OCR
RECOGNISING ACHIEVEMENT

SPECIMEN H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

CHEMISTRY B

B741/02

Unit B741: Chemistry 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 15 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

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.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found on the back page.
- 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 **75**.
- This document consists of **20** pages. Any blank pages are indicated.

Examiner's Use Only:			
1		8	
2		9	
3		10	
4		11	
5		12	
6		13	
7			
Total			

Answer **all** the questions

Section A – Module C1

1 This question is about esters.

Esters are useful substances. They can be used to make perfumes and solvents.

(a) Look at the list.

alcohol

alkane

polymer

protein

water

Complete the word equation to show how an ester is made.

Use words from the list.

acid + ... ⟶ ester + ... **[1]**

(b) Perfumes and drugs can be tested on animals in some countries.

Write about **one** advantage and **one** disadvantage of testing drugs on animals.

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

[Total: 3]

2 Phil wants to choose a fuel to heat his house.

(a) Two important factors Phil needs to think about when choosing a fuel are the cost of the fuel and the energy released per gram.

Suggest two **other** important factors which Phil needs to think about.

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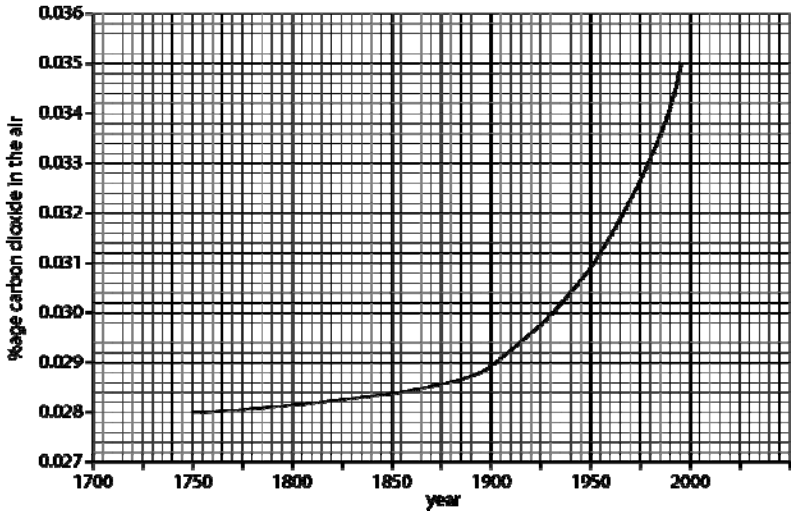
..... **[2]**

(b) Look at the graph. It shows how the percentage of carbon dioxide in the air has increased.



Give **two** reasons why this has happened.

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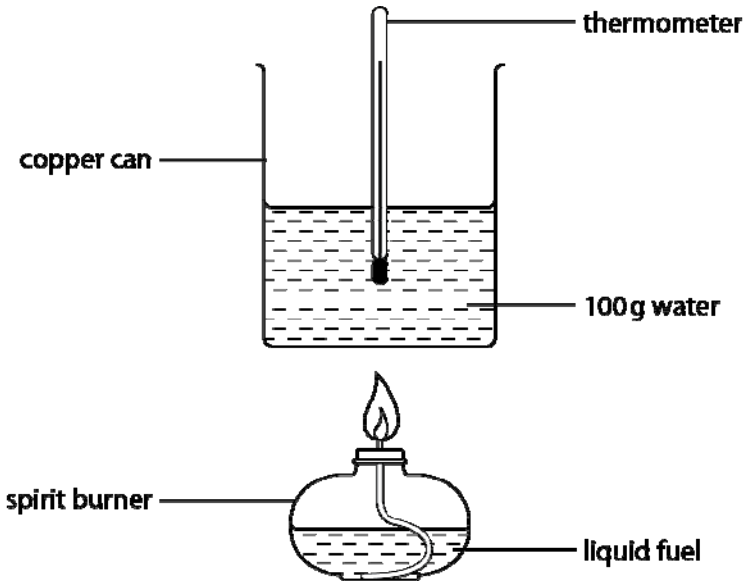
..... **[2]**

(c) Phil wants to heat his greenhouse.

He decides to test four liquid fuels to see which fuel is the best to use.

Look at the diagram.

It shows the apparatus he uses to measure the energy given out by these fuels.



Look at the table. It shows his results.

fuel	temperature of water at start in °C	temperature of water at end in °C	cost of fuel burned in pence
A	15	30	1.0
B	22	42	2.0
C	20	25	0.5
D	20	30	1.5

Phil decides to use fuel **C** to heat his greenhouse.

