

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
GATEWAY SCIENCE  
CHEMISTRY B**

**B641/02**

Unit 1 Modules C1 C2 C3 (Higher 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)

**Wednesday 26 May 2010  
Morning**

**Duration: 1 hour**



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**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. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

**INFORMATION FOR CANDIDATES**

- 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 **60**.
- The Periodic Table is printed on the back page.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

**Section A – Module C1**

- 1 This question is about foods and food additives.

Look at the table. It gives some information about E numbers.

type of food additive	E number range
food colour	E101 to E199
preservative	E200 to E299
antioxidant	E300 to E321
emulsifier	E400 to E499
sweetener	E950 to E967

Look at the food label found on a packet of cake mix.

**Ingredients:**

Sugar, wheat flour, vegetable oil, baking powder, E341, dried whey, E477, E471, salt and E415.

- (a) What type of food additive is E477?

..... [1]

- (b) Does the cake mix contain any preservatives?

.....

Explain your answer.

..... [1]

- (c) One of the ingredients is baking powder.

Baking powder contains sodium hydrogencarbonate.

When sodium hydrogencarbonate,  $\text{NaHCO}_3$ , is heated it breaks down.

Sodium carbonate,  $\text{Na}_2\text{CO}_3$ , water and carbon dioxide are made.

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

..... [2]

(d) Describe how you can test for **carbon dioxide** gas.

name of the chemical used .....

result you would expect to see ..... [2]

[Total: 6]

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2 An elephant in a zoo has an injured foot. A vet makes a shoe for the elephant.



The shoe is made out of Gore-Tex®.

The shoe is hard-wearing and waterproof. It is also breathable.

(a) Suggest **one** reason why the elephant's shoe was **not** made out of nylon.

..... [1]

(b) Gore-Tex® is made of nylon with an outer layer of PTFE/polyurethane.

The PTFE layer has holes in it.

(i) The holes make Gore-Tex® breathable while still waterproof.

Explain how.

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

(ii) The PTFE layer is combined with nylon.

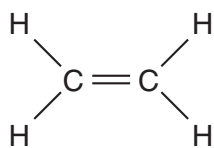
Explain why.

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

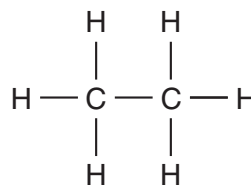
[Total: 4]

## 3 Ethene and ethane are both hydrocarbons.

Look at the displayed formulas.



ethene



ethane

(a) The molecular formula for ethene is  $C_2H_4$ .

What is the molecular formula for **ethane**?

..... [1]

(b) Ethane is a member of a group of hydrocarbons called the **alkanes**.

Explain why ethane is an alkane.

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

(c) Bromine water can be used to tell the difference between **ethane** and **ethene**.

Look at the table.

It shows the effects of ethane and ethene on bromine water.

Complete the table.

name of compound	effect on bromine water
ethane	no effect – remains orange/brown
ethene	..... .....

[1]

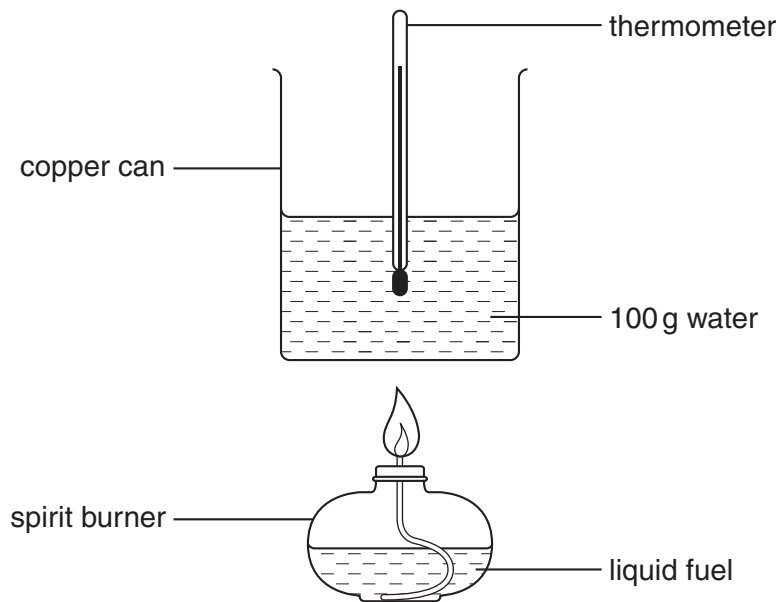


4 Megan and Neil investigate three fuels.

They want to find out which gives off most energy.

They burn each fuel separately.

