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RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

ADDITIONAL SCIENCE B

B624/02

Unit 2 Modules B4 C4 P4 (Higher Tier)

B621830111

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)

Monday 24 January 2011
Afternoon

Duration: 1 hour

B 6 2 4 0 2

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. Pencil may be used for graphs and diagrams only.
- 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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

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EQUATIONS

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

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

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

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

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

$$\text{kinetic energy} = \frac{1}{2}mv^2$$

$$\text{potential energy} = mgh$$

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

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

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BLANK PAGE

Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

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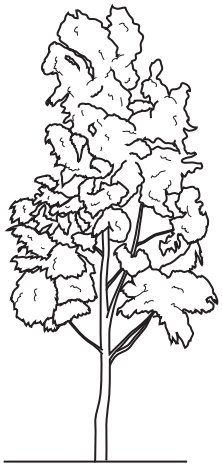
Answer **all** the questions.

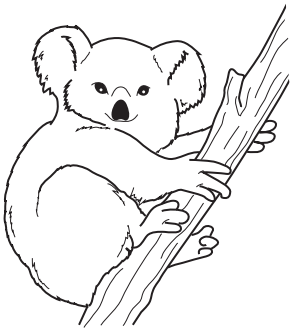
Section A – Module B4

1 Eucalyptus trees grow in Australia.

They are important for both humans and animals.



(a) Animals called koalas feed on eucalyptus leaves.



Koalas need to eat a lot of eucalyptus leaves, about a thousand every day.

Koalas are not very active, resting for about 16–18 hours every day.

Suggest what this information tells us about eucalyptus leaves.

.....

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

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(b) Eucalyptus trees are sometimes planted to drain swamps and other wet areas.

They remove a lot of water from the ground when they transpire.

(i) Explain how transpiration removes water from the ground.

In your answer, write about

- the parts of a plant through which water moves
- the processes that make water move.

.....

.....

.....

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

(ii) Transpiration brings water into eucalyptus trees.

Describe **one other** way transpiration helps eucalyptus trees.

.....

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

(c) Look at the drawing of eucalyptus leaves.

Describe and explain **two** ways eucalyptus leaves are adapted for efficient photosynthesis.

first adaptation .....

explanation .....

.....

second adaptation .....

explanation .....

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

[Total: 7]

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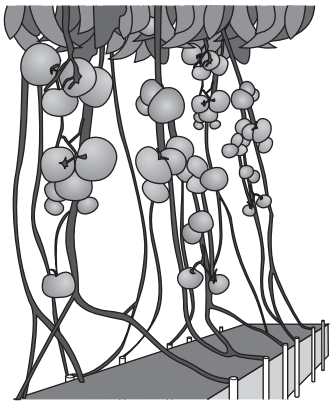
2 Sam grows tomatoes in a glasshouse.



(a) Sam grows the tomato plants using hydroponics.

This means the roots grow in water **not** soil.

Sam adds minerals to the water.

(i) The roots absorb the minerals by **active transport**.

What is active transport?

.....

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

(ii) One of the minerals Sam adds contains magnesium.

Tomato plants need magnesium to photosynthesise.

Explain why plants need magnesium to photosynthesise.

.....

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

(iii) Using hydroponics is one example of an **intensive farming** method.

Explain what is meant by intensive farming.

.....

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

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(b) Sam finds insects called greenflies feeding on the tomato plants.

She puts other insects called ladybirds into the glasshouse.

Ladybirds eat greenflies.

(i) This method of controlling greenflies would **not** work so well if Sam was growing her tomato plants outside.

Suggest why it would **not** work so well.

.....

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

(ii) The diagram shows the energy transfer through the living things in the glasshouse.

For every 1000 J of energy in the tomato plants, 5 J are transferred to the greenflies.

What is the percentage efficiency of energy transfer from tomato plants to greenflies?

.....

.....

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

(iii) The efficiency of energy transfer from tomato plants to greenflies can **never** be 100 %.

Explain why.

.....

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

(iv) The ladybirds do **not** kill all the greenflies.

Sam decides to use pesticide.

The pesticide does **not** kill the greenflies.

However it does eventually kill the ladybirds that eat the greenflies.

