OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

ADDITIONAL SCIENCE B

B623/02

Unit 1 Modules B3 C3 P3
(Higher Tier)

CUP/T67578

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 19 January 2009
Morning

Duration: 1 hour

B623021

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use 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.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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.

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

EQUATIONS

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

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

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

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

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

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

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

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

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

Answer **all** the questions.

Section A – Module B3

1 Scientists are trying to develop new treatments for heart attacks.

Heart attacks may cause heart muscle to be damaged.

(a) Heart attacks are often caused by cholesterol.

Explain how cholesterol can cause problems in blood vessels.

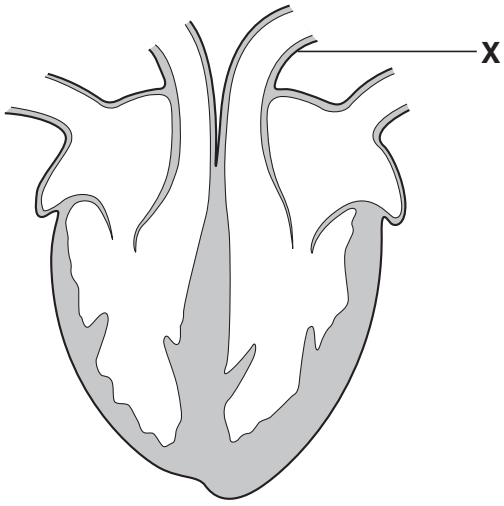
.....

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

(b) The scientists insert a small tube into a blood vessel in the leg.

The tube is moved along inside this blood vessel so that it enters the heart.

They use this tube to inject stem cells into the heart muscle.



The tube enters the heart through the blood vessel labelled **X**.

Write down the name of blood vessel **X**.

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

(c) The scientists inject stem cells into the heart muscle.

They hope that the stem cells will repair the damaged muscle.

What are stem cells?

.....

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

(d) Stem cells can be extracted from human embryos.

Describe **two** reasons why some people might object to the use of stem cells.

1 .....

.....

2 .....

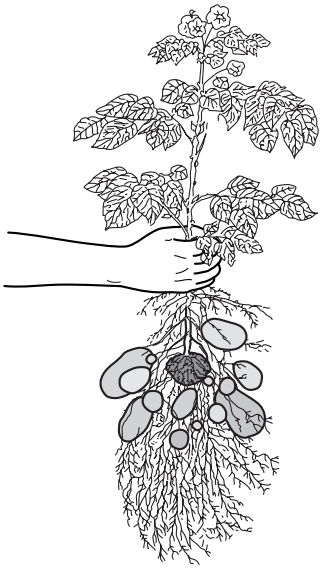
..... **[2]**

[Total: 6]

2 Harry grows potatoes.

Harry plants a potato in soil and it grows into a potato plant.

Several months later the plant has made many new potatoes.



(a) The potatoes grow by producing new cells by cell division.

Write down the name of this type of cell division.

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

Turn over for the remainder of question 2

(b) Harry grows different types of potatoes.

They all have different properties.

Some of these properties are shown in the table.

property of potato	type of potato			
	goldrush	**asterix**	**Yukon gold**	**pink eye**
good for baking	✓	✗	✓	✓
good for potato salads	✗	✓	✗	✗
skin colour	brown	red	yellow	pink
number of potatoes produced	high	very high	high	medium

(i) Harry wants to produce a yellow skinned potato with a very high yield.

He decides that he needs to set up a selective breeding programme.

Which **two** types of potato from the table should he use in his programme?

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

(ii) Harry starts his selective breeding programme by growing these two types of potato.

Describe what he should do to complete the selective breeding programme.

.....

.....

.....

.....

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

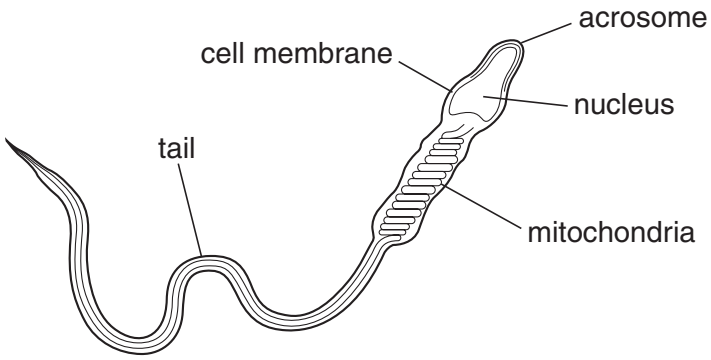
(iii) Write down **one** possible **disadvantage** of selective breeding programmes.