Look at the diagram. It shows the apparatus they use.



(a) Write down **one** thing Megan and Neil must do to make their experiments fair.

..... [1]



(b) Look at the table. It shows the results for one of the fuels.

fuel	temperature at start in °C	temperature at end in °C
paraffin	22	46

Calculate the amount of heat energy transferred by the paraffin to the water.

Use the formula:

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

The specific heat capacity of water is 4.2J/g °C.

.....

.....

.....

answer ..... J [2]

(c) Paraffin is obtained from crude oil.

Crude oil is a **fossil fuel**.

The amount of fossil fuels being burnt each year is steadily increasing.

Suggest why.

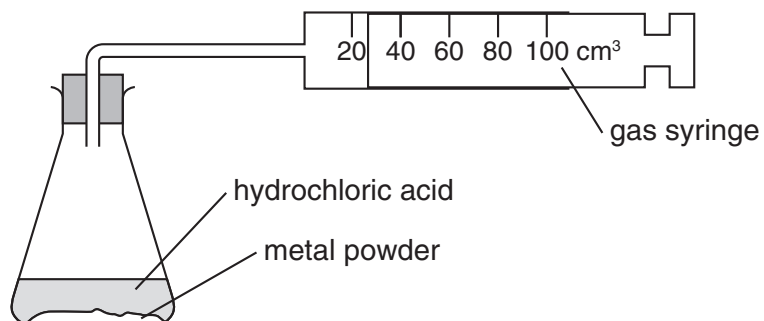
.....

..... [1]

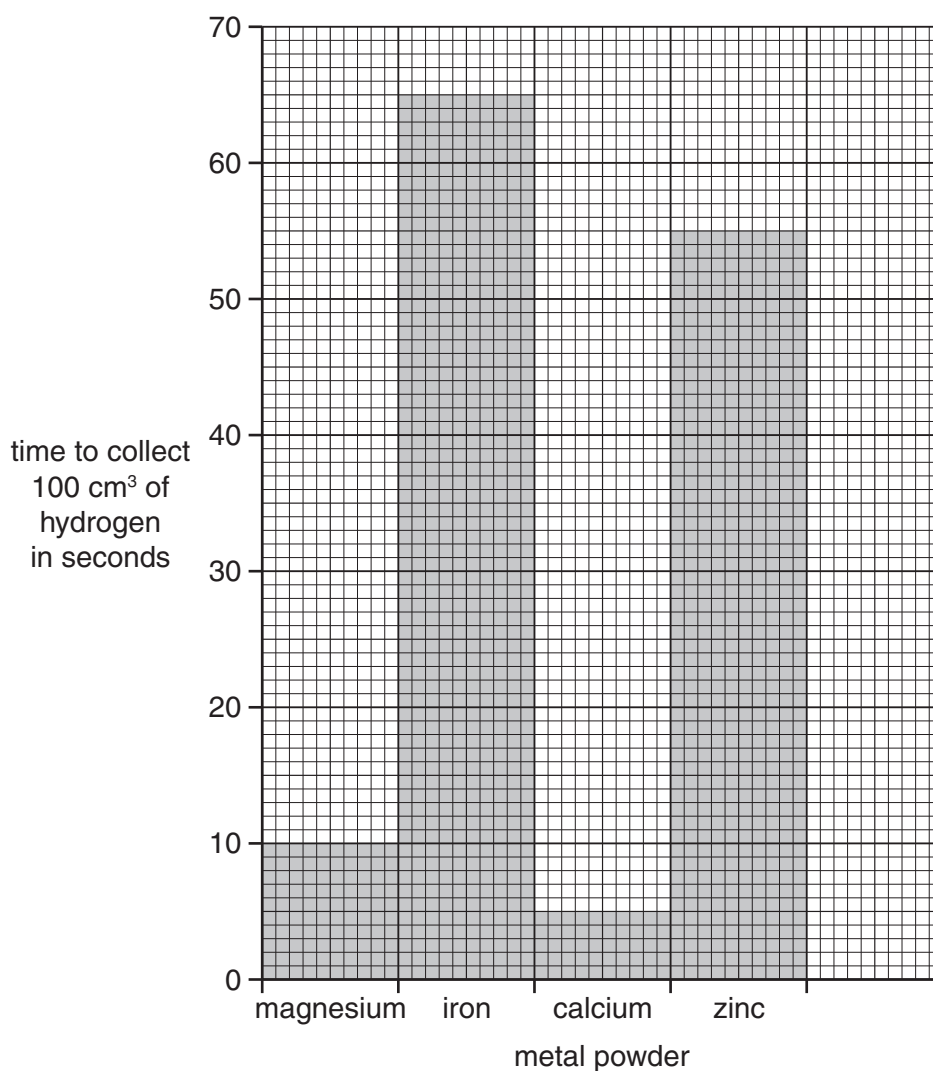
[Total: 4]

## Section B – Module C2

- 5 Cameron investigates the reaction of metal powders with dilute hydrochloric acid. Look at the apparatus he uses.