Explain why the pesticide kills the ladybirds but **not** the greenflies.

.....

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

[Total: 7]

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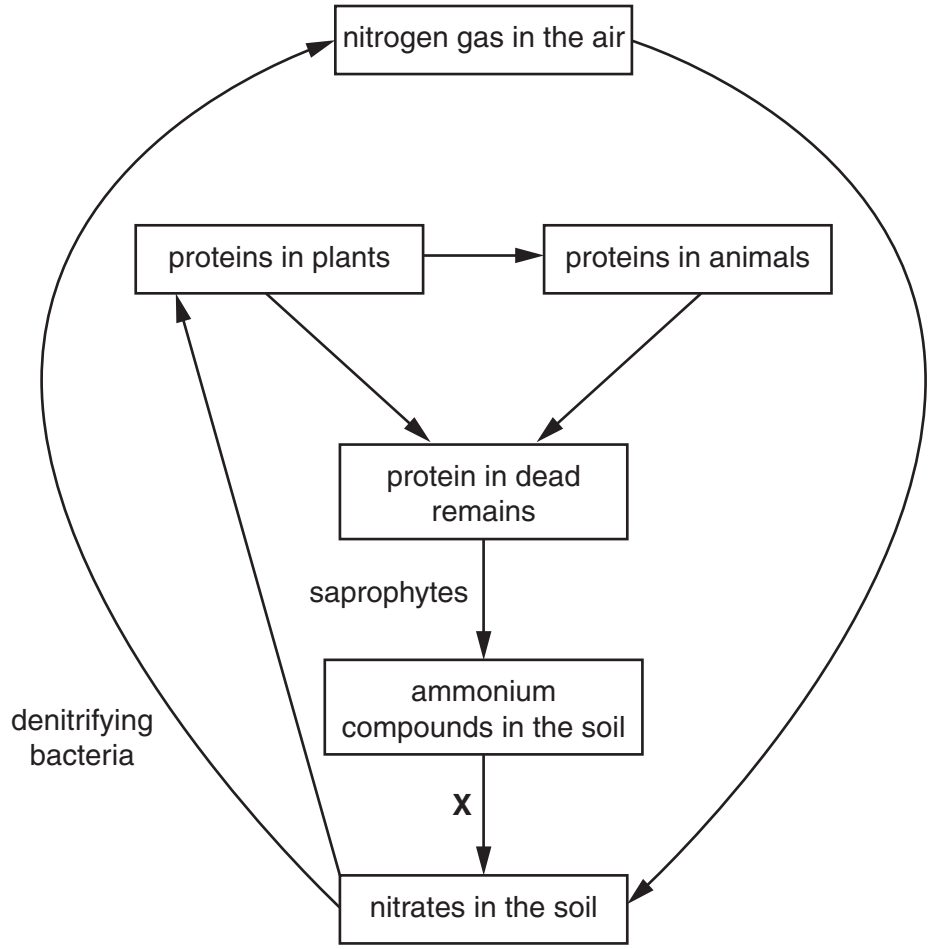
3 The diagram shows part of the nitrogen cycle.



(a) Nitrogen is important for all living things because it is used to make proteins.

(i) There is a lot of nitrogen gas in the air, but animals and plants can **not** use this nitrogen.

Explain why they can **not** use this nitrogen.

.....

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

(ii) Plants use nitrates to make compounds which are then used to make proteins.

Write down the name of these compounds.

nitrates → ..... → proteins **[1]**

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(b) Saprophytes are part of the nitrogen cycle.

Look at the list of organisms.

Which **two** organisms could be saprophytes?

Put ticks (✓) in the boxes next to the **two** correct answers.

bacteria	☐
earthworms	☐
fungi	☐
maggots	☐
woodlice	☐

[2]

(c) Look at the diagram of part of the nitrogen cycle.

Process **X** is the result of one type of bacteria.

Write down the name of this **type** of bacteria.

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

(d) Some farmers add nitrate fertilisers to their fields.

They do **not** need to use as much if there has been a thunderstorm.

Explain why.

.....

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

[Total: 6]

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Section B – Module C4

4 Julie buys a new jacket.

Look at the wash label from inside her jacket.

