OCR
RECOGNISING ACHIEVEMENT

H

B624/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION
GATEWAY SCIENCE
ADDITIONAL SCIENCE B
Unit 2 Modules B4 C4 P4 (Higher Tier)

WEDNESDAY 23 JANUARY 2008

Afternoon
Time: 1 hour

Candidates answer on the question paper.
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T42453

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE		
Section	**Max.**	**Mark**
A	**20**	
B	**20**	
C	**20**	
TOTAL	**60**	

This document consists of **22** printed pages and **2** blank pages.

EQUATIONS

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

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

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

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

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

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

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

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

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

BLANK PAGE

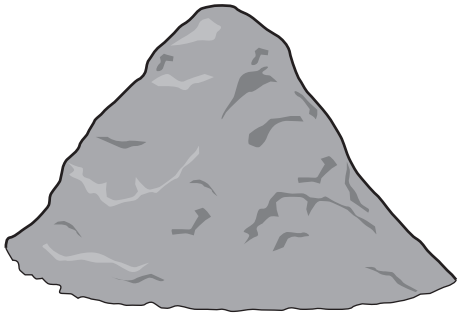
Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

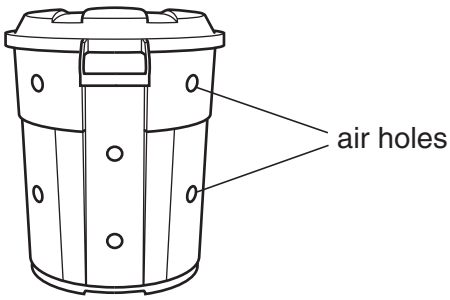
Answer **all** the questions.

Section A – Module B4

1 Bob has been cutting his grass.



Bob puts his grass cuttings into a compost bin.



(a) Grass cuttings decay faster in the summer than in the winter.

Suggest why.

..... [1]

(b) When grass cuttings decay, carbon dioxide is made.

What makes this carbon dioxide?

..... [1]

(c) Bob adds some earthworms to his compost bin.

Suggest why.

.....

.....

..... [2]

[Total: 4]

2 Look at the information about a farmland food chain.

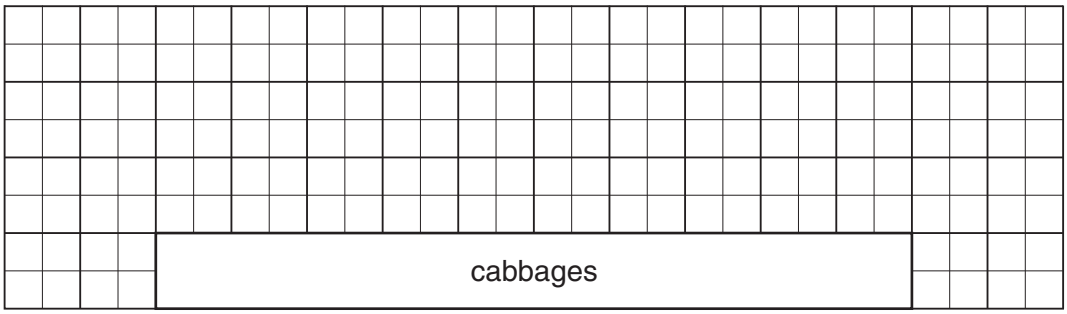
	number of individuals	mass of an individual in g	total biomass in g
cabbages	8	250	……
caterpillars	400	2	800
thrushes	5	80	400
hawks	……	200	200

(a) Complete the table. [2]

(b) Use the data in the table to complete a pyramid of **biomass**.

- Use 1 cm square = 200 g.
- Label the pyramid.

The bar for cabbages has been done for you.



[2]

[Total: 4]

3 John is a farmer. He uses organic farming techniques.

(a) One organic farming technique that John uses is to grow mainly peas and beans which are nitrogen-fixing crops.

This means that he does **not** have to use artificial nitrate fertilisers.

Suggest **one advantage** and **one disadvantage** of growing nitrogen-fixing crops instead of using nitrate fertilisers.

advantage .....

.....

.....

disadvantage .....

.....

..... [2]

(b) John's neighbour Ed uses **intensive farming** techniques.

What does intensive farming mean?

.....

..... [1]

(c) Ed **does** use artificial nitrate fertilisers.

He puts the fertilisers on to his fields when his crops start to grow.

(i) Nitrates are needed for plant growth.

Explain why.

