OCR
RECOGNISING ACHIEVEMENT

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B642/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

CHEMISTRY B

Unit 2 Modules C4 C5 C6 (Higher Tier)

WEDNESDAY 18 JUNE 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/T50946

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.
- 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**.
- 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 **19** printed pages and **1** blank page.

[Turn over

Answer **all** the questions.

Section A – Module C4

1 Diamond and graphite have different properties and different uses.

Look at the table.

It shows some information about the properties of diamond and graphite.

property	diamond	graphite
state at room temperature	solid	solid
appearance at room temperature	colourless, clear and lustrous	dull black
melting point	very high	very high
hardness	very hard	soft
solubility in water	insoluble	insoluble
electrical conductivity	does not conduct	good conductor

(a) Diamond is used in jewellery.

This is because diamond is colourless, clear and lustrous.

Diamond is also used to make cutting tools.

Write about **two** properties of diamond that make it suitable for cutting tools.

Use the table to help you.

.....

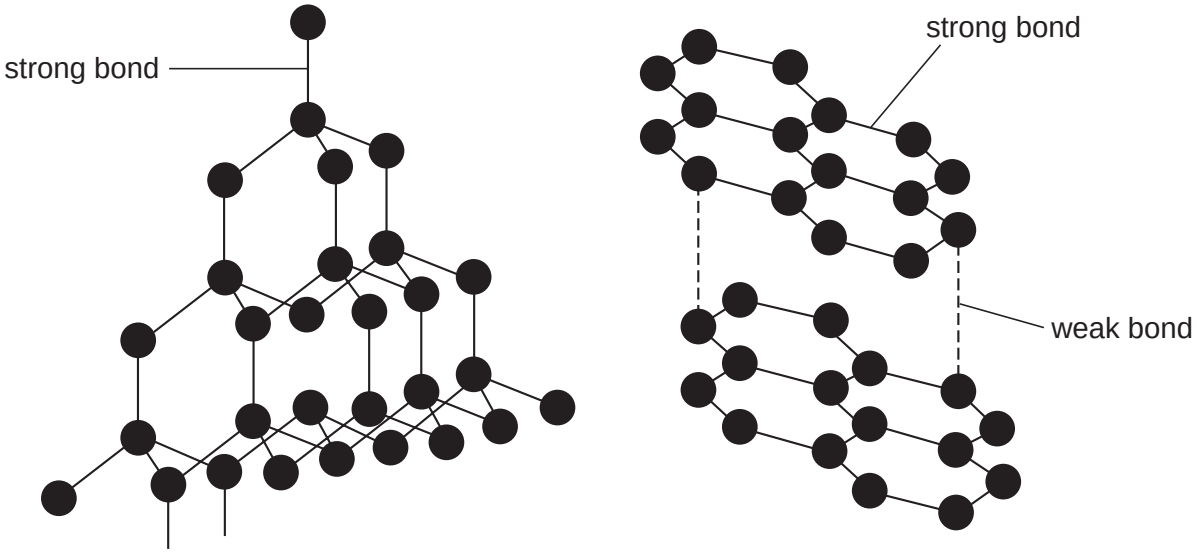
.....

.....

.....[2]

(b) Look at the structures of diamond and graphite.

● = carbon atom



diamond **graphite**

(i) Diamond and graphite both have very high melting points.

Explain why.

Use ideas about their structure.

.....

.....[1]

(ii) Graphite conducts electricity.

Explain why.

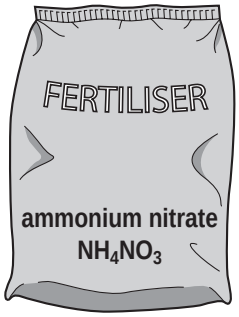
Use ideas about its structure.

.....

.....[1]

[Total: 4]

2 Natalie enjoys gardening.



She uses the internet to find out about fertilisers.

She finds out that ammonium nitrate, NH_4NO_3, improves leaf and stem growth.

(a) Ammonium nitrate can be made by reacting an alkali with an acid.

(i) What is the name of the alkali needed?

.....[1]

(ii) What is the name of the acid needed?

.....[1]

(b) Natalie finds out that potassium chloride can also be used as a fertiliser.

Potassium chloride can be made by reacting potassium carbonate with hydrochloric acid.

Balance the **symbol** equation for this reaction.

