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Monday 21 May 2012 – Morning

GCSE GATEWAY SCIENCE
ADDITIONAL SCIENCE B

B624/02 Unit 2 Modules B4 C4 P4 (Higher Tier)

B620980612

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

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. 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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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 **28** pages. Any blank pages are indicated.

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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Question 1 begins on page 4.

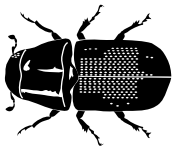
PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module B4

1 Large areas of Canada are covered by forests containing pine trees.

(a) Many of the pine trees in Canada are being killed by small beetles.



The mountain pine beetle feeds from the tubes in the tree that transport sugar.

The beetle also infects the tree with a fungus.

This fungus blocks up the xylem vessels in the tree trunk.

This kills the tree.

(i) Write down the name of the tubes from which the beetle feeds.

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

(ii) The leaves (needles) of the infected pine trees often change colour because they become short of minerals.

Explain why they become short of minerals.

.....

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

(iii) The leaves often die because they lack water.

This lack of water causes the stomata to close.

Explain the mechanism that causes the stomata to **close**.

.....

.....

.....

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

(iv) Biomass, such as dead trees, may be used in many ways.

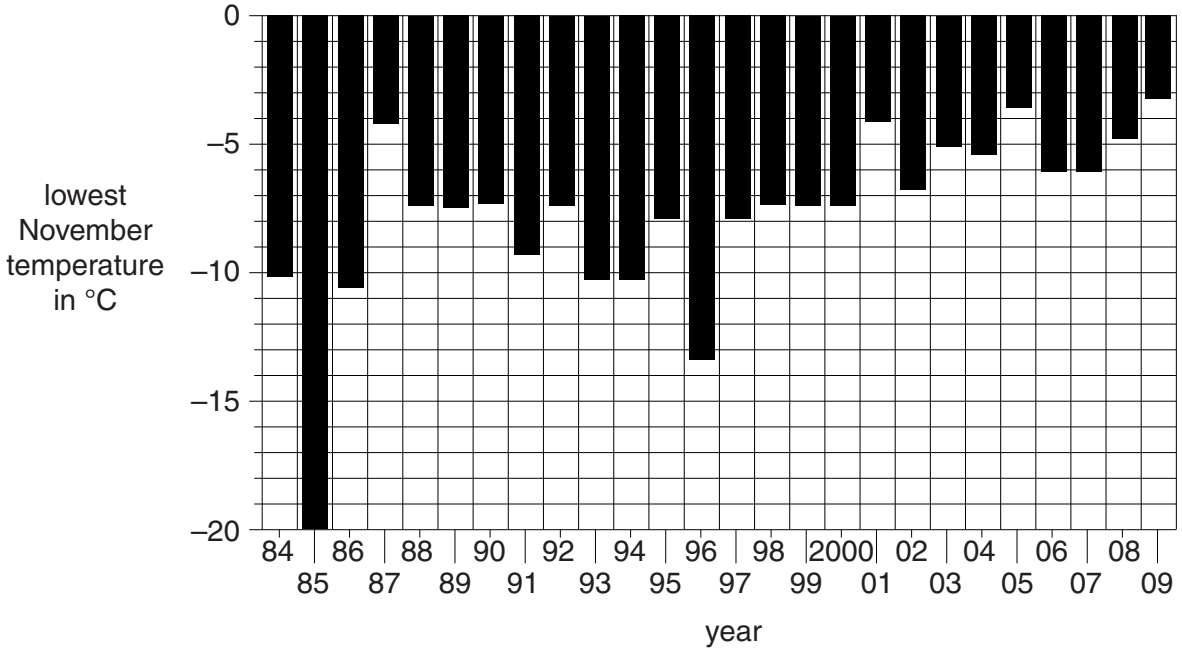
These dead trees are used for fuel and burned **as soon as possible**.

Suggest why it is important that these trees are burned as soon as possible.

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

(b) Many of the beetles are killed if temperatures drop below –6 °C in November.

The graph shows the lowest November temperature in the pine forest each year from 1984 to 2009.



(i) In 1988 there was a large outbreak of the beetle but they soon decreased in number.

Use the graph to work out in which year the next major outbreak started.

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

(ii) The recent outbreak has lasted for a number of years.

Scientists are worried that it might continue for many more years.