.....

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

[Total: 5]

3 The diagram shows a normal sperm cell.



(a) Which part of the sperm cell provides most of the energy?

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

(b) The nucleus of the sperm cell is haploid.

Why is this important for the correct formation of the zygote?

.....

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

(c) Scientists have discovered a mutation in the DNA of mice.

The mutation changes a protein called the MSJ protein.

They have found that this change makes the mice produce sperm without an acrosome.

(i) What effect do mutations have on DNA?

.....

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

(ii) Why is a mutation likely to change the protein that the DNA codes for?

.....

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

(iii) The sperm that are produced without an acrosome **cannot** fertilise an egg.

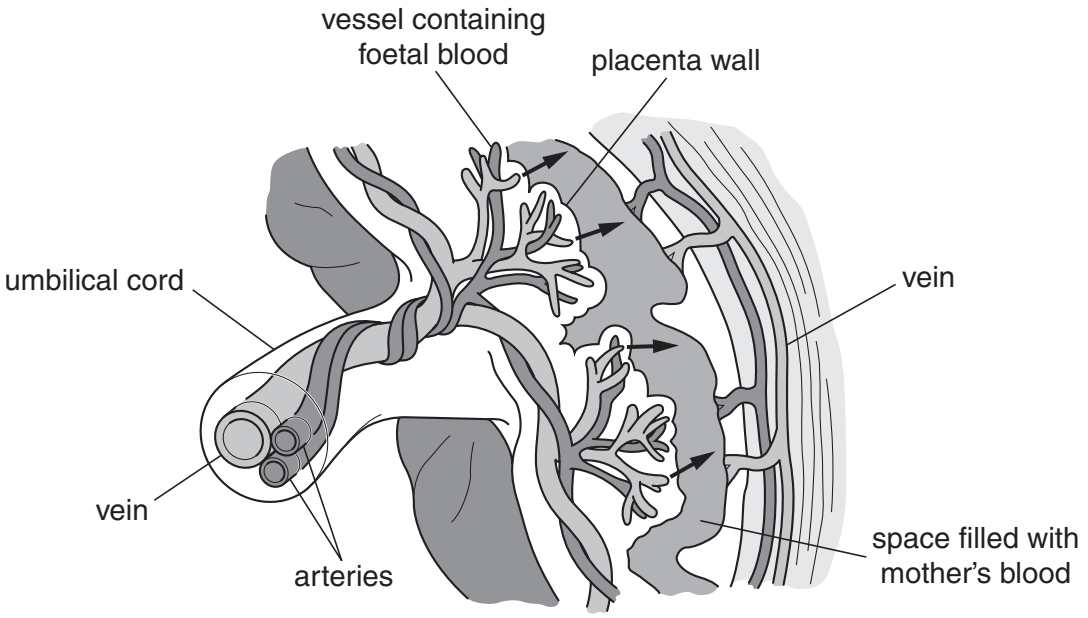
Explain why.

.....

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

[Total: 5]

4 The diagram shows the structure of the placenta.



(a) Write down the name of **one** substance that moves in the direction of the arrows.

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

(b) Write down the name of the process by which this substance moves.

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

(c) Write down **two** ways that the placenta is adapted to speed up the exchange of substances between the mother and the foetus.

1 .....

.....

2 .....

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

[Total: 4]

Section B – Module C3

5 This question is about the elements in the Periodic Table.

Look at the list of elements.

bromine	**chromium**
hydrogen	**iodine**
magnesium	**neon**
nitrogen	**oxygen**
potassium	**sodium**

Answer the questions.

Choose your answers from the list.

Each element can be used **once**, **more than once** or **not at all**.

The Periodic Table on the back page may help you.

(a) Write down the name of an element which has **8 electrons** in its outer shell.