K_2CO_3 + HCl → KCl + CO_2 + H_2O [1]

(c) Natalie makes some potassium chloride.

She uses 2.76 g of potassium carbonate.

She **predicts** she should make 1.49 g of potassium chloride.

(i) Natalie **actually** makes 0.596 g of potassium chloride.

What is her percentage yield?

.....

.....

percentage yield = ...% [2]

(ii) In another experiment, Natalie uses less potassium carbonate.

This time she uses 1.38 g of potassium carbonate.

How much potassium chloride does she **predict** she will make?

.....

.....

predicted mass of potassium chloride made = ... g [1]

(d) Natalie also finds out that there are problems when farmers use too much fertiliser.

One problem is called **eutrophication**.

Write about eutrophication.

Your answer should include

- how it happens
- the effect of eutrophication.

.....

.....

.....

.....

.....[3]

[Total: 9]

3 Jack investigates some reactions of dilute sulfuric acid.

(a) Jack adds some sodium hydroxide solution to dilute sulfuric acid.

Sodium hydroxide is an alkali.

The pH value of the acid increases as the sodium hydroxide is added.

(i) Explain why the pH value increases.

.....

.....[1]

(ii) A salt is made when sodium hydroxide reacts with dilute sulfuric acid.

What is the name of this salt?

.....[1]

(b) Jack also uses the internet to investigate sulfuric acid, H_2SO_4.

He finds out that dilute sulfuric acid contains ions.

One of these is the sulphate ion, SO_4^{2-}.

Write down the name or formula of another **ion** found in dilute sulfuric acid.

.....[1]

[Total: 3]

4 River water sometimes contains dissolved salts, pollutants, microbes and insoluble materials.

River water must be purified before it can be used as drinking water.

Water purification involves filtration, sedimentation and then chlorination.

(a) Chlorination kills microbes.

What happens during the filtration stage of water purification?

.....[1]

(b) Even after purification, the water obtained may still contain some poisonous pollutants.

Suggest why.

.....

.....[1]

(c) Sea water is a possible source of drinking water.

(i) Describe one way of getting drinking water from sea water.

.....[1]

(ii) Using sea water to make large quantities of drinking water is expensive.

Explain why.

.....

.....[1]

[Total: 4]

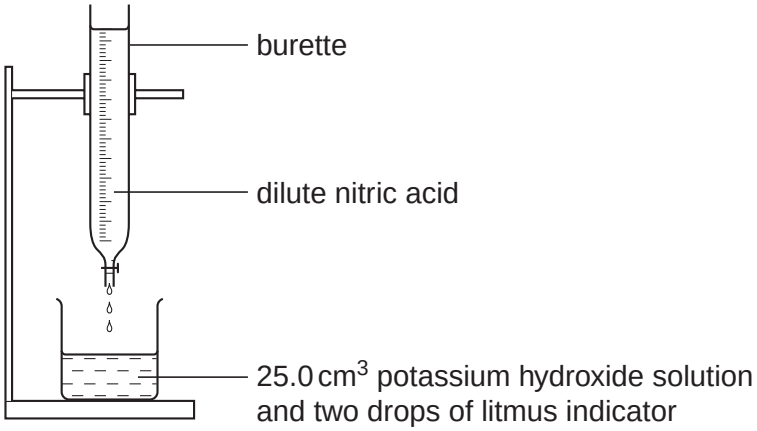
Section B – Module C5

5 This question is about acid-base titrations.

Judy wants to find out the volume of dilute nitric acid needed to neutralise 25.0 cm^3 of an alkali.

The alkali used is potassium hydroxide solution.

Look at the apparatus she uses.



She adds dilute nitric acid slowly until the litmus suddenly changes colour.

She repeats the experiment two more times.

Look at Judy's results table.

titration number	1	2	3
final burette reading in cm^3	29.7	27.0	34.8
initial burette reading in cm^3	8.5	6.9	14.9
volume of acid used (titre) in cm^3	21.2	20.1	19.9

(a) It is important that the colour of the indicator changes suddenly.

Suggest why Judy cannot use universal indicator instead of litmus.

.....[1]

(b) Judy decides to only use the second and third titration results.

Explain why.

.....[1]

(c) Look at the balanced symbol equation for the reaction between potassium hydroxide and nitric acid.

$$KOH + HNO_3 \rightarrow KNO_3 + H_2O$$

(i) The concentration of the potassium hydroxide solution is 0.100 mol / dm^3.