55% POLYESTER
45% VISCOSE
LINING
100% POLYESTER

(a) The label shows that Julie's jacket can be **dry cleaned**.

What is meant by dry cleaning?

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

(b) Julie's friend Colin works for a company that makes washing powders.

Colin tests three washing powders, **A**, **B** and **C**.

He tests how well they clean at different temperatures.

Colin scores how well each washing powder cleans a piece of cloth.

He uses this number scale.

1 (very dirty) ⟷ 2 ⟷ 3 ⟷ 4 ⟷ 5 (very clean)

Look at his results.

washing powder	**washing temperature in °C**		
	30	**60**	**90**
A	1	3	4
B	2	4	5
C	3	4	5

(i) What do the results show about the effect of **temperature** on the cleaning action of these three washing powders?

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

(ii) Write down one way in which washing powder **C** is better than **A and B**.

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

[Total: 3]

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5 This question is about fertilisers.

(a) Look at the table. It shows some information about two fertilisers.

name of fertiliser	formula	relative formula mass, M_r
ammonium nitrate	NH_4NO_3	80
ammonium sulfate	$(NH_4)_2SO_4$	.....

Calculate the relative formula mass, M_r, of ammonium sulfate.

Write your answer in the table.

The relative atomic mass, A_r, of N = 14, of H = 1, of S = 32 and of O = 16. **[1]**

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(b) Ann-Marie makes some ammonium sulfate solution in a laboratory.

She uses a neutralisation reaction.

Write about how she could make ammonium sulfate solution.

Your answer should include

- the names of the **reactants** she uses
- how she obtains a solution that contains **only** ammonium sulfate.

You may use a diagram to help your answer.

.....

.....

.....

.....

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

(c) Ann-Marie carefully evaporates the solution to make solid ammonium sulfate.

She predicts that she should make 3.5 g of ammonium sulfate.

She actually makes 2.1 g.

Calculate her percentage yield of ammonium sulfate.

.....

.....

.....

percentage yield = ... % **[2]**

[Total: 6]

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6 This question is about water.

(a) There are three main stages in water purification.

(i) Match each **stage** in the water purification process to the **reason** it is carried out.

Draw **three** straight lines.

stage	reason
filtration	kills microbes
sedimentation	allows larger solid particles to settle out
chlorination	traps finer particles using sand

[1]

(ii) List the stages in the correct order.

1 .....

2 .....

3 ..... **[1]**

(b) Clean water is very important.

People in developing countries are sometimes unable to get clean water.

Suggest why having clean water is important for people in developing countries.

.....

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

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(c) Water can be tested to identify some of the chemicals in it.

Silver nitrate solution is used to test for chloride ions.

An **insoluble solid** is made.

What is this type of reaction called?

Choose from the list.

neutralisation

oxidation

precipitation

purification

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

(d) Barium chloride solution is used to test for sulfate ions.

Barium chloride, $BaCl_2$, reacts with sodium sulfate, Na_2SO_4.

Barium sulfate, $BaSO_4$, and sodium chloride are made.

Write a **balanced symbol** equation for this reaction.

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

[Total: 6]

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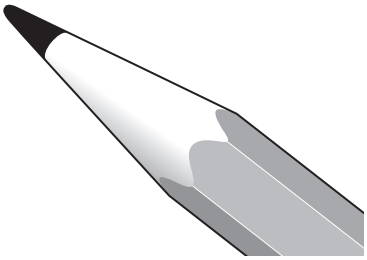
7 **(a)** Graphite is used to make pencil leads.



Graphite easily makes marks on paper.

Explain why.

.....

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

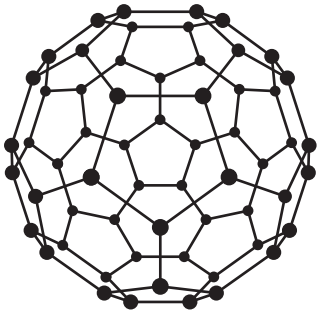
(b) Graphite is also used as an electrode in electrolysis because it **conducts electricity**.

Explain how graphite conducts electricity.

.....

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

(c) Another form of carbon is buckminster fullerene.



Write down the molecular formula for buckminster fullerene.

