$$NH_2SO_3H(aq) + NaNO_2(s) \rightarrow N_2(g) + H_2O(l) + NaHSO_4(aq)$$

(a) The formula for sulfamic acid is NH_2SO_3H.

The formula for sodium nitrite is $NaNO_2$.

(i) How many atoms are there in one molecule of sulfamic acid?

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

(ii) In this reaction sulfamic acid **solution** is added to **solid** sodium nitrite.

Explain how you can tell **from the symbol equation** that sulfamic acid solution is added to solid sodium nitrite.

.....

.....

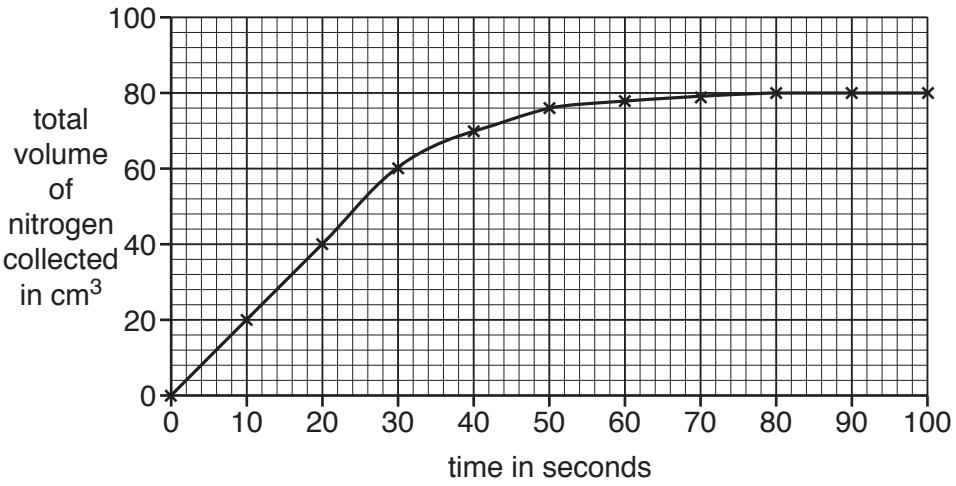
.....

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

(b) Julie investigates the reaction between sulfamic acid and sodium nitrite.

She measures the volume of nitrogen made during the reaction.

Look at her results.



(i) Julie uses 0.23 g of sodium nitrite in her experiment.

What is the total volume of nitrogen made in her experiment?

..... cm^3 **[1]**

(ii) Julie does another experiment.

This time she uses 4.6 g of sodium nitrite with excess sulfamic acid.

Predict the volume of nitrogen made in this experiment.

volume of nitrogen = ... cm^3 **[1]**

(iii) Draw a labelled diagram of the apparatus and describe the experiment Julie does to collect the results shown in the graph.

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

.....

.....

.....

.....

.....

.....

.....

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

8 Ethanoic acid is a **weak** acid and hydrochloric acid is a **strong** acid.

(a) Louise has a bottle of dilute ethanoic acid and another bottle of dilute hydrochloric acid.

Both acids have a concentration of 0.10 mol / dm^3.

She tests the pH of each acid.

Look at the table. It shows possible pH values of the acids.

	Ethanoic acid	**Hydrochloric acid**
A	4	1
B	4	5
C	4	7
D	8	1
E	8	13

Which row shows the correct pH values?

Choose from **A**, **B**, **C**, **D** or **E**.

Explain your answer.

.....

.....

.....

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

(b) Louise adds dilute ethanoic acid and dilute hydrochloric acid from the bottles to separate samples of calcium carbonate.

The hydrochloric acid reacts much faster than ethanoic acid.

Use the reacting particle model to explain why.

.....

.....

.....

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

(c) Ethanoic acid has the molecular formula $C_2H_4O_2$.

(i) What is the **empirical formula** for ethanoic acid?

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

(ii) Calculate the molar mass of ethanoic acid.

The relative atomic mass of H = 1, of O = 16 and of C = 12.

answer ..... g / mol **[1]**

9 Lead nitrate solution is used to test for halide ions.

Describe how lead nitrate solution is used to test for chloride ions **and** for iodide ions.

.....

.....

.....

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

SECTION C – Module P5

10 Artificial satellites orbit the Earth.

(a) A TV satellite is placed high above a point on the equator.

Its orbit around the Earth takes 24 hours.

(i) What type of orbit does this TV satellite have?

Choose from the list.

geostationary orbit

low polar orbit

polar orbit

spiral orbit

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

(ii) Explain why this type of orbit is an **advantage** for satellite TV.

.....

.....

.....

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

(iii) TV satellites use microwaves to communicate with the Earth.

TV satellites do **not** use long wavelength radio waves.

Explain why microwaves are **better** than long wavelength radio waves for TV satellites.

.....

.....

.....

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

(b) Satellites are used to keep weather forecasts up to date.

These satellites have a **lower** orbit around the Earth than TV satellites.