Calculate the number of moles in 25.0 cm^3 of the potassium hydroxide solution.

.....

.....

number of moles of potassium hydroxide = ... [1]

(ii) Use your answer to **(i)** to work out the number of moles of nitric acid that will react with the potassium hydroxide.

.....

.....

number of moles of nitric acid = ... [1]

(iii) Calculate the concentration, in mol / dm^3, of the dilute nitric acid.

Use the

- average titre of titrations **2** and **3**
- answer to part **(ii)**.

.....

.....

.....

concentration of nitric acid = ... mol / dm^3 [2]

[Total: 6]

6 Silicon dioxide and iron(III) hydroxide have been discovered on the planet Mars.

(a) Silicon dioxide, SiO_2, has a molar mass of 60 g / mol.

Calculate the molar mass of iron(III) hydroxide, $Fe(OH)_3$.

The relative atomic mass (A_r) for H is 1, for O is 16, for Si is 28 and for Fe is 56.

.....

.....

.....

.....

molar mass = ... g / mol [1]

(b) Compound **X** has been discovered on the planet Mars.

Compound **X** has the empirical formula CH.

Which two formulae could be compound **X**?

Choose from the list.

$\mathbf{CH_4}$	$\mathbf{C_2H_2}$
$\mathbf{C_2H_6}$	$\mathbf{C_4H_8}$
$\mathbf{C_6H_6}$	$\mathbf{C_{10}H_{22}}$

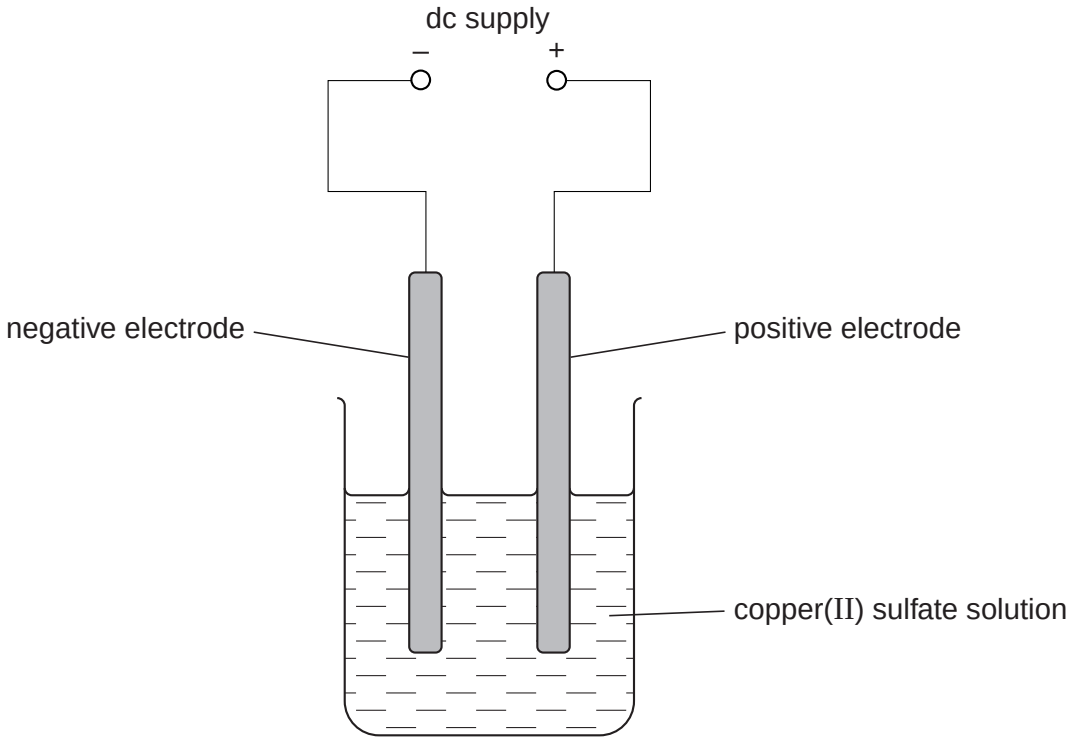
answer ..... and .....[2]

[Total: 3]

7 Azhar does an electrolysis experiment.

He uses copper(II) sulfate solution.

Look at the apparatus he uses.



Azhar uses copper electrodes.

(a) Which **two** of the following observations are correct?