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

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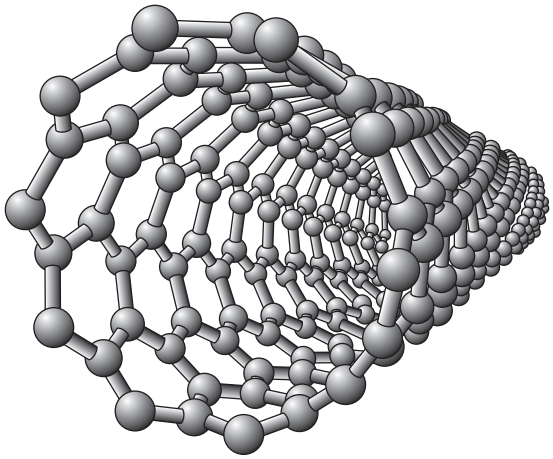
(d) Fullerenes can be joined together to make nanotubes.



Nanotubes are used as catalysts.

Explain why.

.....

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

[Total: 5]

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Section C – Module P4

8 **(a)** Ultrasound is used in hospitals for body scans.

Humans can hear sounds between frequencies of 20 Hz and 20 000 Hz.

What is the approximate frequency of ultrasound waves?

Choose from

28 Hz

180 Hz

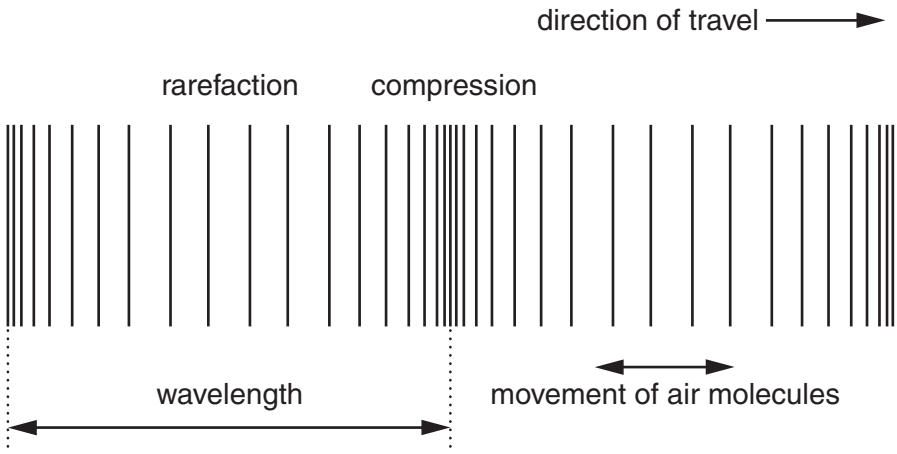
2800 Hz

18 000 Hz

28 000 Hz

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

(b) Ultrasound is a longitudinal wave. Look at the diagram.



Scientific words are used to describe waves.

(i) What is meant by a **compression**?

.....

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

(ii) What is meant by the **amplitude**?

.....

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

[Total: 3]

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9 This question is about static electricity.

(a) Catrina rubs a plastic rod with a cloth.

The rod becomes positively charged.

Finish the sentence.

