

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**GATEWAY SCIENCE**  
**CHEMISTRY B**  
Unit 1 Modules C1 C2 C3  
HIGHER TIER  
**THURSDAY 14 JUNE 2007**

**H B641/02**

Afternoon  
Time: 1 hour

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



\* C U P / T 3 0 3 9 4 \*

Candidate  
Name

Centre  
Number

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Candidate  
Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- **WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.**

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The Periodic Table is printed on the back page.

**FOR EXAMINER'S USE**

Section	Max.	Mark
A	20	
B	20	
C	20	
<b>TOTAL</b>	<b>60</b>	

This document consists of **18** printed pages and **2** blank pages.

Answer **all** the questions.

**Section A – Module C1**

1 This question is about crude oil.

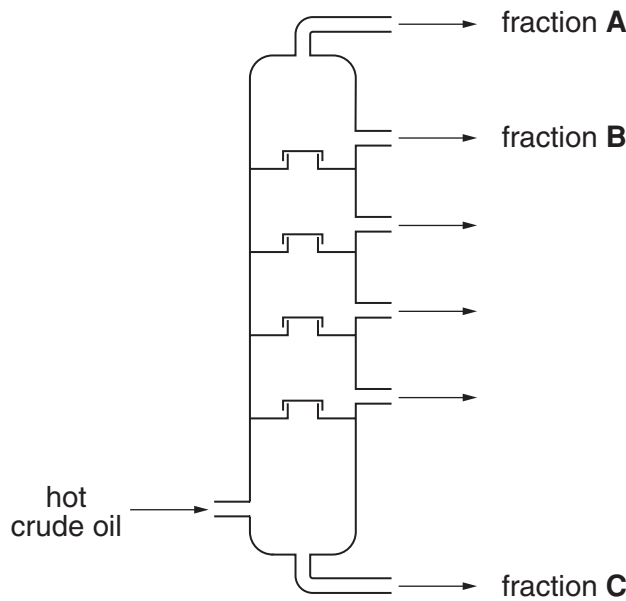
(a) Crude oil is a **non-renewable** resource.

Explain why.

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

(b) Crude oil is used to make useful substances in an oil refinery.  
 Two of the processes that happen in a refinery are fractional distillation and cracking.  
 Crude oil is separated by fractional distillation into fractions.  
 Each fraction has a different range of boiling temperatures.

Look at the diagram. It shows a fractional distillation column.



(i) Mark with an **X** the hottest part of the column. [1]

(ii) Draw a straight line from each **fraction** to the correct **name**.

fraction	name
<b>A</b>	bitumen
<b>B</b>	liquefied petroleum gases
<b>C</b>	petrol

[2]

(c) Cracking is also used to make useful substances from crude oil.

Write about cracking.

Your answer should include

- what cracking is
- why it is important.

.....

.....

.....

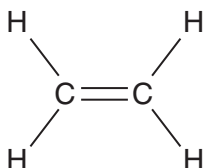
.....[2]

[Total: 6]

2 This question is about polymers and plastics.

(a) Addition polymers are made from alkenes such as ethene.

Look at the displayed formula of ethene.



Which part of this formula shows that ethene is an alkene?

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

(b) Alkanes and alkenes can be distinguished by using bromine water.

Ethene is unsaturated.

Ethane is saturated.

(i) Bromine water is added to a sample of ethene.

Describe what you would see.

.....[1]

(ii) Bromine water is then added to a sample of ethane.

Describe what you would see.

.....[1]

(c) Look at the picture.

These plastic objects are non biodegradable.

They are often thrown away and cause litter.



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Explain the problems of disposing of these objects in landfill sites.

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

3 This question is about fuels.

(a) The use of fossil fuels increases each year.

Suggest why.

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

(b) Burning fuels gives out heat energy.

What is the scientific name for reactions that give out heat energy?

Choose from this list.

- decomposition**
- endothermic**
- exothermic**
- reduction**

answer .....[1]

(c) Propane is a fossil fuel.

Propane, C<sub>3</sub>H<sub>8</sub>, burns in oxygen, O<sub>2</sub>.  
Carbon dioxide and water are made.

Write a balanced symbol equation for this reaction.

.....[2]

(d) When propane burns, some bonds are broken and new bonds are made.

Energy is taken in when bonds are broken.

Energy is given out when propane burns.

Explain why. Use ideas about making and breaking bonds.

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

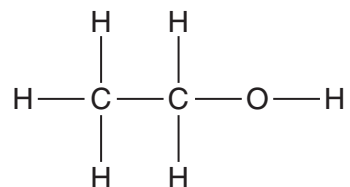
[Total: 6]

4 This question is about fuels and energy.

(a) Methane and ethanol are both fuels.

