

**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)

**Monday 18 January 2010  
Morning**

**Duration: 1 hour**



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**MODIFIED LANGUAGE**

**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.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

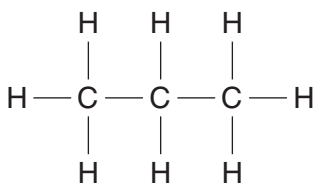
**BLANK PAGE**

**PLEASE DO NOT WRITE ON THIS PAGE**

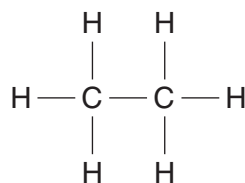
Answer **all** the questions.

**Section A – Module C1**

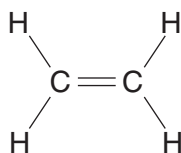
1 Look at the displayed formulas of some compounds of carbon.



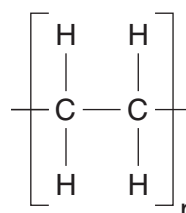
compound **A**



compound **B**



compound **C**



compound **D**

(a) Which one of the compounds is a **polymer**?

Choose from **A, B, C** or **D**.

answer ..... [1]

(b) Which one of the compounds is an **alkene**?

Choose from **A, B, C** or **D**.

answer ..... [1]

(c) Compounds **A, B, C** and **D** are hydrocarbons.

The atoms of carbon and hydrogen are joined together by covalent bonds.

Describe how a covalent bond is formed between an atom of carbon and an atom of hydrogen.

.....

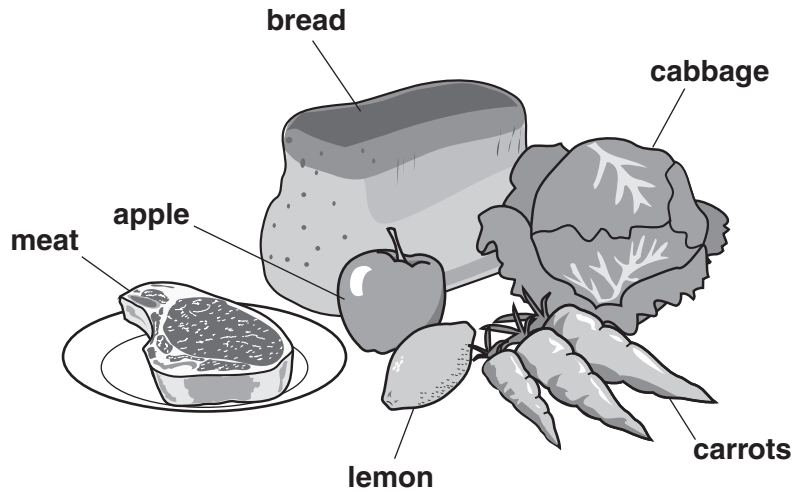
.....

..... [2]

[Total: 4]

2 This question is about cooking and foods.

Look at the picture of some foods.



(a) Write down the name of one food that contains a lot of **protein**.

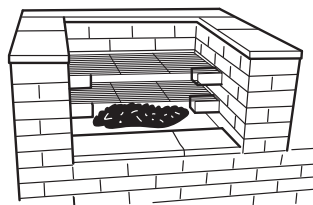
Choose from the foods in the picture.

..... [1]

(b) Some of the foods in the picture need to be cooked before eating them.

Look at the picture of a barbecue.

This is used to cook food at a high temperature.



(i) Write down **one** reason why some foods need to be cooked.

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

(ii) Cooking food is an example of a chemical change.

Explain why.

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

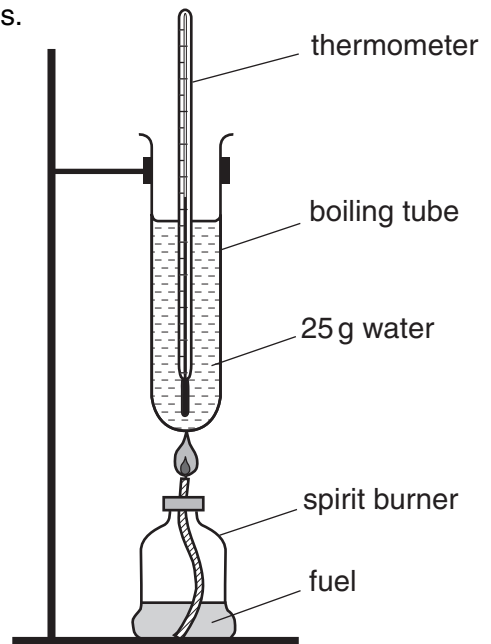
[Total: 3]

3 Luke and Sophie investigate the energy content of two fuels.

(a) (i) Look at the diagram.