(i) Describe how this lower orbit affects the time it takes to orbit the Earth.

.....

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

(ii) This low orbit is an advantage for keeping weather forecasts up to date.

Describe why it is an **advantage** to weather forecasting.

.....

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

(c) Satellites are used by the military to take pictures of the Earth.

These satellites contain expensive equipment and have a low polar orbit.

Write about the **advantages** and **disadvantages** of the military using satellites.

.....

.....

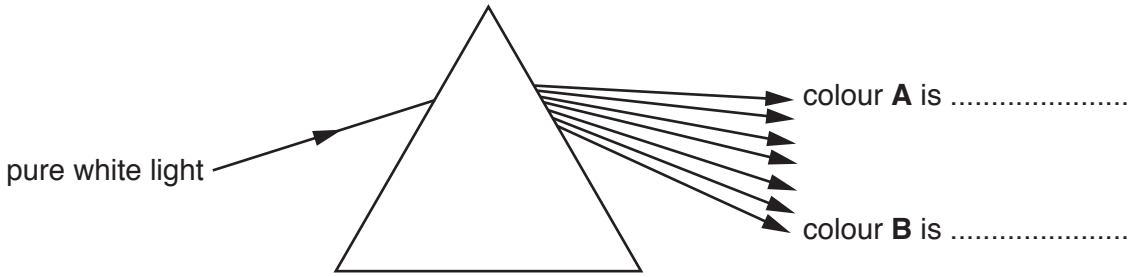
.....

.....

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

(d) Scientists carry out experiments in space because space is a vacuum.

Look at the diagram of a prism in a vacuum.



The pure white light enters the prism.

The light is dispersed into a spectrum of colours (colours of the rainbow).

Write down the names of colour **A** and colour **B**.

Explain what happens to the light as it passes through the prism and why the colours of the spectrum are always in the same order.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

11 There are many different speed limits on UK roads.

Look at the table of speed limits in miles per hour (mph) and metres per second (m/s).

Speed limit in miles per hour (mph)	Speed limit in metres per second (m/s)
70	31.3
60	26.8
40	17.9
30	13.4

(a) A car starts at a speed of 4 metres per second (m/s).

The car then accelerates at $2\,m/s^2$ for 7 seconds.

How many speed limits has the car broken?

.....

Use the data and a calculation to explain your answer.

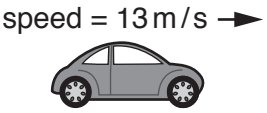
.....

.....

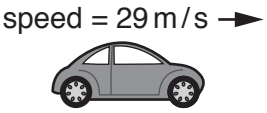
.....

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

(b) Look at the speeds of a car as it passes two points, **A** and **B**, on a road.



A



B

The car takes 5 seconds to accelerate from **A** to **B**.

Calculate the **distance** between point **A** and point **B**.

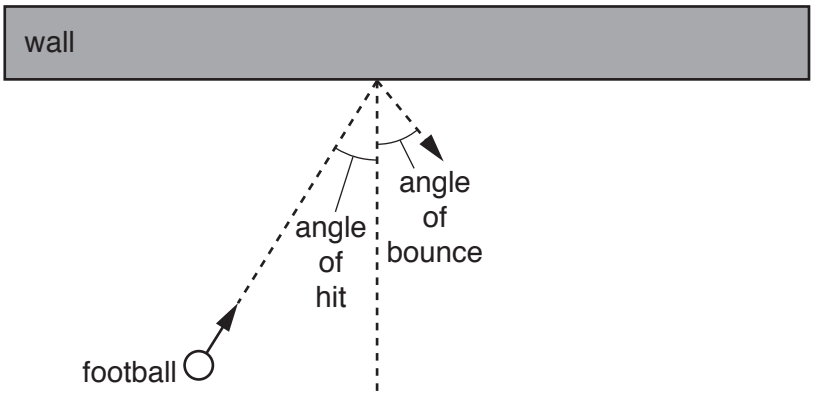
.....

.....

.....

Answer ..... m **[2]**

12 Dave and Alex kick a football against a wall.



They measure the angle of hit and the angle of bounce.

They repeat the experiment for different angles.
Look at their results.

Angle of hit in degrees	**Angle of bounce in degrees**
80°	81°
60°	59°
40°	40°
20°	26°
0°	2°

(a) Alex thinks that one of the results is **not** accurate.

(i) Which result is **not** accurate?

.....

Suggest **one** reason why it is **not** accurate.

.....

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

(ii) Describe what Alex and Dave could do to improve their results.

.....

.....

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

(b) Dave thinks that kicking a football against a wall is like light on a mirror.

He says

'**it is evidence that light behaves like particles**'

Explain how the results from the football experiment remind him of light on a mirror.

.....

.....

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

(c) A long time ago scientists argued about the nature of light.

There were two main theories:

- some scientists thought light was made of particles
- some scientists thought light was made of waves.

The wave theory became more acceptable.

In time, the particle theory became **less** popular.

Suggest **one** reason why.

.....

.....

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

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.