Put a tick (✔) next to each of the **two** correct answers.

The positive electrode gets plated with copper.	☐
A colourless gas is made at the negative electrode.	☐
The blue colour of the electrolyte becomes colourless.	☐
The negative electrode gains mass.	☐
The positive electrode loses mass.	☐

[2]

(b) Azhar decides to replace copper(II) sulfate solution with solid copper(II) sulfate.

Electrolysis does not happen.

Explain why.

.....

.....[1]

[Total: 3]

8 Sulfamic acid solution is used to remove limescale in kettles.

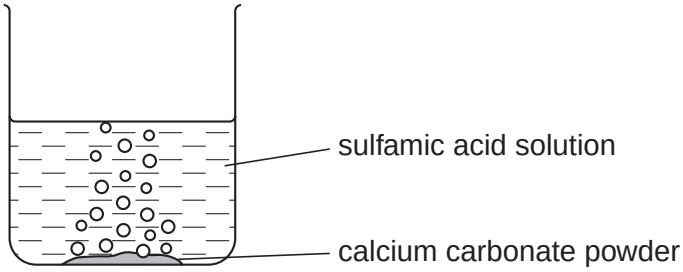
Limescale is mostly calcium carbonate.

Sulfamic acid reacts with calcium carbonate as shown in the equation.

sulfamic acid + calcium carbonate → calcium sulfamate + carbon dioxide + water

Robin investigates sulfamic acid solution.

Look at the diagram.



Robin adds 0.20 g of calcium carbonate powder to 100 cm^3 of sulfamic acid solution.

At the start of the reaction there is a lot of fizzing.

After a minute there is still some calcium carbonate powder left, but the fizzing has stopped.

(a) Why does the reaction stop?

.....

.....[1]

(b) Describe an experiment to measure the volume of carbon dioxide made in this reaction.

A labelled diagram will help you answer this question.

.....

.....

.....[2]

(c) In an experiment, 0.030 mol of carbon dioxide is made.

What is the volume, measured at room temperature and pressure, of this amount of carbon dioxide?

One mole of any gas occupies 24 dm^3 at room temperature and pressure.

.....

.....

volume of carbon dioxide = ... dm^3 [1]

[Total: 4]

9 Sulfuric acid is made in the Contact Process.

Look at the symbol equation. It describes one reaction that happens in the Contact Process.

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

The conditions used for this reaction are

- a temperature of 450 °C
- atmospheric pressure
- a V_2O_5 catalyst.

Explain the three conditions used in this reaction.

Use ideas about

- rate of reaction
- position of equilibrium.

temperature of 450 °C

.....

.....

.....

atmospheric pressure

.....

.....

.....

V_2O_5 catalyst

.....

.....[4]

[Total: 4]

Section C – Module C6

10 This question is about fuel cells.

Fuel cells use hydrogen and oxygen.

Fuel cells make water and release energy.

(a) Write a **word** equation for the reaction in a hydrogen-oxygen fuel cell.

..... + ... → ..... [1]

(b) Fuel cells are used in spacecraft.

Write down one **advantage** of using fuel cells rather than batteries in spacecraft.

.....[1]

(c) Look at the energy level diagram for the reaction taking place in a fuel cell.

Label the diagram.

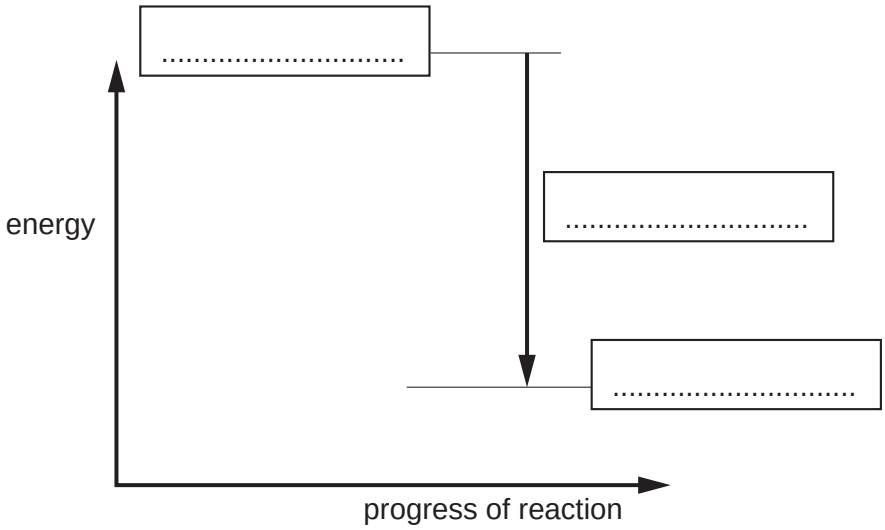
Choose words from the list.

catalyst

energy change

product

reactants



[3]

(d) What is the name given to all reactions that give out heat?