It shows the apparatus they use.

They burn 1.0g of fuel each time.



Look at their table of results.

fuel	starting temperature of water in °C	final temperature of water in °C
ethanol	20	35
paraffin	20	50

Calculate the amount of energy transferred when they burn 1.0g of ethanol.

**energy = mass × specific heat capacity × temperature change**

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

.....  
 .....  
 .....

answer ..... J [3]

(ii) When 1.0g of paraffin is burnt 3150J is released.

Calculate the energy transferred in joules when burning 0.5g of paraffin.

..... [1]

(b) Burning fuels is an **exothermic** reaction.

What is meant by an exothermic reaction?

..... [1]

**[Total: 5]**  
**Turn over**

4 This question is about polymers and plastics.

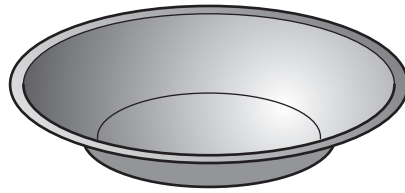
(a) Local councils find it difficult to dispose of plastics.

Explain why. Complete the table.

method of disposal	difficulties and problems
recycling	difficult to sort different types of plastics
burning	..... .....
landfill site	..... .....

[2]

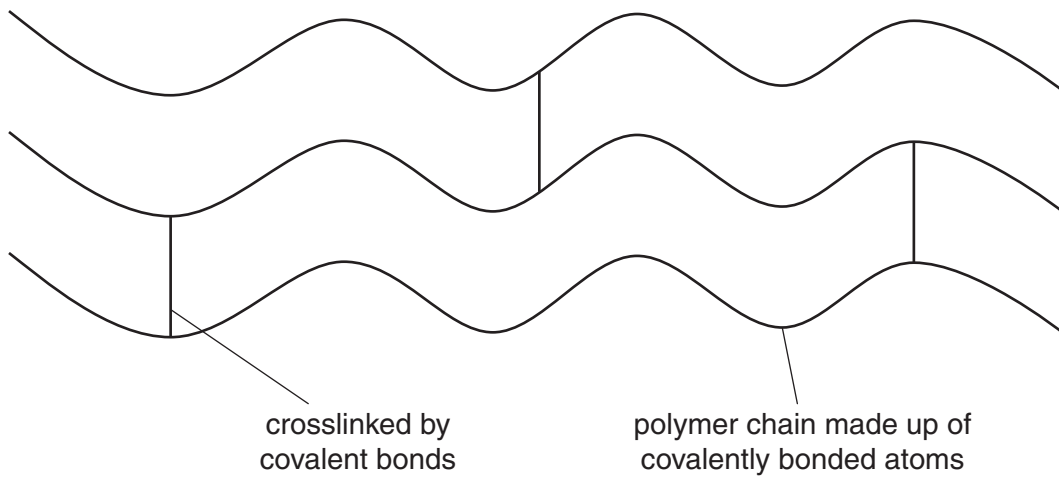
(b) Look at the picture.



The plastic container shown in the picture cannot be stretched.

This property is due to the way the polymer molecules are arranged.

The diagram shows how the polymer chains are arranged in the plastic.



Explain why the plastic cannot be stretched easily.

.....

.....

.....

.....

.....

..... [3]

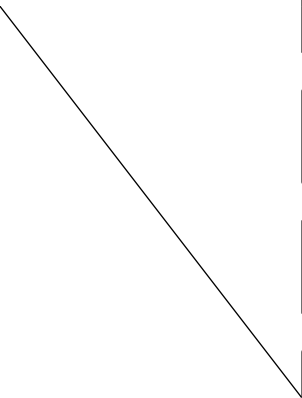
[Total: 5]

5 This question is about different types of chemical processes.

(a) Match the **process** with its correct **description**.

One has been done for you.

process	description
combustion	a reaction which converts large alkane molecules into smaller alkane and alkene molecules
cracking	a reaction which makes large molecules from many smaller molecules
fractional distillation	the separation of a mixture of hydrocarbons
polymerisation	a reaction in which carbon dioxide and water are made



[2]

(b) Alcohols react with acids to make an ester and water.

Write a **word** equation for this reaction.

