OCR

H

Thursday 15 May 2014 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE CHEMISTRY A/SCIENCE A

A171/02 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)

Duration: 1 hour

A171102

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Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- 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).
- Do **not** write in the bar codes.

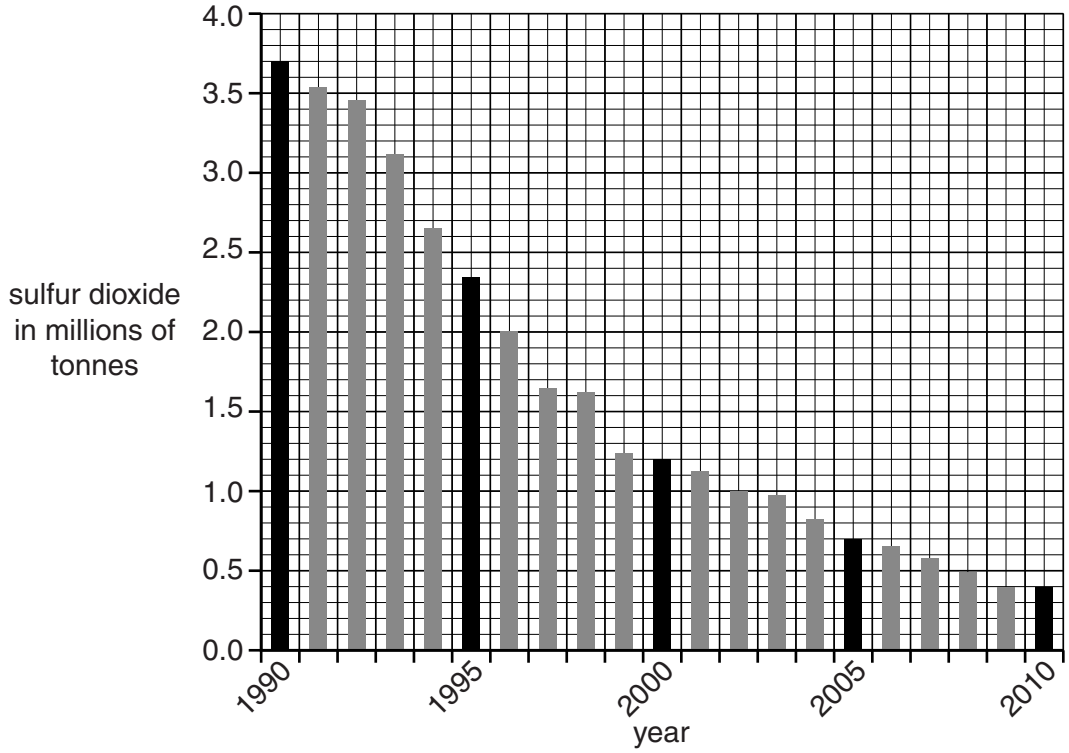
INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table is printed on the back page.
- 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**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Sulfur dioxide is an air pollutant.

The graph shows the amount of sulfur dioxide put into the air from 1990 to 2010 in the UK.



(a) (i) What was the amount of sulfur dioxide put into the air in 2010 as a fraction of that in 2000?

answer = ... **[1]**

(ii) The Government says that the amount of sulfur dioxide put into the air falls to a third every 10 years since 1990.

Is this true? Justify your answer.