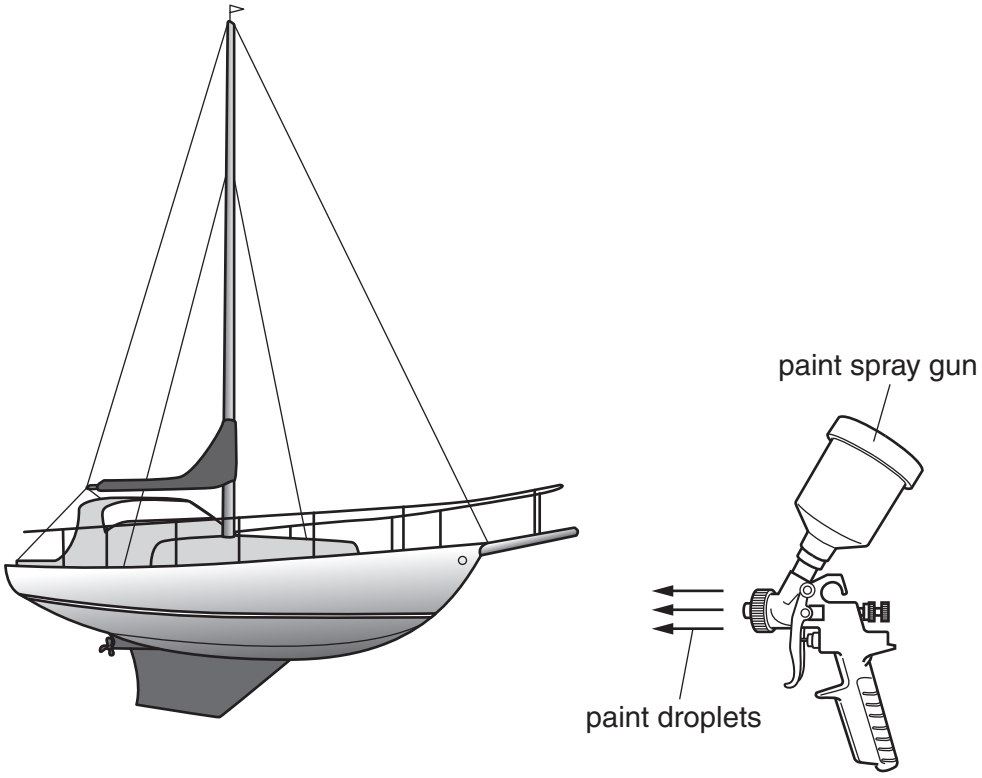
The cloth becomes **negatively** charged because .....

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

(b) Catrina wants to paint her boat.

She uses static electricity, rather than a brush, to help her.

Look at the picture.



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The boat gets a better paint finish when she uses static electricity instead of a brush.

Explain

- how the paint spray gun produces a fine spray
- why less paint is wasted
- why she gets a better finish.

.....

.....

.....

.....

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

(c) Static electricity can sometimes be dangerous and cause explosions.

Static electricity can also just be a nuisance.

Write down **one** example of static electricity being a **nuisance**.

.....

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

[Total:5]

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10 (a) Doug measures the current and voltage for a torch bulb.

Look at his results.

current in amps	voltage in volts
0.25	1.5

Calculate the resistance of the torch bulb.

The equations on page 2 may help you.

.....

.....

answer ..... ohms **[2]**

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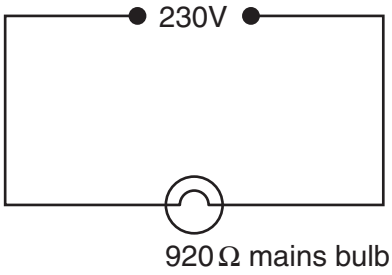
(b) Doug has a mains light bulb.

It has a resistance of 920 ohms.

The bulb is connected to a 230 V mains supply.



Show that the current is 0.25 A.

The equations on page 2 may help you.

.....

.....

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

[Total: 3]

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11 Radiation is emitted from the nucleus of an atom.

Only some nuclei emit radiation.

(a) Suggest why some nuclei emit radiation.

.....

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

(b) Some radioactive materials are used as tracers in hospitals.

Radioactive materials which emit alpha particles cannot be used as tracers.

Explain why.

.....

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

(c) An atom of radium-224 ($^{224}_{88}Ra$) emits an alpha particle.

(i) What happens to the number of protons when an alpha particle is emitted?

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

(ii) What happens to the number of neutrons when an alpha particle is emitted?

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

(iii) Write down the name of the new substance that is formed.

You may use the periodic table on page 24 to help you.

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

(d) Radioactivity can be used to date rocks.

Explain how.

Finish the sentences.

Scientists measure the amounts of two metals.

The two metals they measure in the rocks are ..... and ..... .

They find the age of the rocks by .....

.....

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

[Total: 7]

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12 Nuclear power stations use uranium as fuel.

Energy is produced in a nuclear reactor when a uranium atom splits.

(a) Write down the name of this process.

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

(b) Metals can be made radioactive.

This happens when they **absorb** particles inside a nuclear reactor.

Write down the name of the particles absorbed.

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

[Total: 2]

END OF QUESTION PAPER

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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.