..... [1]

[Total: 3]

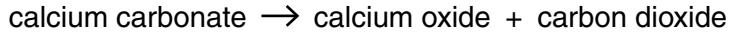


Section B – Module C2

6 Limestone is a rock used to make buildings.

The chemical name for limestone is calcium carbonate, CaCO<sub>3</sub>.

When calcium carbonate is heated strongly it changes into calcium oxide.



This change is called **thermal decomposition**.

(a) What is thermal decomposition?

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

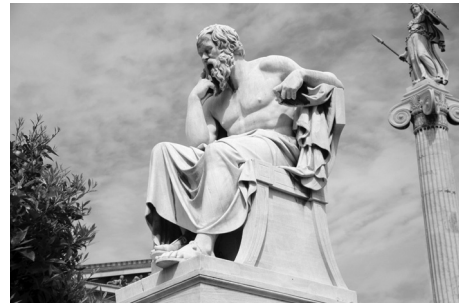
(b) Write the balanced **symbol** equation for the thermal decomposition of calcium carbonate.

..... [1]

(c) Look at the pictures. They show limestone and marble.



This building is made from limestone.  
Limestone is calcium carbonate.  
Limestone is a soft and crumbly rock.



This statue is made from marble.  
Marble is calcium carbonate.  
Marble is a hard rock.

Marble is harder than limestone.

Explain why. Use ideas about types of rock and how they are made.

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

[Total: 4]

Turn over

7 Iron reacts very slowly with dilute sulfuric acid.

The reaction makes iron sulfate and hydrogen.

(a) Write down the **word** equation for this reaction.

..... [1]

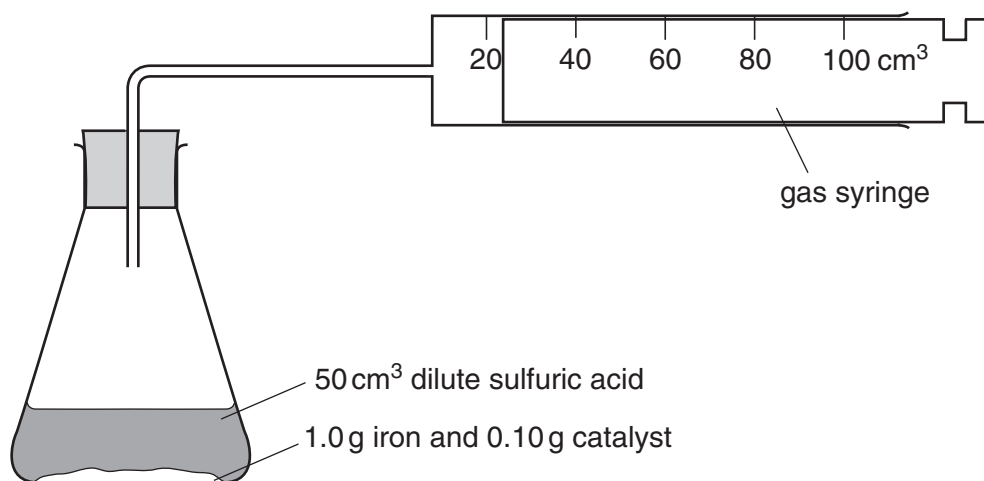
(b) Milly wants to make the reaction faster.

She knows that catalysts make reactions faster.

She tries to find a catalyst for this reaction.

Look at the diagram.

It shows the apparatus she uses.



She measures the time it takes to collect 100 cm<sup>3</sup> of hydrogen in the gas syringe.

In experiment 1 she does not use a catalyst.

In experiments 2 to 5 she uses 0.10 g of catalyst each time.

Look at the results table.

Experiment number	name of catalyst	colour of catalyst at start of reaction	colour of catalyst at end of reaction	mass of catalyst at the start of reaction in grams	mass of catalyst left at the end of reaction in grams	time to collect 100 cm <sup>3</sup> of hydrogen in seconds
1	no catalyst added					130
2	copper powder	pink	pink	0.10	0.10	20
3	copper sulfate powder	blue	pink	0.10	0.04	15
4	calcium sulfate powder	white	white	0.10	0.10	130
5	zinc powder	silver	silver	0.10	0.05	10

Milly thinks that copper powder is a catalyst for this reaction.

Explain how Milly made this conclusion from her results.

.....

.....

..... [2]

(c) Milly uses iron powder rather than a lump of iron.

This is because the reaction is faster with iron powder.

Explain why the reaction is faster.

Use ideas about collisions between particles.

.....

.....