Cameron measures the time it takes to collect 100 cm<sup>3</sup> of hydrogen in the gas syringe. He makes sure that all of his experiments are fair. Look at the bar chart of Cameron's results.



(a) Cameron does the experiment with zinc again.

This time he uses a **more** concentrated solution of hydrochloric acid.

The particles in the acid are more crowded.

(i) Predict how long it will take to collect 100 cm<sup>3</sup> of hydrogen.

..... [1]

(ii) Explain your answer. Use ideas about collisions between particles.

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

(b) Cameron does the experiment with zinc again.

This time he uses acid at a **higher** temperature.

The reaction is much **faster**.

Explain why.

Use ideas about particles.

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

(c) Cameron does the experiment with zinc again.

This time he uses a **lump** of zinc rather than zinc **powder**.

What happens to the rate of reaction?

.....  
  
Explain your answer.  
.....  
.....  
..... [2]

(d) Magnesium reacts with dilute hydrochloric acid, HCl.

Hydrogen and magnesium chloride, MgCl<sub>2</sub>, are made.

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

..... [2]

[Total: 8]

**12**  
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6 This question is about air quality.

Air contains nitrogen, oxygen, carbon dioxide and water vapour.

Air also contains pollutants such as carbon monoxide, oxides of nitrogen and sulfur dioxide.

(a) What is the percentage by volume of nitrogen in air?

..... [1]

(b) The exhaust gases from cars affect air quality.

The exhaust gases contain carbon monoxide, oxides of nitrogen and carbon dioxide.

Look at the table.

It shows information about the different gases in car exhausts.

type of car	percentage by volume of		
	carbon monoxide	oxides of nitrogen	carbon dioxide
petrol powered car <b>without</b> a catalytic converter	5	0.3	8
petrol powered car <b>with</b> a catalytic converter	2	0.06	11
diesel powered car <b>without</b> a catalytic converter	0.1	0.01	10

(i) Diesel powered cars do not need to be fitted with a catalytic converter.

Suggest why.

The information in the table may help you.

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

(ii) Describe what a catalytic converter does.

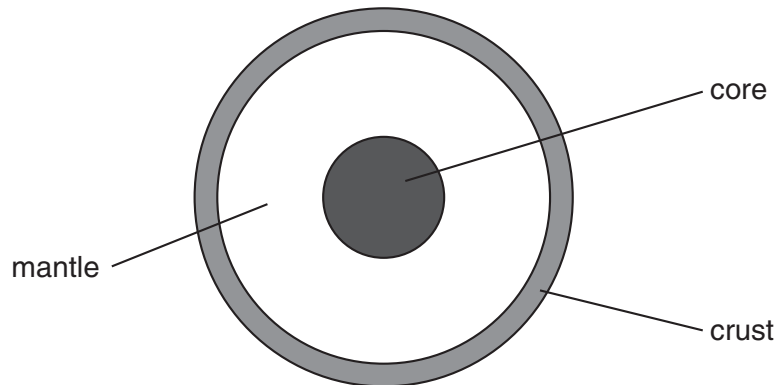
The information in the table may help you.

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

[Total: 3]

7 The Earth is made of several layers.

Look at the diagram. It shows the structure of the Earth.



(a) It is difficult to study the structure of the Earth.

Explain why.

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

(b) The **lithosphere** is part of the Earth's structure.

What is meant by the lithosphere?

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

(c) Which of the following pieces of evidence were used to develop the theory of plate tectonics?

Put a tick (✓) next to the **two** correct pieces of evidence.

- Both Africa and South America contain igneous rocks.
- The shape of the coastlines of Africa and South America fit together.
- Both Africa and South America have active volcanoes.
- The same type of fossils are found in South America and Africa.
- Both Africa and South America have dangerous earthquakes.

[2]

(d) Lava is liquid (molten) rock that erupts from a volcano.

Lava often cools down very rapidly.

Describe how the rate of cooling affects the size of crystals in the rock.

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

(e) Construction materials are used to make buildings.

Brick and glass are construction materials.

Brick and glass are made from rocks from the Earth's crust.

Finish the table.

construction material	rock from which the construction material is made
brick	clay
glass	.....