Use the graph to suggest why.

.....

.....

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

[Total: 9]

2 Bill grows lettuces on his farm.

(a) He finds that the lettuces are being eaten by slugs and birds.

The slugs are being eaten by hedgehogs.

Sketch a **pyramid of biomass** to represent these feeding relationships.

Write the names of the organisms in the correct boxes in the pyramid.

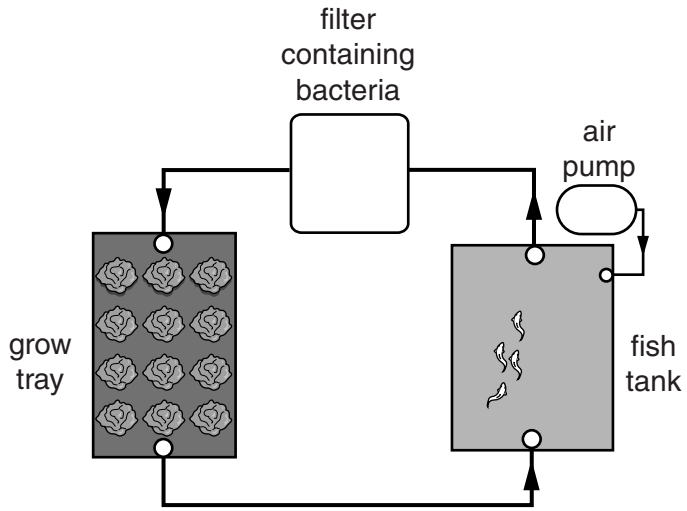
[2]

(b) Bill investigates a new way of growing lettuces.

This involves growing them in tanks without soil.

Water containing minerals is pumped through the tanks.

The diagram shows the equipment that Bill uses.



He keeps fish in a tank and then circulates the water through a filter containing bacteria.

The fish make ammonia. The bacteria convert the ammonia into nitrates.

(i) What type of bacteria would be used in the filter?

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

(ii) As well as nitrates, the lettuces need magnesium.

Why do plants need magnesium?

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

(iii) The air pump adds oxygen to the circulating water.

Oxygen is needed by the fish and the bacteria.

It is also needed by the lettuce roots.

Complete these sentences to describe why oxygen is needed by the roots.

Plant roots use oxygen in the process of ..... to release energy.

Some of this energy is used to absorb minerals by a process called

..... .

The energy is needed because the minerals are absorbed against a

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

[Total: 7]

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3 Read this information about preserving food.

In the 18th century, Napoleon was travelling in hot countries with his army.

The hot conditions meant that their food rotted faster.

The food could be preserved by adding salt but this made the soldiers thirsty.

The French government offered a large sum of money to anybody who could find a solution.

Nicolas Appert solved the problem.

He put food into glass bottles and used steam to heat the bottles to high temperatures.

He then removed the steam and quickly sealed each bottle with a cork and wax.

Appert won the prize and set up his own factory.

(a) Napoleon's food was being rotted or decomposed by microbes.

(i) What name is used to describe the type of nutrition shown by these microbes?

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

(ii) Explain why food rots much faster in hot countries.

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

(b) Before Appert devised his method, food could be preserved by adding salt.

How does adding salt preserve food?

.....

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

[Total: 4]

Section B – Module C4

4 Miles is doing the washing.

He washes a shirt.

(a) Miles washes his shirt at a low temperature.

This saves him money.

Write down one **other advantage** of washing clothes at lower temperatures.

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

(b) Miles uses a washing powder containing a detergent.

Look at the diagram of a detergent molecule.

Write about how the detergent removes grease from clothes.

Use ideas about the structure of the detergent molecule.

You may wish to draw a **labelled** diagram.

.....

.....

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

(c) Miles wants to clean his best suit.

He decides to have it dry cleaned.

(i) What is meant by **dry cleaning**?

.....

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

(ii) Explain why dry cleaning is used.

.....

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

[Total: 6]

5 Kylie makes a fertiliser called potassium nitrate.

She adds an alkali called potassium hydroxide to nitric acid.

(a) Kylie uses 5.6 g of potassium hydroxide and 6.3 g of nitric acid.

She makes 10.1 g of potassium nitrate.

potassium hydroxide	+	nitric acid	→	potassium nitrate	+	water
5.6 g		6.3 g		10.1 g		1.8 g

Kylie does the experiment again.