..... [2]

[Total: 5]

8 Steel is an alloy that contains iron and carbon.

Iron rusts much more easily than steel.

(a) Write one **other** way in which steel is more useful than iron.

..... [1]

(b) Look at the word equation for rusting.

It is not finished.

Fill in the names of the missing substances in the **word** equation.

iron + water + ..... → ..... [2]

(c) Solder is an alloy.

Which **two** metals are found in solder?

Choose from:

iron

lead

mercury

tin

zinc

answer ..... and ..... [1]

(d) Fizzy drinks cans are made from metal.

Look at the diagram. It shows a can of fizzy drink.



The metal used to make the can must be malleable.

This is a property of the metal.

Write down two **other** properties that the metal used to make this fizzy drinks can must have.

1 .....

2 ..... [2]

[Total: 6]

9 This question is about paints.

Look at the table. It shows the ingredients of two different paints.

ingredient	percentage	
	in gloss paint	in emulsion paint
additives	4	1
binder	52	21
extender	11	21
pigment	23	19
solvent	10	38

(a) Describe **two** differences between this gloss paint and this emulsion paint.

1 .....

2 ..... [2]

(b) Paints are not solutions. They are examples of a colloid.

The solid particles in these colloids are mixed with particles of a liquid.

The particles do not settle at the bottom. Explain why.

..... [1]

(c) Two processes are involved when an oil paint dries.

The first process is solvent evaporation.

What is the second process?

..... [1]

(d) Years ago 'glow in the dark' watches used a radioactive substance.

Now a phosphorescent pigment is used.

Suggest why.

..... [1]

[Total: 5]

## Section C – Module C3

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

Look at the diagram. It shows part of the Periodic Table.

		H								He
Li	Be			B	C	N	O	F	Ne	
Na	Mg			Al	Si	P	S	Cl	Ar	
K	Ca									

Answer the questions.

Choose your answers from the symbols shown on this Periodic Table.

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

(a) Write the symbol of the most reactive Group 1 metal **shown above**.

.....

[1]

(b) Write the symbol for an element with an atom with **seven** electrons in its outer shell.

.....

[1]

(c) An atom **gains two** electrons to get an outer shell with eight electrons.

Write the symbol for an element with this atom.

.....

[1]

[Total: 3]

11 Iron and copper are transition elements.

(a) Brahim adds a small volume of sodium hydroxide solution to five different solutions.

An insoluble solid called a precipitate is made each time.

Look at the results table. It is not finished.

solution	formula	colour of precipitate made
copper chloride	$\text{CuCl}_2$	blue
copper nitrate	$\text{Cu}(\text{NO}_3)_2$	.....
iron(II) chloride	$\text{FeCl}_2$	green
iron(II) sulfate	$\text{FeSO}_4$	green
iron(III) nitrate	$\text{Fe}(\text{NO}_3)_3$	.....

(i) Finish the table. [2]

(ii) Look at the formulas in the table.

Which formula contains **six** oxygen atoms?

Choose from the table.

..... [1]

(iii) Solutions of copper chloride and sodium hydroxide react.

Copper hydroxide,  $\text{Cu}(\text{OH})_2$ , is made.

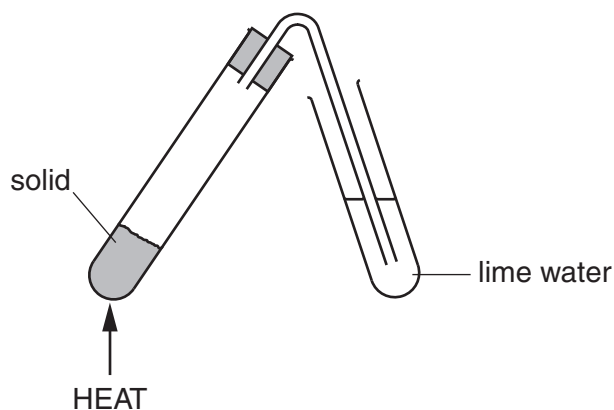
In this reaction copper ions,  $\text{Cu}^{2+}$ , react with hydroxide ions,  $\text{OH}^-$ .

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

..... [2]

(b) Brahim investigates what happens when he heats some solids.

Look at the apparatus he uses.



Look at the results table.

<b>solid</b>	<b>colour change of solid</b>	<b>effect on lime water</b>
<b>copper carbonate</b>	green to black	goes milky
<b>iron(II) sulfate</b>	green to brown	stays colourless
<b>potassium carbonate</b>	stays white	stays colourless
<b>zinc carbonate</b>	white to yellow and back to white	goes milky

Copper carbonate,  $\text{CuCO}_3$ , makes two products when it is heated.