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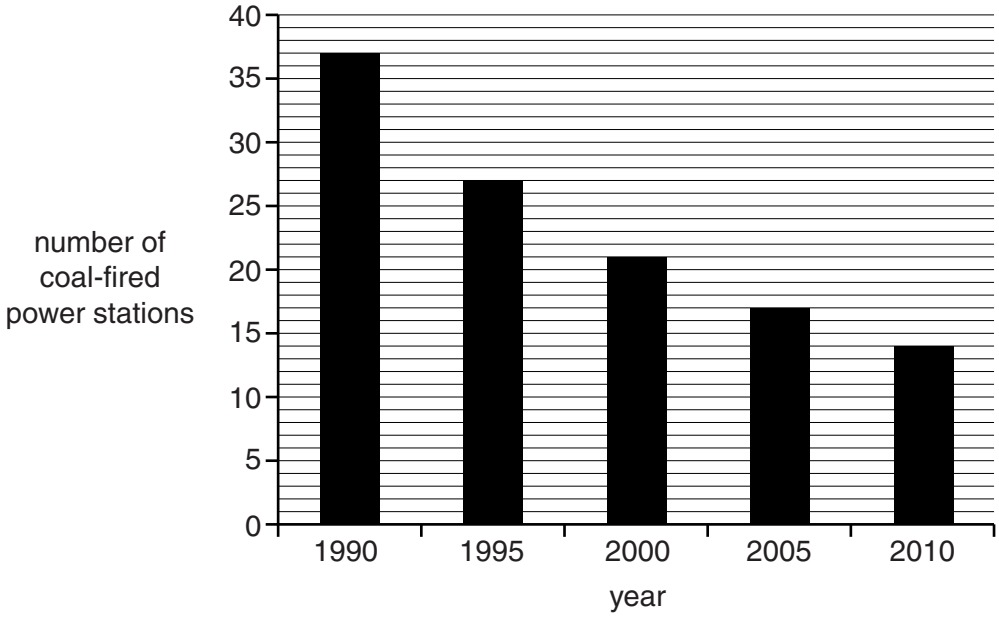
..... **[2]**

Most sulfur dioxide in the air comes from power stations.

This graph shows the number of coal-fired power stations in the UK between 1990 and 2010.



(b) Look at the **two** graphs.

What is the correlation shown by the data?

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

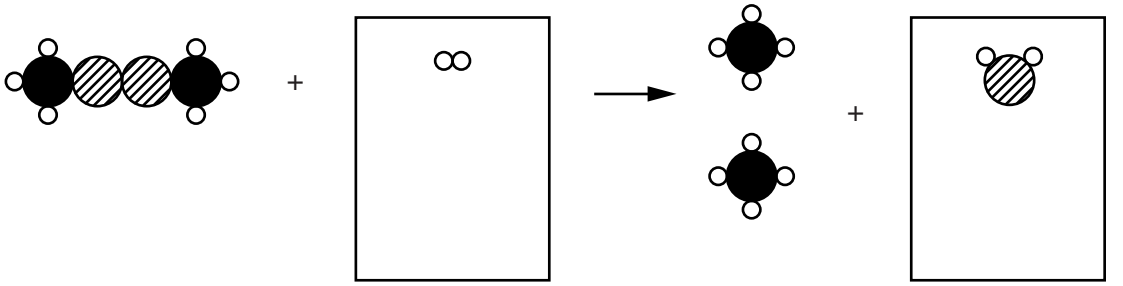
(c) Power stations can also burn natural gas.

The amount of sulfur dioxide put into the air is lowered by removing sulfur from natural gas.

Sulfur is removed from molecules in natural gas by reacting them with hydrogen.

The diagram shows this type of reaction.

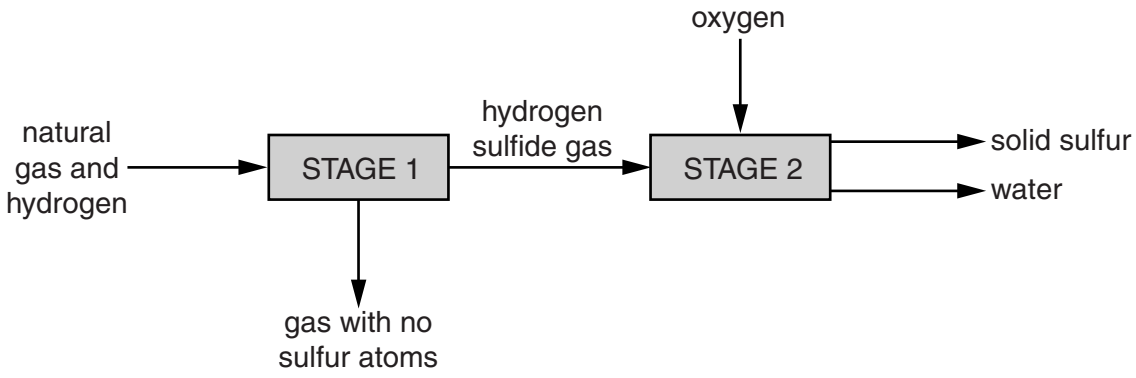
(i) Complete this diagram to show the correct number of hydrogen and hydrogen sulfide molecules.



a molecule with sulfur atoms | hydrogen | methane | hydrogen sulfide

[2]

(ii) The flow scheme shows the process of removing sulfur from natural gas.