Methane has the molecular formula,  $\text{CH}_4$ .

Look at the displayed formula for ethanol.



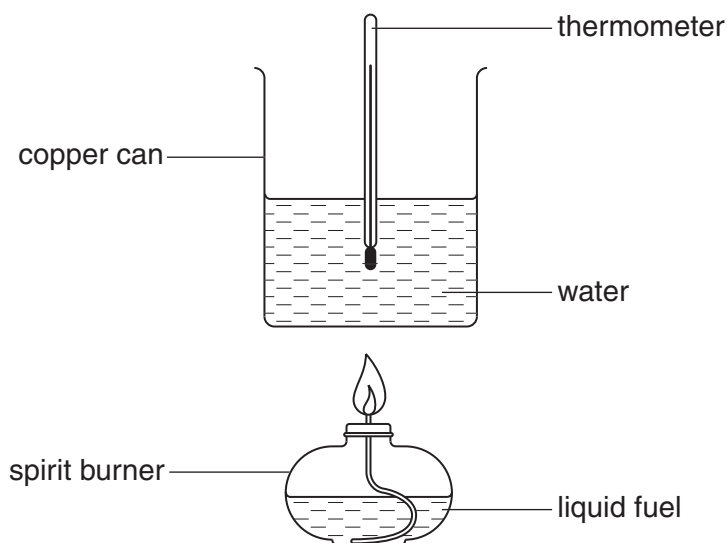
Write down the molecular formula of ethanol.

.....[1]

(b) John investigates the energy content of ethanol.

Look at the diagram.

It shows the apparatus that he uses.



John works out that 0.3 g of ethanol releases 780 J of energy.

Calculate the energy released per gram of ethanol.

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

[Total: 3]

Section B – Module C2

5 This question is about limestone and cement.

(a) Limestone has the chemical name calcium carbonate,  $\text{CaCO}_3$ .

Limestone is heated. Calcium oxide,  $\text{CaO}$ , and carbon dioxide,  $\text{CO}_2$ , are made.

Write a balanced symbol equation for this reaction.

.....[1]

(b) Cement is made when limestone is heated with another substance.

Write down the name of this substance.

.....[1]

[Total: 2]

6 This question is about tectonic plates.

Describe what happens when an oceanic plate slowly collides with a continental plate.

Include in your answer

- a labelled diagram
- the name of the process that happens.

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

[Total: 2]

**8**  
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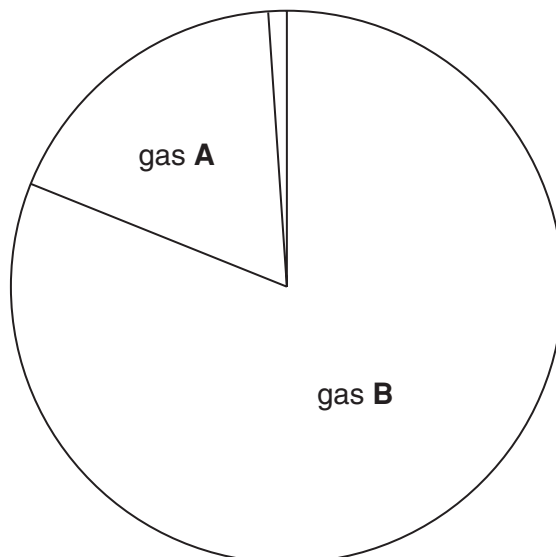


7 This question is about air and pollution.

(a) Clean air is a mixture of different gases.

Look at the pie chart.

It shows the composition of clean air.



Complete the table.

letter	gas	percentage in air
<b>A</b>	oxygen	
<b>B</b>		78%

[2]

(b) Sometimes small amounts of sulfur dioxide pollute the air.

Write down **one** way in which sulfur dioxide is made.

.....[1]

(c) A catalytic converter in a car exhaust helps to reduce pollution.

Carbon monoxide and nitrogen monoxide, NO, react in the converter.