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

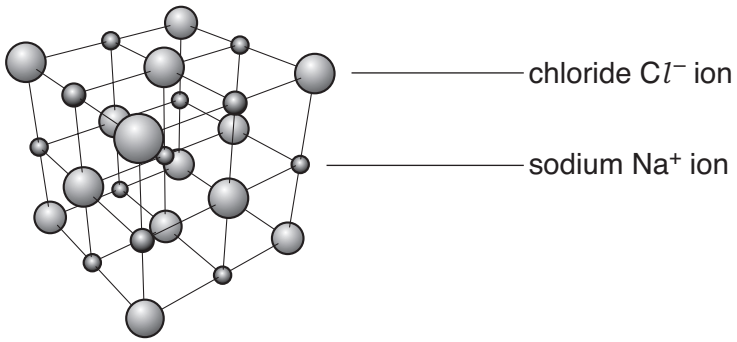
(b) Write down the name of an element which has the electronic structure **2.8.1**.

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

[Total: 2]

6 This question is about ionic compounds.

Look at the diagram. It shows the structure of **solid** sodium chloride.



(a) Sodium chloride has a high melting point.

Explain why. Use ideas about forces between particles.

.....

.....

.....

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

(b) **Solid** sodium chloride does **not** conduct electricity.

Explain why.

.....

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

[Total: 3]

7 Nadia holds a flask half full of a solution.

She does not know if the solution contains

- a copper compound (containing Cu^{2+} ions)
- or an iron compound (containing Fe^{2+} ions)

She uses sodium hydroxide solution to find out.

Nadia adds sodium hydroxide solution to the unknown solution in the flask.

A coloured solid forms.

She decides that the unknown solution contains a copper compound.

(a) Write down the **colour** of the solid made.

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

(b) Write down the name of the type of solid which forms in the flask.

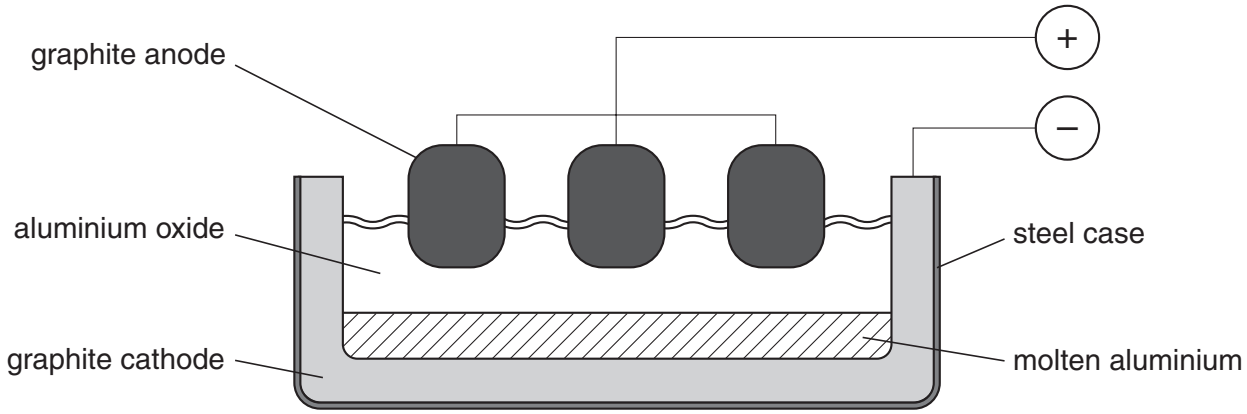
..... **[1]**

[Total: 2]

8 Aluminium is extracted from its mineral using electricity.

Look at the diagram.

It shows the equipment that is used.



(a) Molten aluminium oxide is broken down by electrolysis into aluminium and oxygen.

Write down the **word** equation for the electrolysis of aluminium oxide.

....	→	....	+	....

[1]

(b) Every few days the **graphite anodes** have to be replaced.

Explain why the graphite anodes need to be replaced.

In your answer

- describe what happens to the graphite anodes
- and explain why it happens.

.....

.....

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

(c) At the cathode, an aluminium ion, Al^{3+}, gains electrons to make an aluminium atom, Al.

Write down the ionic equation for this reaction. Use e^- to represent an electron.

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

(d) The extraction of aluminium from aluminium oxide is very expensive.

Explain why.

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

(e) Cryolite is added to the aluminium oxide.

Why does using cryolite reduce the cost of making aluminium?

.....

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

[Total: 6]

9 Chlorine, bromine and iodine are halogens.

The halogens are in Group 7 of the Periodic Table.