..... [1]

(ii) Nitrates are taken in by plant roots using **active transport**.

What is active transport?

.....

.....

..... [2]

(iii) Nitrates move through a plant in the xylem vessels.

The nitrates are absorbed and move through plants faster on warm days than on cold days.

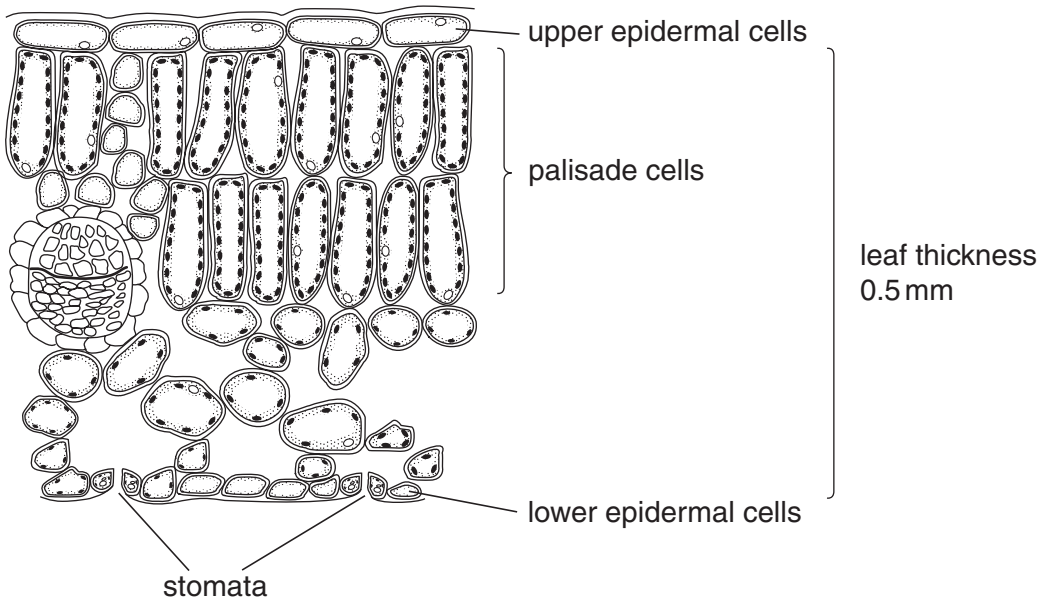
Write down **one** reason why.

.....

..... [1]

[Total: 7]

4 The diagram shows the inside of a leaf.



(a) Leaves contain veins.

Describe **one** job of the veins.

..... [1]

(b) Upper epidermal cells are adapted so that leaves can photosynthesise efficiently.

Describe **one** way the cells are adapted for this.

.....

..... [1]

(c) Carbon dioxide diffuses from the stomata to the palisade cells.

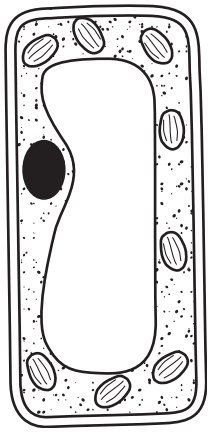
Leaves are adapted for efficient diffusion of carbon dioxide between the stomata and palisade cells.

Describe **one** way that leaves are adapted for this.

.....

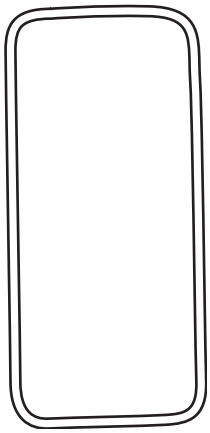
..... [1]

(d) The diagram shows a palisade cell.



If a plant wilts, the cells may become **plasmolysed**.

Finish the diagram below to show what the cell would look like if it were plasmolysed.



[1]

(e) Animal cells **never** become plasmolysed.