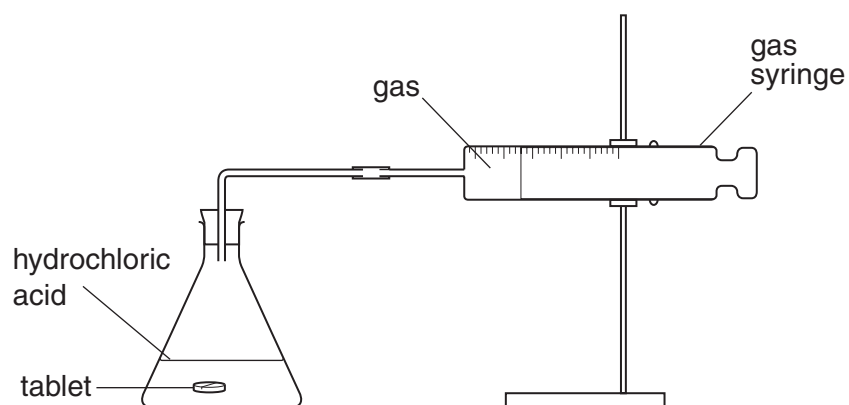
They make nitrogen gas, N<sub>2</sub>, and carbon dioxide.

Write a balanced symbol equation for this reaction.

.....[2]

[Total: 5]

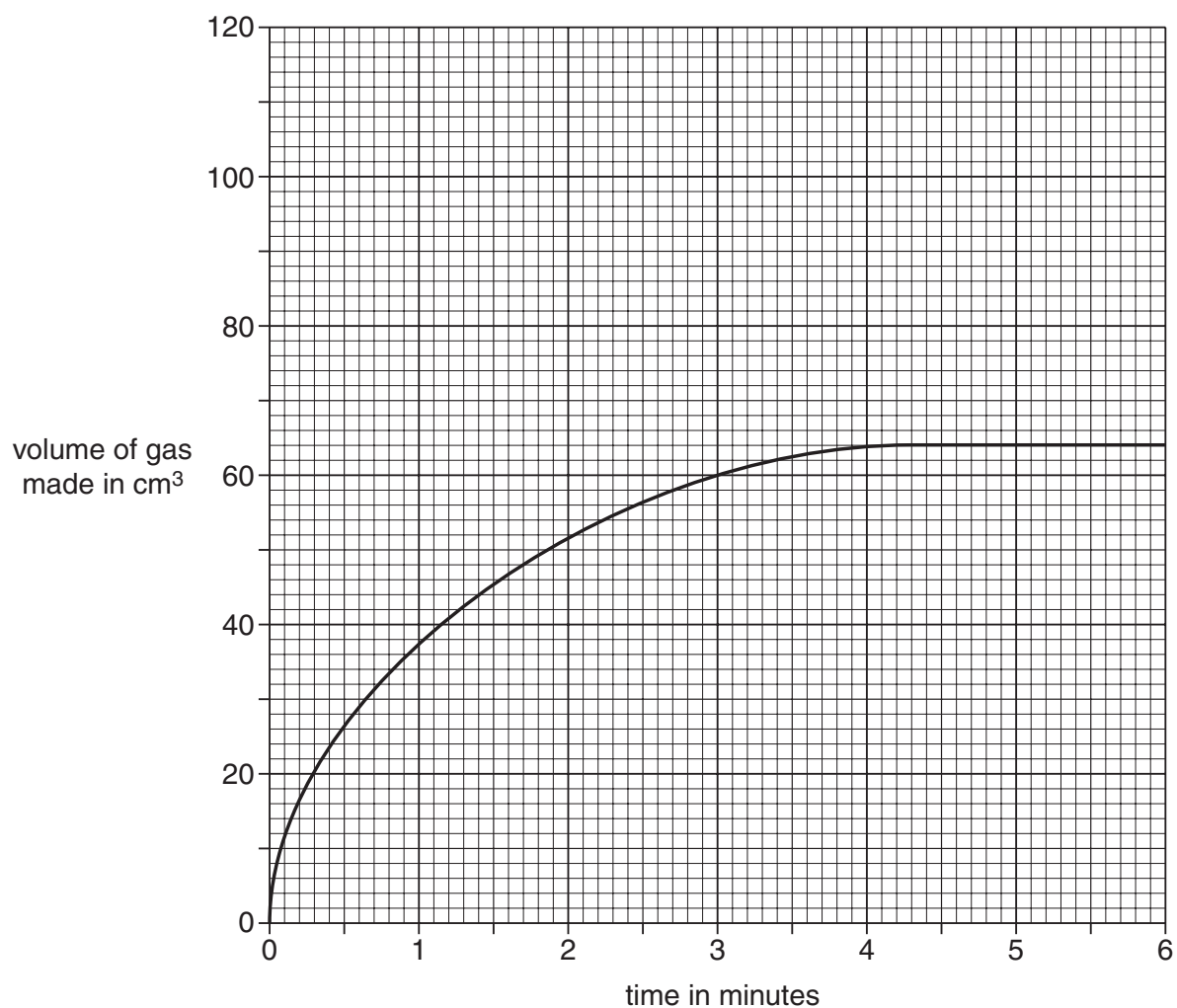
- 8 Paul investigates the reaction between an antacid tablet and 50 cm<sup>3</sup> dilute hydrochloric acid. Look at the diagram. It shows the apparatus that he uses.