(a) How does the reactivity of the halogens change down the group?

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

(b) Look at the word equation.

chlorine + sodium bromide → sodium chloride + bromine

In this reaction, chlorine **displaces** bromine from sodium bromide solution.

In another experiment, iodine is added to sodium bromide solution.

There is no reaction.

Explain why.

.....

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

(c) Look at the equation.

It shows how a chloride ion, Cl^-, is made from a chlorine molecule.

$$Cl_2 + 2e^- \rightarrow 2Cl^-$$

This is an example of **reduction**.

Explain why.

.....

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

[Total: 3]

10 The diagram shows the reaction between sodium and water.

(a) Complete the following sentences to describe this reaction.

Choose words from the list.

acidic	**alkaline**
decreases	**hydrogen**
increases	**neutral**
oxygen	**stays the same**

Going down Group 1, the reactivity of the alkali metals ..... .

A solution of sodium hydroxide, NaOH, is made which is ..... .

[2]

(b) Sodium, Na, reacts with water.

Sodium hydroxide, NaOH, and hydrogen, H_2 are made.

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

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

[Total: 4]

Section C – Module P3

11 This question is about road safety.

(a) Look at the diagram.

It shows the stopping distance for a car travelling at 13 m/s (30 miles per hour).

(i) Cars travel into the city along a busy road.

They travel at 13 m/s.

One car travels less than 3 m behind the car in front.

This is very dangerous.

Explain why.

Use the information in the diagram to explain your answer.

.....

.....

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

(ii) When the car goes faster the **thinking** distance increases.

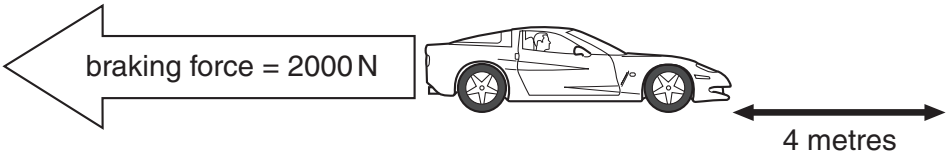
What will happen to the **braking** distance when the car goes faster?

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

(iii) Write down **one** other thing that increases thinking distance.

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

(b) The car brakes. Look at the diagram.



The braking force is 2000 N. The braking distance is 4 m.

Calculate the **work done** by the brakes on the car.

The equations on page 2 may help you.

.....

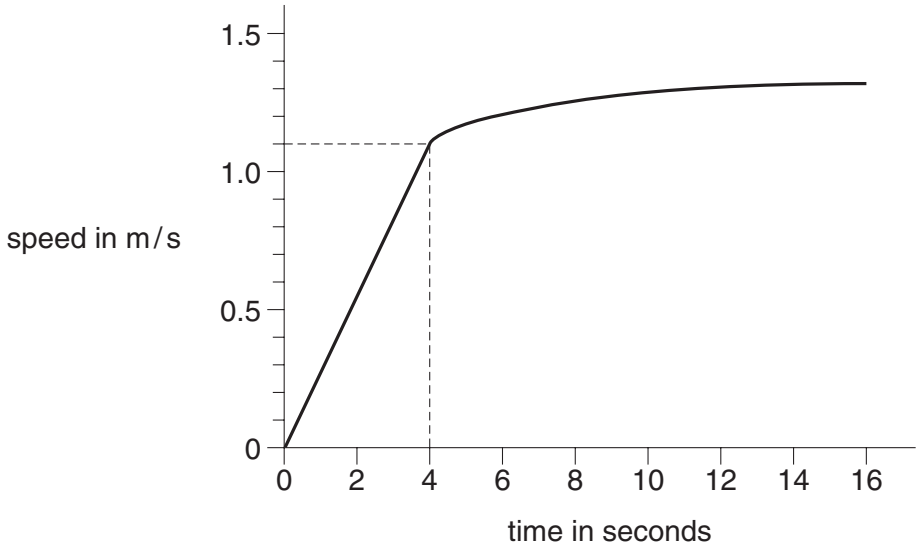
.....

answer ..... J **[2]**

[Total: 6]

12 Daly is in the swimming pool. He starts to swim and increase his speed.

Look at the graph of his speed.