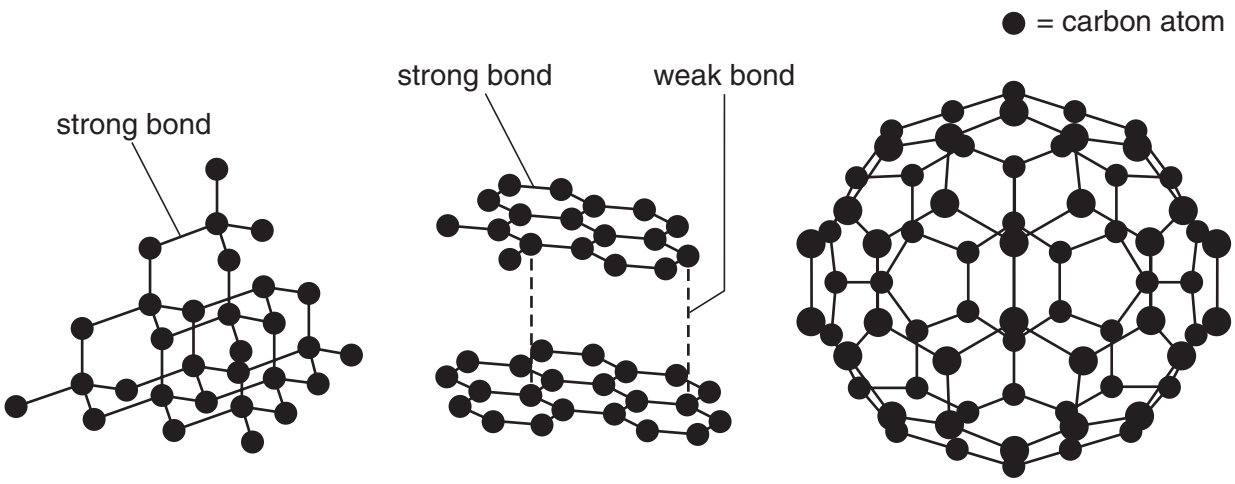
Explain why.

..... [1]

[Total: 5]

Section B – Module C4

5 Look at the diagrams. They show the different forms of carbon.



diamond **graphite** **type C**

(a) What is the name of type **C**?

..... [1]

(b) There are three different solid forms of carbon.

What is the name given to these forms?

Choose from the list.

allotropes

isotopes

nanotubes

polymers

answer ..... [1]

(c) Graphite is used in lubricants. This is because it is slippery.

Explain why graphite is slippery. Use ideas about the structure of graphite.

.....

.....

..... [1]

[Total: 3]

6 This question is about detergents.

Look at the label from a packet of washing powder.

Active ingredients

detergent
water softener
bleach
optical brighteners
enzymes

(a) Enzymes are used in low temperature washes to remove food stains.

Write down an **advantage** of washing clothes at lower temperatures.

..... [1]

(b) Look at the diagram. It shows a detergent molecule.

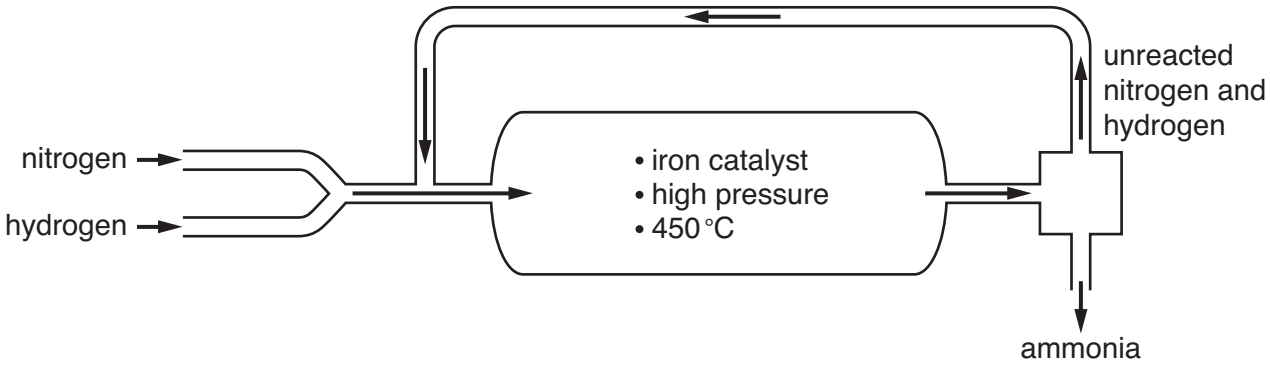
The head is attracted to water.

The tail 'hates' water but is attracted to oil and dirt.