Paul does the experiment at 20°C.

He measures the volume of gas in the gas syringe every minute.

Look at the graph. It shows his results.



(a) Paul does the experiment again.

He still uses one antacid tablet and 50 cm<sup>3</sup> of dilute hydrochloric acid.

This time he uses a temperature of 40 °C instead of 20 °C.

The reaction goes faster.

**On the graph**, sketch a line to show the results Paul should get. [2]

(b) Increasing the temperature of the acid makes the reaction go faster.

Explain why.

Use ideas about collisions between particles.

.....

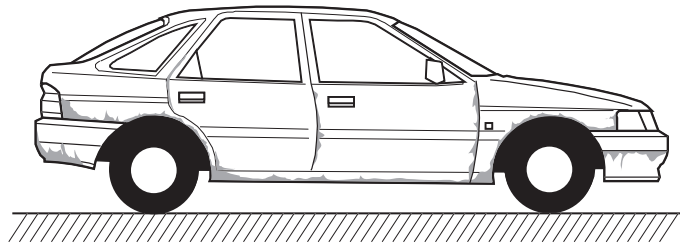
.....

.....

.....[3]

[Total: 5]

9 Claire has a car. The car body could be made of iron or aluminium.



Claire's car is made of iron.

It is going rusty.

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

.....[2]

(b) Aluminium does not corrode.

Explain why aluminium does not corrode.

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

(c) Glass is used for car windscreens because it is see-through.

Suggest another material that is used in making cars and say what makes it suitable for that use.

material.....  
use in a car.....  
reason for use.....  
.....[2]

[Total: 6]

Section C – Module C3

10 This question is about bonding.

(a) The atoms in water are held together by shared pairs of electrons.

What is the name of this type of bonding?

.....[1]

(b) Magnesium reacts with chlorine to form magnesium chloride.

In this reaction, magnesium atoms lose electrons to make magnesium ions,  $Mg^{2+}$ .

At the same time, chlorine atoms make chloride ions,  $Cl^{-}$ .

Describe how chloride ions are made.

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

(c) Look at these diagrams. They show the electronic structures of hydrogen and carbon.



Methane has the formula  $CH_4$ .

Draw a 'dot and cross' diagram to show the bonding in a molecule of methane.

[2]

(d) The atomic number of chlorine is 17. The electronic structure of chlorine is 2.8.7.  
 The atomic number of potassium is 19.

Write down the electronic structure of potassium.

.....[1]

[Total: 5]

**[Turn over**

- 11 Look at this part of the Periodic Table.  
It shows the symbols of three elements in Group 1 of the Periodic Table.

Li
Na
K

The names of the three elements are lithium, sodium and potassium.

- (a) Potassium reacts with cold water.

A small piece of potassium is dropped into a bowl of cold water.

What would you see?

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

- (b) Meena wants to identify metals.

She uses a flame test.

Describe how Meena does the flame test.

You may draw a diagram to help your answer.

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

- (c) Sodium, Na, loses an electron to form a sodium ion, Na<sup>+</sup>.

Write an equation for this reaction.

Use e<sup>-</sup> to represent an electron.

..... [1]

12 This question is about the halogens.

(a) Look at the table.

It shows some information about the halogens.

Complete the table.

name	colour	state at room temperature
chlorine	green	.....
bromine	.....	liquid
.....	silver/grey	solid

[3]

(b) Sodium reacts with chlorine to make sodium chloride.

Write the word equation for the reaction between sodium and chlorine.

.....[1]

(c) Chlorine is more reactive than bromine.

Explain why.

Use ideas about electrons.

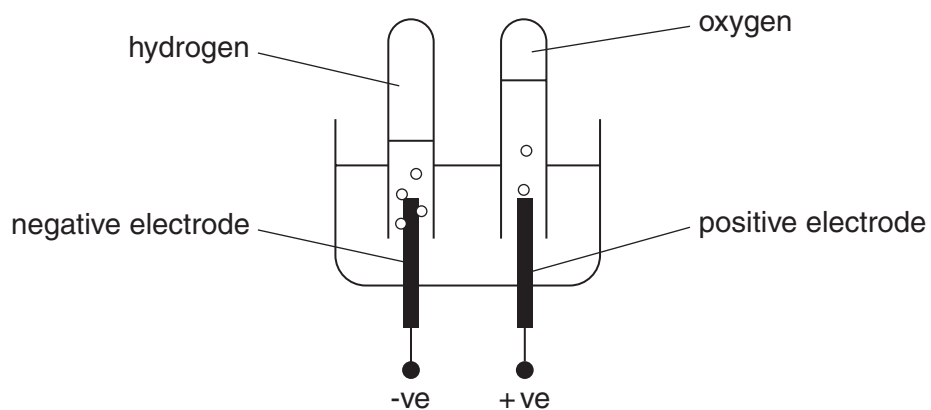
.....