This time she uses 16.8 g of potassium hydroxide and 18.9 g of nitric acid.

Calculate the mass of potassium nitrate she will make.

.....

.....

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

(b) Kylie does the experiment a third time.

She expects to make 5.5 g of potassium nitrate.

She actually makes 4.4 g.

Show by calculation that her percentage yield is 80%.

.....

.....

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

(c) Kylie makes another fertiliser called ammonium sulfate.

Look at the word and symbol equations for this reaction.

ammonia	+	sulfuric acid	→	ammonium sulfate
$2NH_3$	+	H_2SO_4	→	$(NH_4)_2SO_4$

Calculate the mass of ammonium sulfate that can be made from 3.4 g of ammonia.

Relative atomic masses, A_r

N = 14, H = 1, S = 32, O = 16.

.....

.....

.....

.....

answer ..... g **[3]**

(d) Most fertilisers contain the essential element nitrogen.

The nitrogen in fertilisers helps crops grow bigger.

Explain **how** nitrogen in fertilisers helps crops grow bigger.

.....

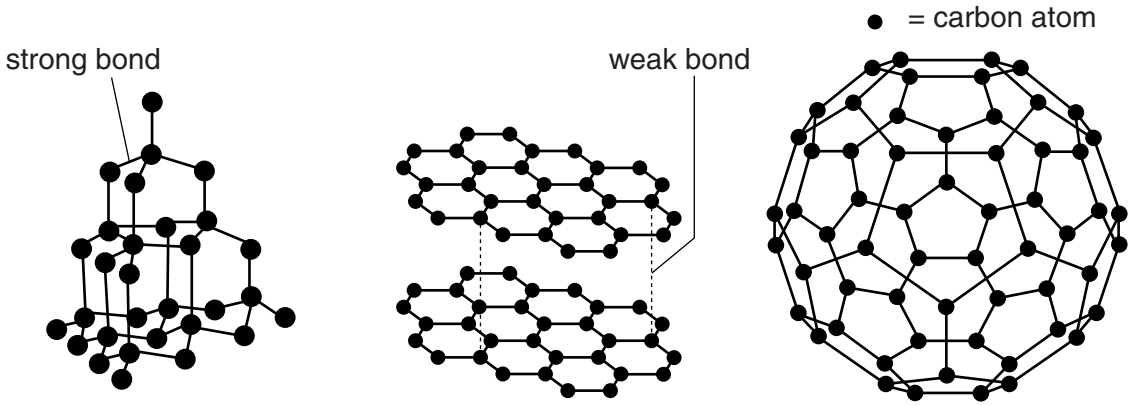
.....

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

[Total: 8]

6 Look at the diagrams.

They show the structures of diamond, graphite and buckminsterfullerene.



(a) Diamond and graphite are giant structures.

Diamond and graphite have **high melting points**.

Explain why they have high melting points. Use the diagrams to help you.

.....

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

(b) Graphite is used to make pencil leads.

Explain why.

.....

.....

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

(c) Buckminsterfullerene has the formula C_x.

Write down the value of x.

Choose from

20	**40**	**60**
80	**100**	**120**

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

(d) Buckminsterfullerene can be made into **nanotubes.**

Write down two **uses** of nanotubes.

1 .....

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

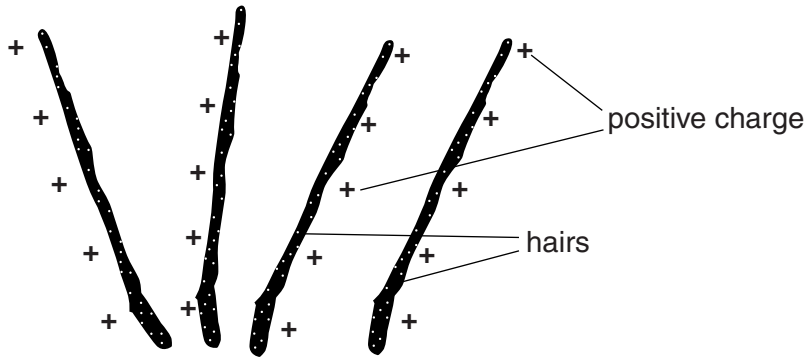
[Total: 6]

Section C – Module P4

7 This question is about static electricity.

Danni combs her hair.