.....[1]

[Total: 6]

11 This question is about rusting.

(a) One way to stop iron rusting is to paint it.

Why does painting stop the iron from going rusty?

.....

.....[1]

(b) The rusting of iron involves both **oxidation** and **reduction**.

What is the name of this type of process?

Choose from the list.

displacement

fermentation

oxred

redox

answer .....[1]

(c) Two other ways of preventing rusting are galvanising and tinning.

Explain why galvanising works better than tinning.

In your answer include

- how tinning works
- how galvanising works.

.....

.....

.....

.....

.....[3]

[Total: 5]

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PLEASE DO NOT WRITE ON THIS PAGE

12 This question is about oils and soap.

(a) Vegetable oil is heated with sodium hydroxide solution.

Soap and glycerol are made.

(i) Write a **word** equation for this reaction.

.....[1]

(ii) What is the name for this process?

Choose from the list.

distillation

fermentation

saponification

saturation

answer .....[1]

(b) Complete the sentence.

Choose a word from the list.

dissolved

immiscible

saturated

soluble

Oil and water are liquids which do not mix.

They are said to be ..... . [1]

(c) Margarine is made from vegetable oil.

Describe how margarine is manufactured from vegetable oil.

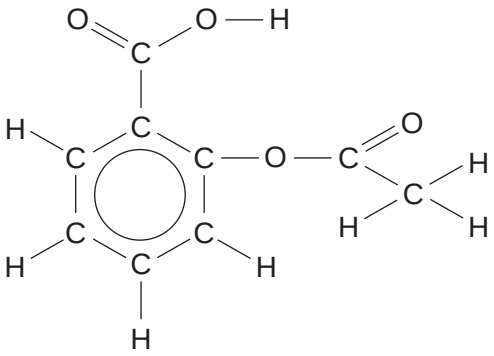
.....

.....[1]

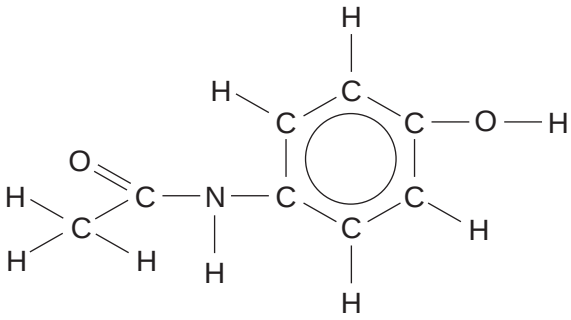
[Total: 4]

13 This question is about analgesics (pain killers).

(a) Look at the displayed formulas of aspirin and paracetamol.



aspirin



paracetamol

(i) Put numbers into the boxes to complete the molecular formula for **aspirin**.

C ☐ H ☐ O ☐ [1]

(ii) Write down one **similarity** in the displayed formulas of aspirin and paracetamol.

.....[1]

(iii) Write down one **difference** between the displayed formulas of aspirin and paracetamol.

.....[1]

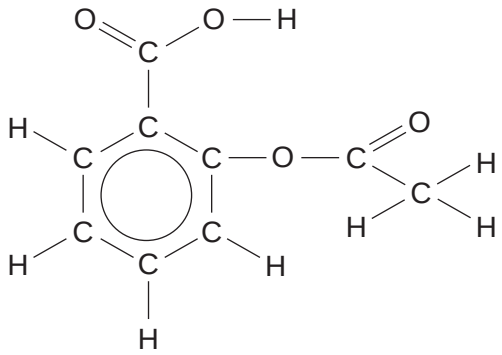
(b) Many people use **soluble** aspirin.

(i) Write down one **advantage** that soluble aspirin has compared to an insoluble aspirin tablet.

.....[1]

(ii) What change is made to the structure of aspirin to make it soluble?

You may use the diagram to help you.



.....

.....

.....[1]

[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.