Stage 2 converts hydrogen sulfide into water and sulfur.

Suggest why stage 2 is necessary.

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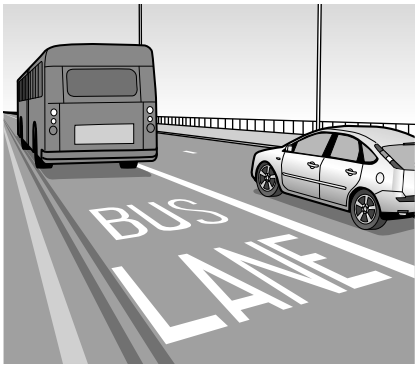
..... **[2]**

[Total: 9]

2 **(a)** Dom and Kate live in a town that has bus lanes.



Only buses can drive in bus lanes.

This means that at busy times buses travel faster than cars.

Buses and cars make carbon dioxide and other pollutants when they burn fuel.

Dom says there will be **less** air pollution as more people will travel by bus.

Kate says there will be **more** air pollution as a bus burns more fuel than a car.

Who is correct and why?

The quality of written communication will be assessed in your answer.

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..... **[6]**

(b) Biofuels may be used to run buses instead of fuels from crude oil.

Suggest a reason for using biofuel. Explain your answer.

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

(c) A fuel is burned to make **only** carbon dioxide and water.

What does this tell you about the elements in the fuel and the conditions in which the fuel burns?

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

(d) Which term describes the changes to the elements in the fuel as it burns?

Put a (ring) around the correct answer.

carbonised **electrolysed** **neutralised** **oxidised** **reduced** **[1]**

[Total: 11]

3 A supermarket uses plastic carrier bags.

The handles of some of a **new** set of bags break when customers carry their shopping away.

The supermarket complains to the company that makes the bags.

The company tests 5 of the new set of bags.

They find the mass that will break each bag.

Here are their measurements.

Bag number	**1**	**2**	**3**	**4**	**5**
Mass to break handle in kg	6.5	8.2	6.1	10.2	9.0

(a) (i) Use **all** their measurements to find the mean value of the mass to break the handles.

Show your working.

answer = ... kg **[2]**

(ii) The company compare the data for the old and new sets of bags.

	Old set of bags	**New set of bags**
Mean value of mass to break the handles in kg	14.5	
Range of values of mass to break the handles in kg	10.0 – 18.5	

Complete the table with your answer to **(a)(i)** and the range of values.

Has the strength of the bags changed?

Use the data to explain your conclusion.

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

(b) Carrier bags are made of polyethene.

There are two types of polyethene.

High density polyethene (HDPE) is stronger than low density polyethene (LDPE).

HDPE is more crystalline than LDPE

How do the **arrangements of molecules** in HDPE and LDPE differ?

Suggest a reason why this makes HDPE stronger.

You may use diagrams to help you answer.

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[Total: 6]

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Question 4 begins on page 10

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4 An oil company refines crude oil into different fractions.

This table shows the volume of each fraction made from a barrel of crude oil in litres.

It also shows the range of the number of carbon atoms in the molecules in each fraction.

	fraction	fraction in one barrel of crude oil in litres	number of carbon atoms in molecules
top of barrel	liquefied fuel gas	3	1 – 4
	petrol	40	5 – 10
	making chemicals	8	6 – 12
	fuel oil	88	13 – 25
	lubricants	8	20 – 22
bottom of barrel	bitumen for roads	13	25+

(a) Show that more than 80% of the crude oil is used as fuel.

[2]

(b) Describe the trend in boiling points of the fractions from the top to the bottom of the barrel.

Explain, using data from the table, why the boiling points change from one fraction to the next.

The quality of written communication will be assessed in your answer.

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..... **[6]**

[Total: 8]

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5 This is a question about nanotechnology.