Hairs become positively charged by friction and repel each other.



(a) (i) Why do the hairs repel each other?

.....

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

(ii) How have the hairs become charged **positively**?

.....

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

(b) What charge does the comb have after Danni combs her hair?

answer .....

Explain your answer.

.....

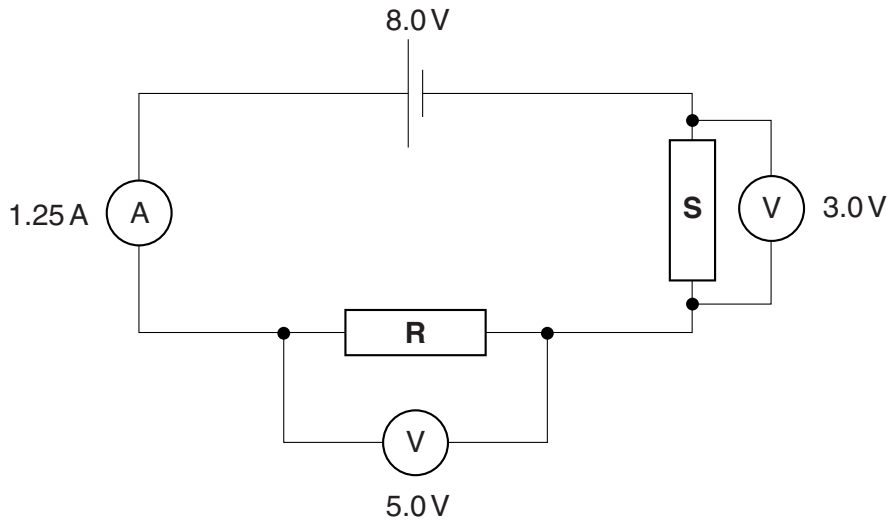
.....

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

[Total: 4]

8 Ramiz is investigating electrical circuits.

He builds a circuit with two resistors in it.



(a) Ramiz measures

- the current in the circuit
- the voltage across each resistor.

Calculate the **resistance** of resistor **R**.

The equations on page 2 may help you.

.....

.....

.....

resistance of **R** = ... ohms (Ω) **[2]**

(b) (i) Ramiz adds another identical cell to his circuit.

This doubles the supply voltage.

This increases the current flowing through the resistor.

What happens to the **value** of the **voltage** across resistor **R**?

.....

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

(ii) He adds a third resistor to the circuit.

It is placed in series with the other resistors.

What happens to the current in the circuit?

.....

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

[Total: 4]

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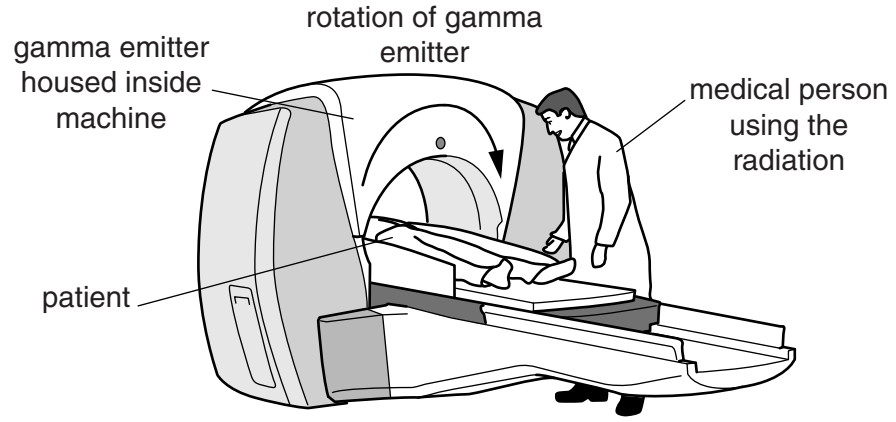
9 Some radioactive isotopes emit gamma rays.

They are used to treat cancerous tumours.



(a) Explain how the gamma rays are used to treat the cancerous tumour.

In your answer, include ideas about

- the beam of gamma rays
- why the beam is rotated
- how damage to healthy human tissue is minimised.

.....

.....

.....

.....