Complete the labels on the diagram. [2]

[Total: 3]

7 Ammonia is made from nitrogen and hydrogen in the Haber process.



The equation for the reaction is

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

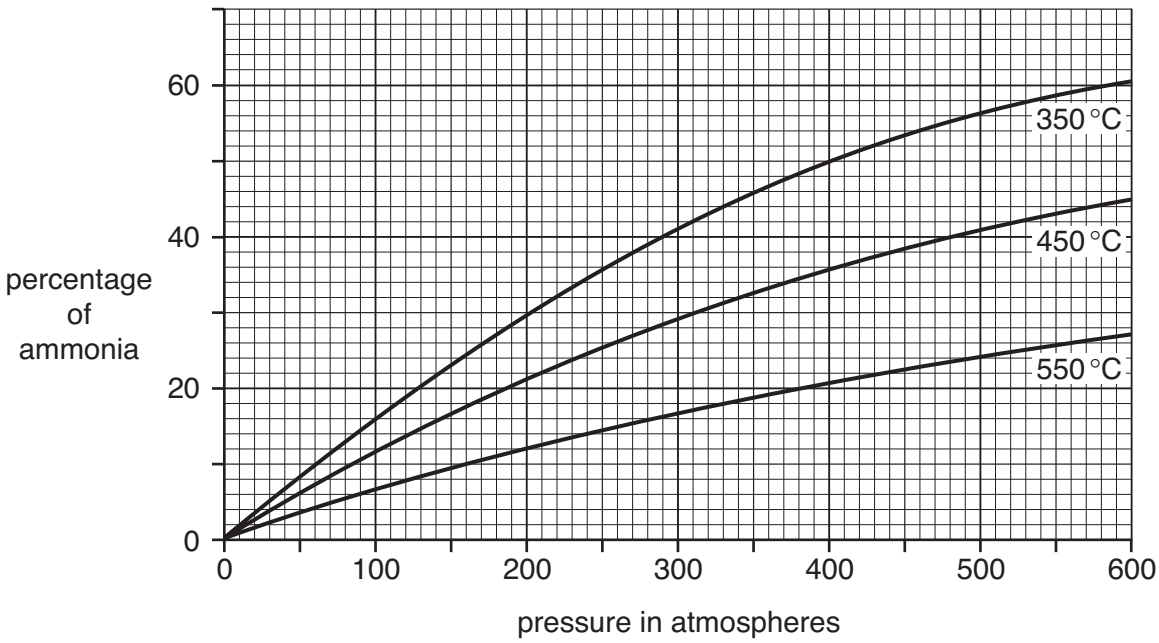
(a) Some of the nitrogen and hydrogen does not react.

What happens to the unreacted nitrogen and hydrogen?

..... [1]

(b) The percentage yield of ammonia made in the Haber process changes as the temperature changes and as the pressure changes.

Look at the graphs.



(i) How does the percentage of ammonia change as the **pressure** increases?

..... [1]

(ii) How does the percentage of ammonia change as the **temperature** increases?

..... [1]

(c) The conditions used to make ammonia are

- an iron catalyst
- a high pressure
- a temperature of 450 °C.

(i) Explain why an iron catalyst is used.

.....

..... [1]

(ii) A temperature of 350 °C would give a higher percentage yield of ammonia.

Why is 450 °C rather than 350 °C chosen for the process?

.....

..... [1]

[Total: 5]

8 This question is about fertilisers.

(a) Ammonium nitrate is a fertiliser.

It is made by reacting nitric acid with ammonia.

Ammonia is a base.

What type of reaction happens when an acid reacts with a base?

Choose from the list.

neutralisation

polymerisation

precipitation

purification

answer ..... [1]

(b) The formula for ammonium nitrate is NH_4NO_3.

Calculate the relative formula mass (M_r) of ammonium nitrate.

The relative atomic mass (A_r) for N is 14, for H is 1 and for O is 16.

.....

.....

.....

answer ..... [1]

(c) Ryan makes some ammonium nitrate.

He predicts that he will make 25 g. His actual yield is 20 g.

Calculate his percentage yield.

.....

.....

.....

answer ..... % [2]

(d) Ryan also makes some ammonium sulfate.

He reacts ammonia, NH_3, with sulfuric acid, H_2SO_4, to make ammonium sulfate, $(NH_4)_2SO_4$.

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

..... [2]

(e) Fertilisers can run off fields and get into rivers and lakes.

This can cause **eutrophication**.

Write about eutrophication.

Your answer should include

- what the fertilisers do in rivers and lakes
- what happens to organisms in the water.

.....

.....

.....

.....