(a) Nanotechnology is the use and control of particles that are very small.

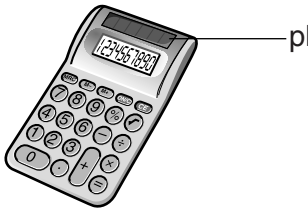
What is the range of sizes of nanoparticles?

Put a tick (✓) in the box next to the correct answer.

0.1 to 1 nm	☐
1 to 100 nm	☐
100 to 200 nm	☐
200 to 1000 nm	☐

[1]

(b) Some calculators have photocells to absorb light to charge the battery.



Photocells contain gold which absorbs light on its surface.

Explain why photocells contain gold nanoparticles rather than a solid piece of gold.

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

(c) Some scientists are concerned about the possible effects of nanoparticles on humans.

Give **two** reasons why scientists are concerned.

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

[Total: 5]

6 Some people are talking about the Government's advice on eating salt.

This is what they say.

(a) (i) Who is talking about information that has been **peer reviewed**?

Put ticks (✓) in the boxes next to the **two** correct answers.

Dr Abbott	☐
Miss Brown	☐
Mr Collins	☐
Professor Derry	☐
Mrs Evans	☐

[1]

(ii) Who is saying that a benefit of salt in food, outweighs a risk from eating too much salt?

Put a tick (✓) in the box next to the correct answer.

Dr Abbott	☐
Miss Brown	☐
Mr Collins	☐
Professor Derry	☐
Mrs Evans	☐

[1]

(iii) Which person is wrong about their salt intake?

Put a tick (✓) in the box next to the correct answer.

Dr Abbott	☐
Miss Brown	☐
Mr Collins	☐
Professor Derry	☐
Mrs Evans	☐

[1]

(iv) Companies add salt to foods to preserve them and for one other reason.

What is that other reason?

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

(b) (i) People with high blood pressure can use potassium chloride as a substitute for salt (sodium chloride).

Rocks containing potassium chloride are found deep underground and mined in the same ways as those containing sodium chloride.

Companies make potassium chloride using solution mining.

Suggest reasons why they might use solution mining rather than digging rocks out of the ground.

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

(ii) The electrolysis of potassium chloride solution is similar to the electrolysis of sodium chloride.

What three products are made when potassium chloride solution is electrolysed?

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

[Total: 8]

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Question 7 begins on page 18