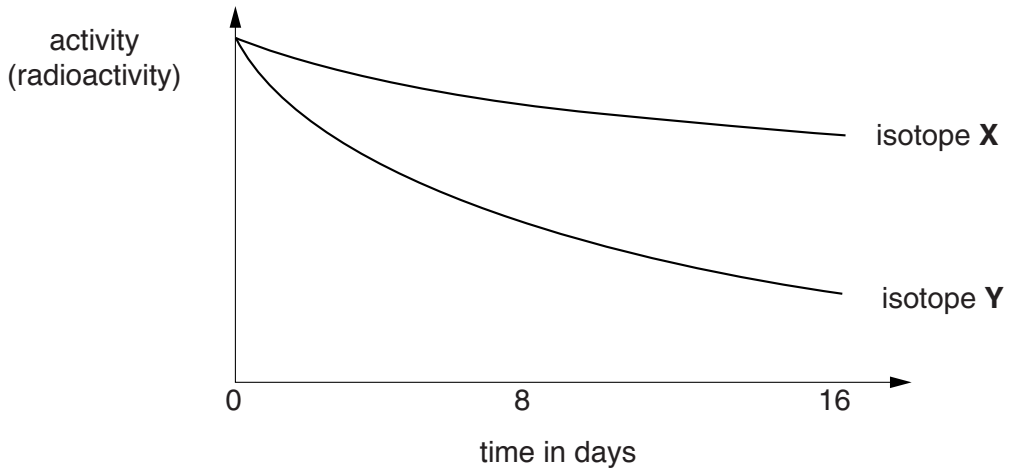
.....

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

(b) Radioisotopes are used as **tracers** in hospitals.

These isotopes have a relatively short **half-life**.

The graph shows the decay of two radioisotopes with different half-lives.



Explain

- what is meant by half-life
- **which** isotope would be the most suitable to use as a tracer **and why**.

The explanation has been started for you.

Half life is .....

.....

Isotope ..... is the **most** suitable because .....

.....

.....

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

(c) (i) Complete the sentences using phrases from this list.

a beta particle

a gamma ray

an X-ray

an alpha particle

An unstable atom emits a helium nucleus.

Scientists call this helium nucleus ..... .

An unstable atom emits a fast moving electron.

Scientists call this fast moving electron ..... . **[2]**

(ii) When radioactive isotope **X** decays it emits a β particle to form a new element, **Z**.

Complete the nuclear equation for the decay of isotope **X**.

$$^{131}_{53}X \longrightarrow {}^{.....}_{.....}Z + {}^{0}_{-1}e^{-}$$

[1]

[Total: 8]

10 Doctors use **ultrasound** to treat people with kidney stones.

There are two parts to the process.

First the doctor locates the kidney stones, then he carries out the treatment.

(a) Complete the sentences to describe what happens.

The kidney stones are located by doing an ultrasound ..... . The waves strike the kidney stones and ..... to the detector outside the body.

Different ultrasound waves are then focused on the kidney stones to ..... the stones by vibrating them vigorously at a very high ..... . **[2]**

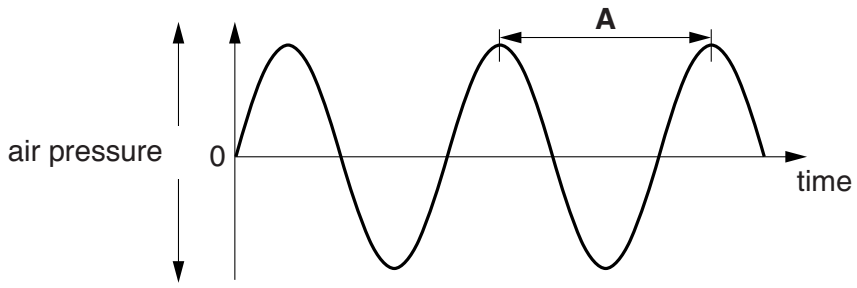
(b) Humans **cannot** hear ultrasound.

Put a tick (✓) beside the reason why.

The ultrasound waves are not loud enough.	☐
The ultrasound waves travel as transverse waves.	☐
The ultrasound waves are just areas of air pressure changes.	☐
The ultrasound waves do not have enough energy.	☐
The ultrasound frequency is above the range of human hearing.	☐

[1]

(c) Ultrasound waves can be shown as a wave diagram.



The wave feature shown by the letter **A** is the **wavelength**.

Describe what is meant by the **frequency** of a wave.

.....

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

[Total: 4]

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.