[1]

[Total: 6]

8 Car bodies can be made from steel or aluminium.

Steel car bodies will rust because steel is an alloy that contains iron.

Rust is hydrated iron(III) oxide.

(a) Write a **word** equation for the rusting of iron.

..... [1]

(b) One of the advantages of using aluminium is that no corrosion takes place.

This means that you do not have to replace your car as often.

Explain **one** other advantage of building car bodies from aluminium rather than steel.

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

[Total: 3]



## Section C – Module C3

- 9 This question is about the elements in the Periodic Table.

Look at the list of elements.

aluminium	oxygen
argon	phosphorus
chlorine	potassium
helium	sodium
iodine	sulfur

Answer the questions.

Choose **all** 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 the element with 8 electrons in its outer shell.

..... [1]

- (b) Write down the **name** of an element that forms a positive ion.

..... [1]

- (c) Write down the **name** of the element with an electronic structure 2.8.3.

..... [1]

[Total: 3]

10 The Group 7 elements are called the halogens.

Look at the table.

It shows some information about the halogens.

element	molecular formula	colour	state at room temperature	melting point in °C	boiling point in °C
fluorine	F <sub>2</sub>	pale yellow	gas	.....	-188
chlorine	Cl <sub>2</sub>	pale green	gas	-101	-35
bromine	Br <sub>2</sub>	.....	liquid	-7	59
iodine	I <sub>2</sub>	dark grey	.....	114	184
astatine	At <sub>2</sub>	black	solid	302	.....

(a) Complete the table to show

- the **colour** of bromine
- the **state** of iodine at room temperature.

[2]

(b) Use ideas about trends down a group to complete the table to predict

- the **melting point** of fluorine
- the **boiling point** of astatine.

[2]

(c) Chlorine reacts with sodium to form sodium chloride.

Sodium chloride is an **ionic** compound.

Sodium has an electronic structure 2.8.1.

Chlorine has an electronic structure 2.8.7.

Draw a 'dot and cross' diagram to show the **two ions** in sodium chloride.

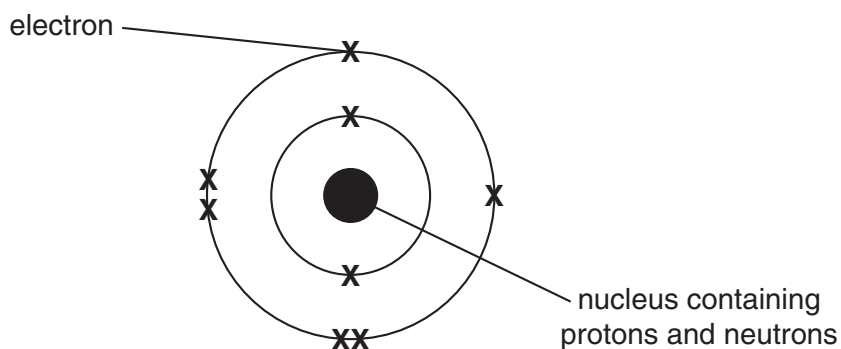
Your diagram should include the charges on the ions.

[2]

[Total: 6]

11 This question is about atoms.

Look at the diagram. It shows an oxygen atom.



(a) Oxygen is in period 2 of the Periodic Table.

Use the diagram of the oxygen atom to explain why oxygen is in period 2.

..... [1]

(b) (i) What is the electrical charge on a proton?

Choose from the list.

**negative**

**neutral**

**positive**

answer ..... [1]

(ii) An oxygen atom is neutral.

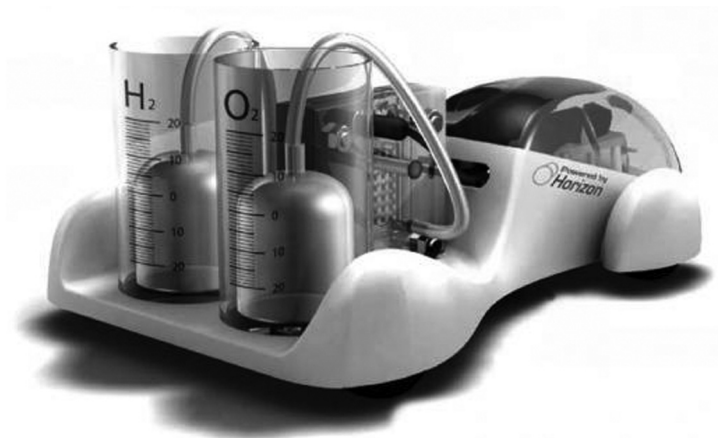
Explain why.

Use ideas about the number of protons and electrons in an atom.