(a) Daly accelerates steadily for the first 4 seconds. He reaches a speed of 1.1 m/s.

How far does he travel in the first 4 seconds? Use the graph to help you.

.....

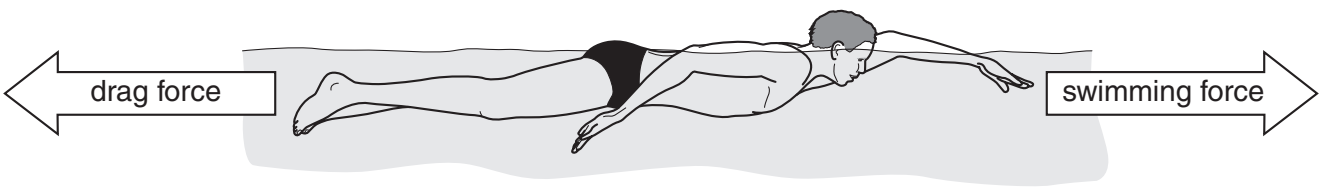
.....

answer ..... metres **[2]**

(b) When Daly swims there are forces acting on him.

Two of these forces are

- a forward swimming force
- a backward drag force.



(i) What can you say about the **size** of these forces as Daly increases his speed?

.....

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

(ii) What can you say about the size of these forces when Daly is at a **steady** speed?

.....

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

(c) Daly swims the next 25 metres in 20 seconds.

Calculate Daly's speed.

The equations on page 2 may help you.

.....

.....

answer ..... m/s **[2]**

[Total: 6]

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PLEASE DO NOT WRITE ON THIS PAGE

13 Look at the information on fuel consumption for different vehicles.

vehicle	average fuel consumption in km per litre
car	11
van	7

(a) The car has an average fuel consumption of 11 km per litre.

The car uses 6 litres of fuel. How far will the car travel?

.....

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

(b) The van has an **average** fuel consumption of 7 km per litre.

Most drivers rarely get 7 km per litre when they drive the van.

Suggest **two** reasons why.

reason 1

.....

.....

reason 2

.....

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

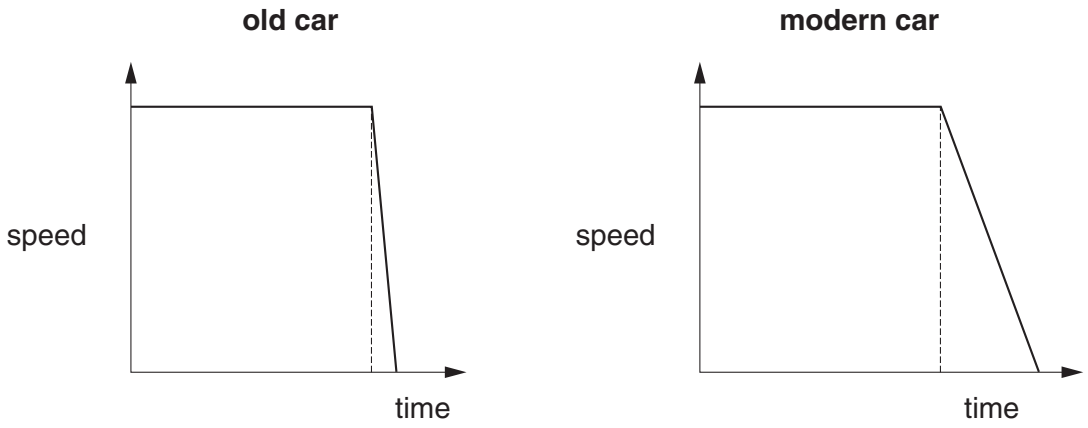
[Total: 3]

14 Modern cars have safety features fitted to help reduce injuries.

They have crumple zones at the front.

The crumple zones absorb energy in a crash.

Look at the graphs from two test crashes.



(a) The modern car has a better crumple zone.

Give **two** reasons how a crumple zone reduces injuries in a crash.

1 .....

.....

2 .....

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

(b) Look at the two statements about car crashes.

who	statement
Mike	'If you double the speed the crash is only twice as bad.'
Sue	'If you double the speed the crash is four times worse.'

Sue is correct.

Explain why.

In your answer use ideas about energy.

The equations on page 2 may help you.

.....

.....

.....

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

[Total: 5]

END OF QUESTION PAPER

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.