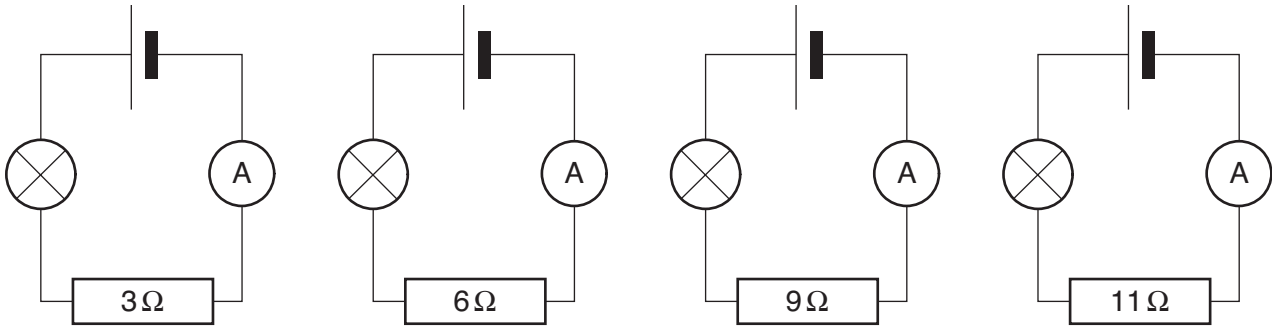
..... [3]

[Total: 9]

Section C – Module P4

9 This question is about electric circuits.

(a) Look at the electric circuits.



A **B** **C** **D**

The lamp and battery are the same in all the circuits.

(i) Which circuit has the smallest current?

Choose from: **A** **B** **C** **D**

answer ..... [1]

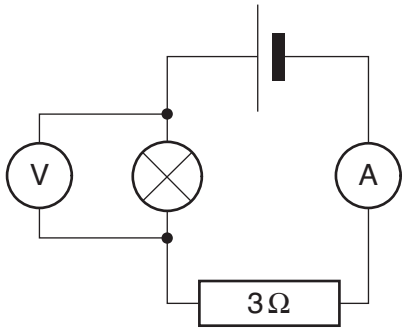
(ii) Which circuit has the largest current?

Choose from: **A** **B** **C** **D**

answer ..... [1]

(b) Yvonne puts a voltmeter across a lamp.

Look at the diagram.



The reading on the voltmeter is 5 V.

The reading on the ammeter is 2 A.

Calculate the resistance of the lamp.

Use the equations on page 2 to help you.

.....

.....

answer .....ohms [2]

[Total: 4]

10 Ultrasound is a longitudinal wave.

Describe how particles move in a longitudinal wave.

.....

.....

..... [2]

[Total: 2]

11 **(a)** Static electricity can be dangerous.

Write down **one example** of when static electricity is dangerous.

.....

..... [1]

(b) Electricity can be useful for restoring a heart beat.

Look at the photograph.

Look at these statements about how electricity is used to restore the heart beat.

(i) The patient's chest is shaved and dried.

Suggest why.

.....

..... [1]

(ii) The operator says "stand clear" before shocking the patient.

Explain why.

.....

..... [1]

(iii) The first shock may not restore the heart beat.

The operator must wait before applying a second shock.

Suggest why.

.....

..... [1]

[Total: 4]

12 There are three types of nuclear radiation.

Alpha and gamma are two of the types.

(a) Write down the name of the third type of nuclear radiation.

..... [1]

(b) Gamma radiation is an electromagnetic wave.

Another type of electromagnetic wave has a similar wavelength.

It is used in medicine.

What is it called?

..... [1]

(c) A doctor uses a radioactive material with a half life of 10 hours.

The count rate at the start is 960 counts per minute.

What is the count rate after 30 hours?

.....

.....

count rate = ... counts per minute [1]

[Total: 3]

13 This question is about radiation.

(a) Complete the table to show the nature of alpha radiation.

radiation	charge	nature	mass
alpha	+2		4
gamma	0	electromagnetic radiation	0

[1]

(b) Most atoms are not radioactive.

Some atoms are radioactive.

What is different about the nucleus of a radioactive atom?

..... [1]

(c) Alpha emitters are not used as tracers in the body.

Explain why.

.....

..... [1]

(d) X-rays do not come from the nucleus of an atom.

How are X-rays made?

.....

..... [1]

[Total: 4]

14 **(a)** The reaction inside a nuclear reactor is a chain reaction.

The chain reaction needs to be controlled.

Explain how.

.....

.....

.....

..... [2]

(b) When a piece of metal is placed inside a nuclear reactor, it may become radioactive.

Explain why.

.....

.....

.....

..... [1]

[Total: 3]

END OF QUESTION PAPER

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

PLEASE DO NOT WRITE ON THIS PAGE

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.