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

**[Total: 3]**

- 12 A company has created a new toy car that uses hydrogen and oxygen.



- (a) Hydrogen and oxygen react to make water.

Write a **word equation** for this reaction

..... [1]

- (b) In a molecule of water, hydrogen and oxygen combine by **sharing** electrons.

What is the **name** of this type of bonding?

..... [1]

- (c) The hydrogen and oxygen for the car are made by **electrolysis**.

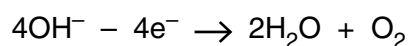
- (i) During the electrolysis hydrogen ions, H<sup>+</sup>, gain electrons.

Hydrogen gas, H<sub>2</sub>, is made.

Write a balanced **symbol** equation for this reaction. Use e<sup>-</sup> to represent an electron.

..... [2]

- (ii) Look at this equation. It shows how oxygen is made during electrolysis.



This is an example of oxidation.

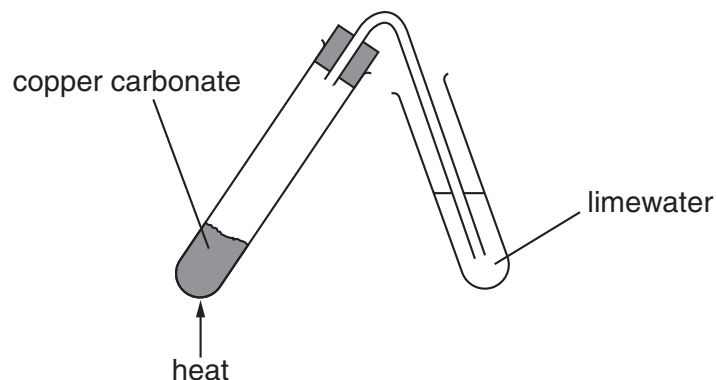
Explain why.

..... [1]

[Total: 5]

13 Helen and Brian heat copper carbonate.

Look at the diagram. It shows the apparatus they use.



(a) What would you see when the copper carbonate is heated?

.....

.....

..... [2]

(b) Helen reacts copper carbonate with dilute sulfuric acid.

A solution of copper sulfate is made.

Helen tests the copper sulfate solution with sodium hydroxide solution.

An insoluble solid is made when the solutions react.

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

Choose from the list.

**neutralisation**

**oxidation**

**precipitation**

**thermal decomposition**

answer ..... [1]

[Total: 3]

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

1	2	3	4	5	6	7	0										
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>Mg</b> magnesium 12	13 <b>Al</b> aluminium 13	14 <b>Si</b> silicon 14	15 <b>P</b> phosphorus 15	16 <b>S</b> sulfur 16	17 <b>Cl</b> chlorine 17	18 <b>Ar</b> argon 18								
19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	21 <b>Sc</b> scandium 21	22 <b>Ti</b> titanium 22	23 <b>V</b> vanadium 23	24 <b>Cr</b> chromium 24	25 <b>Mn</b> manganese 25	26 <b>Fe</b> iron 26	27 <b>Co</b> cobalt 27	28 <b>Ni</b> nickel 28	29 <b>Cu</b> copper 29	30 <b>Zn</b> zinc 30	31 <b>Ga</b> gallium 31	32 <b>Ge</b> germanium 32	33 <b>As</b> arsenic 33	34 <b>Se</b> selenium 34	35 <b>Br</b> bromine 35	36 <b>Kr</b> krypton 36
37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	39 <b>Y</b> yttrium 39	40 <b>Zr</b> zirconium 40	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium [98]	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45	46 <b>Pd</b> palladium 46	47 <b>Ag</b> silver 47	48 <b>Cd</b> cadmium 48	49 <b>In</b> indium 49	50 <b>Sn</b> tin 50	51 <b>Sb</b> antimony 51	52 <b>Te</b> tellurium 52	53 <b>I</b> iodine 53	54 <b>Xe</b> xenon 54
55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	72 <b>Hf</b> hafnium 72	73 <b>Ta</b> tantalum 73	74 <b>W</b> tungsten 74	75 <b>Re</b> rhenium 75	76 <b>Os</b> osmium 76	77 <b>Ir</b> iridium 77	78 <b>Pt</b> platinum 78	79 <b>Au</b> gold 79	80 <b>Hg</b> mercury 80	81 <b>Tl</b> thallium 81	82 <b>Pb</b> lead 82	83 <b>Bi</b> bismuth 83	84 <b>Po</b> polonium 84	85 <b>At</b> astatine 85	86 <b>Rn</b> radon 86
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

1	<b>H</b> hydrogen 1
---	---------------------------

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.