.....[1]

[Total: 5]

13 Look at the diagram.

It shows the apparatus used in the electrolysis of dilute sulfuric acid.



At the cathode the hydrogen ions,  $\text{H}^+$ , gain electrons to make hydrogen molecules,  $\text{H}_2$ .

Write a balanced symbol equation for this reaction.

Use  $\text{e}^-$  to represent an electron.

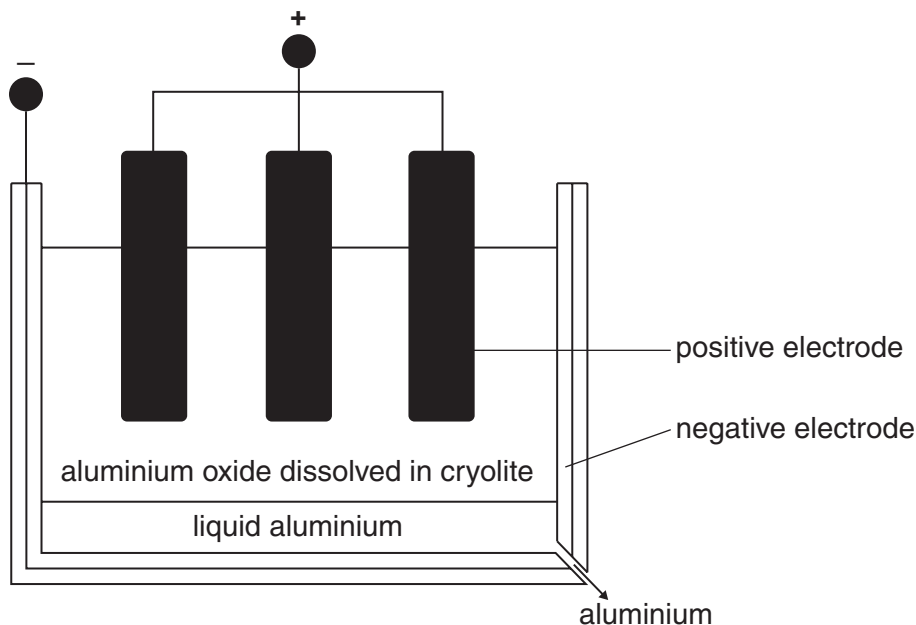
.....[2]

[Total: 2]



14 Aluminium is made by the electrolysis of molten aluminium oxide.

Look at the diagram. It shows the equipment used to make aluminium.



(a) During electrolysis, aluminium oxide breaks down.

Aluminium and oxygen are made.

Write a word equation for this reaction.

.....[1]

(b) Cryolite is used in the electrolysis of aluminium oxide.

What is the job of the cryolite?

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

(c) Aluminium is more expensive than iron.

There is plenty of aluminium oxide in the Earth's crust.

Suggest why aluminium is more expensive than iron.

.....  
 .....[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							4 <b>He</b> helium 2								
23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12							20 <b>Ne</b> neon 10								
39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20	45 <b>Sc</b> scandium 21	48 <b>Ti</b> titanium 22	51 <b>V</b> vanadium 23	52 <b>Cr</b> chromium 24	55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26	59 <b>Co</b> cobalt 27	59 <b>Co</b> cobalt 27	65 <b>Zn</b> zinc 30	70 <b>Ga</b> gallium 31	73 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	91 <b>Zr</b> zirconium 40	93 <b>Nb</b> niobium 41	96 <b>Mo</b> molybdenum 42	[98] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	112 <b>Cd</b> cadmium 48	115 <b>In</b> indium 49	119 <b>Sn</b> tin 50	122 <b>Sb</b> antimony 51	127 <b>I</b> iodine 53	131 <b>Xe</b> xenon 54	
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	197 <b>Au</b> gold 79	204 <b>Tl</b> thallium 81	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	[210] <b>At</b> astatine 85	[222] <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					

**Key**  
relative atomic mass  
atomic symbol  
name  
atomic (proton) number

1  
**H**  
hydrogen  
1

\* 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.