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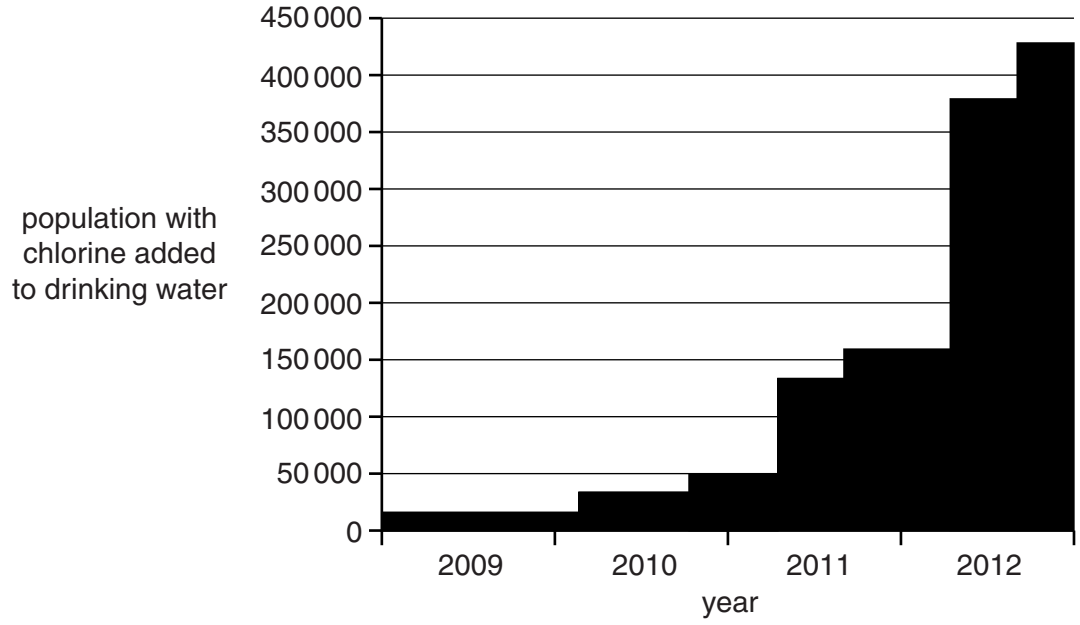
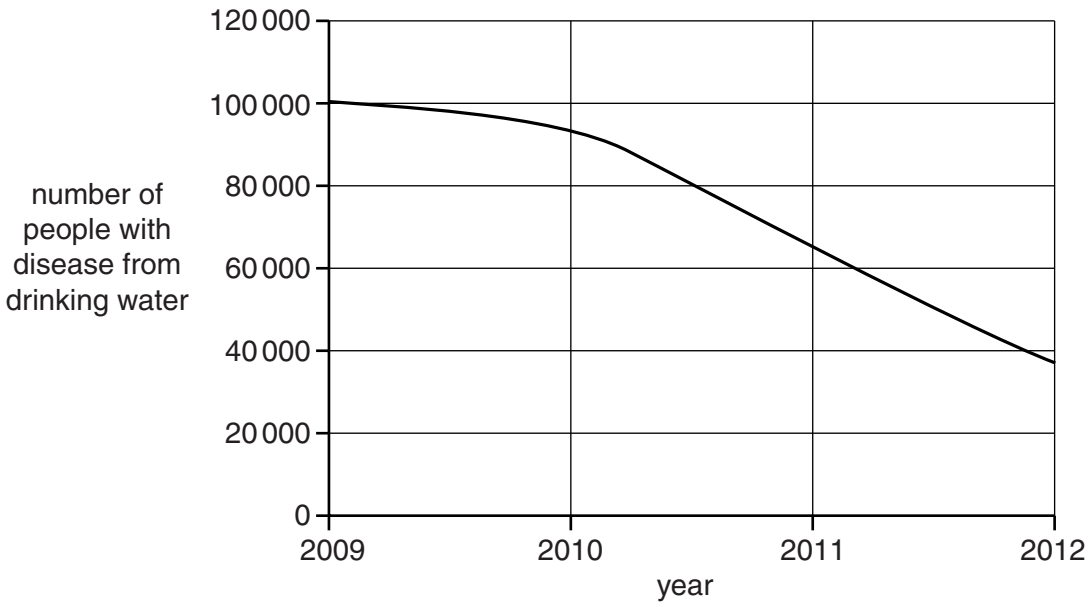
7 In remote parts of a developing country, the drinking water causes diseases that kill people.

In one area people started to add chlorine to drinking water from 2009.

A charity raised the money to pay for this.

Look at the graphs.





Describe in detail what the two graphs tell you.

What conclusions can you make about the effectiveness of adding chlorine to drinking water in this area?

The quality of written communication will be assessed in your answer.

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[Total: 6]

8 Geologists understand the history of the Earth's surface by looking at rocks.

(a) Features in these rocks tell us things about their origin.

Draw a straight line from each **feature** to **what it tells us**.

feature	what it tells us
rock salt	formed in fast flowing rivers
fossils of plants and animals	formed in deserts
rounded grains of sand in sandstone	the age of the rock
sharp grains of sand in sandstone	formed when shallow seas evaporated

[3]

(b) Salt, limestone and coal were made in different climatic conditions.

All three of these rock types are found in north west England.

Which two statements, when put together, explain how this happened?

Put ticks (✓) in the boxes next to the **two** correct answers.

The atmosphere of the early Earth was mainly nitrogen.	☐
Ocean currents cause land areas to move.	☐
When continents moved their climate changed.	☐
The weather in the UK changes every day.	☐
Earthquakes occur on the edges of tectonic plates as they move.	☐
Tectonic plates move across the Earth.	☐

[2]

(c) Studies of the magnetic properties of rocks tell scientists about the rocks.

What do they measure and what does this tell them about the rocks?

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

[Total: 7]

END OF QUESTION PAPER

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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.