What are the names of these two products?

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

[Total: 6]



12 This question is about the elements in Group 7.

These elements are called the halogens.

(a) Look at the table. It shows information about some of the halogens.

element	atomic number	density in g/dm <sup>3</sup>	melting point in °C	atomic radius in pm
chlorine	17	1.56	-101	99
bromine	35	2.93	-7	114
iodine	53	4.93	114	133

(i) Fluorine is a halogen with an atomic number of 9.

Predict the melting point of fluorine.

answer ..... °C [1]

(ii) Astatine is a halogen with an atomic number of 85.

Predict the atomic radius for astatine.

answer ..... pm [1]

(b) The reactivity of the halogens changes as the atomic number increases.

Describe how.

..... [1]

(c) Fluorine is bubbled through a solution of potassium iodide.

Predict the **names** of the **two** products of this reaction.

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

(d) Look at the table. It shows information about two isotopes of chlorine.

	isotope 1	isotope 2
atomic number	17	17
mass number	35	37
number of protons	17	17
number of neutrons	18	20

What is an isotope? Use information from the table to help you.

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

[Total: 5]  
 Turn over

13 This question is about alkali metals and their compounds.

(a) Hannah tests some metal compounds.

She uses the flame test.

Look at Hannah's results.

metal compound	colour of flame
potassium chloride	lilac
sodium chloride	yellow
lithium chloride	red

Describe how to do a flame test.

Include a labelled diagram of the apparatus she uses.

.....

.....

.....

..... [3]

- (b) Sodium chloride is an ionic compound.

Solid sodium chloride does not conduct electricity.

Explain why.

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

- (c) Sodium has an electronic structure of 2.8.1.

Oxygen has an electronic structure of 2.6.

Sodium reacts with oxygen to make sodium oxide,  $\text{Na}_2\text{O}$ .

Sodium oxide is an ionic compound.

Draw 'dot and cross' diagrams to show the ions in sodium oxide.

Include the charges on the ions.

[2]

[Total: 6]

**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>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>P</b> phosphorus 15	16 <b>O</b> oxygen 8	17 <b>F</b> fluorine 9	18 <b>Ar</b> argon 18
19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	23 <b>Cr</b> chromium 24	24 <b>Mg</b> magnesium 12	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
37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	40 <b>Zr</b> zirconium 40	39 <b>Y</b> yttrium 39	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
55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	72 <b>Hf</b> hafnium 72	57 <b>La*</b> lanthanum 57	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
87 <b>Fr</b> francium 87	88 <b>Ra</b> radium 88	104 <b>Rf</b> rutherfordium 104	89 <b>Ac*</b> actinium 89	105 <b>Db</b> dubnium 105	106 <b>Sg</b> seaborgium 106	107 <b>Bh</b> bohrium 107	108 <b>Hs</b> hassium 108	109 <b>Mt</b> meitnerium 109	110 <b>Ds</b> darmstadtium 110
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	178 <b>Hf</b> hafnium 72	139 <b>La*</b> lanthanum 57	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
223 <b>Fr</b> francium 87	226 <b>Ra</b> radium 88	261 <b>Rf</b> rutherfordium 104	227 <b>Ac*</b> actinium 89	262 <b>Db</b> dubnium 105	266 <b>Sg</b> seaborgium 106	268 <b>Mt</b> meitnerium 109	277 <b>Hs</b> hassium 108	272 <b>Rg</b> roentgenium 111	271 <b>Ds</b> darmstadtium 110
131 <b>Xe</b> xenon 54	127 <b>I</b> iodine 53	128 <b>Te</b> tellurium 52	119 <b>Sn</b> tin 50	122 <b>Sb</b> antimony 51	128 <b>Te</b> tellurium 52	112 <b>Cd</b> cadmium 48	108 <b>Ag</b> silver 47	106 <b>Pd</b> palladium 46	103 <b>Rh</b> rhodium 45
86 <b>Rn</b> radon [222]	85 <b>At</b> astatine [210]	84 <b>Po</b> polonium [209]	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	204 <b>Tl</b> thallium 81	201 <b>Hg</b> mercury 80	197 <b>Au</b> gold 79	195 <b>Pt</b> platinum 78	192 <b>Ir</b> iridium 77
Elements with atomic numbers 112-116 have been reported but not fully authenticated									

\* 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.