Evaluate if this is a sensible choice.

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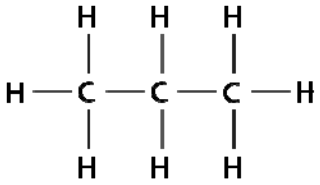
..... **[3]**

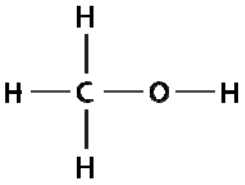
[Total: 7]

3 This question is about carbon compounds.

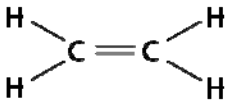
Look at the displayed formulas.



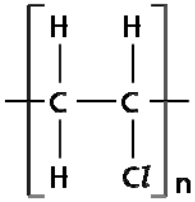
propane



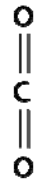
methanol



ethene



poly(chloroethene)



carbon dioxide

(a) Which compound is a **saturated** hydrocarbon?

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

(b) Which compound will decolourise bromine water?

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

(c) Write down the molecular formula of methanol.

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

(d) Poly(chloroethene) is a polymer.

Look at the displayed formula of poly(chloroethene).

Poly(chloroethene) is made from a monomer called chloroethene.

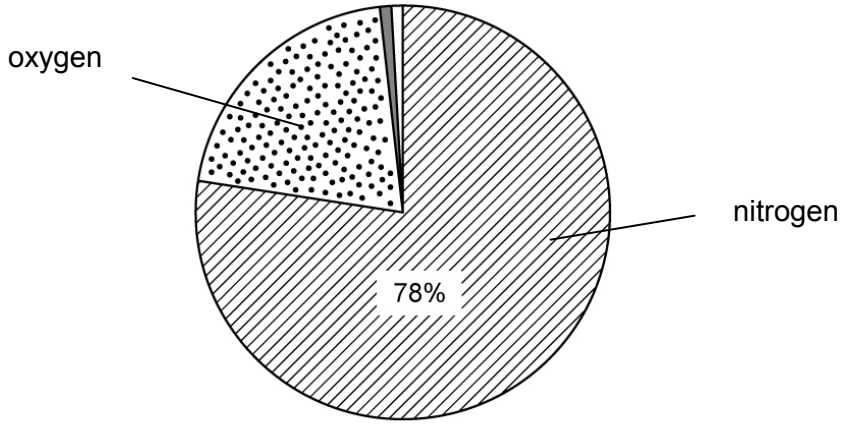
Draw the displayed formula of chloroethene.

[1]

[Total: 4]

4 This question is about gases in the air.

Look at the pie chart. It shows the composition of the air.



(a) What percentage of the air is oxygen?

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

(b) Carbon monoxide is a pollutant in the air made when petrol burns in car engines.

A catalytic converter removes carbon monoxide from the exhaust gases of a car.

Describe, with the aid of a **balanced symbol** equation, how a catalytic converter removes carbon monoxide.

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

(c) Nitrogen and oxygen do not normally react with each other.

However within a car engine nitrogen and oxygen do react to make nitrogen monoxide.

Explain, with the aid of a **balanced symbol** equation, why nitrogen and oxygen react within a car engine.

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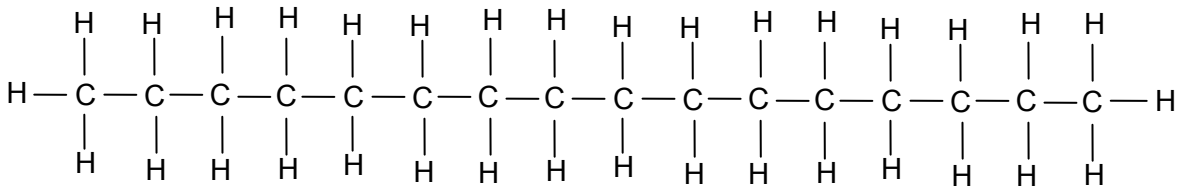
..... **[2]**

[Total: 5]

5 Cracking is an important reaction that takes place within an oil refinery.

Cracking converts large hydrocarbon molecules into more useful smaller hydrocarbon molecules

Look at the displayed formula for hexadecane.



The cracking of hydrocarbons, such as hexadecane, produces many different products and is a very important reaction in an oil refinery.

Explain why using chemical equations.

✎ *The quality of written communication will be assessed in your answer to this question.*

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

[Total: 6]

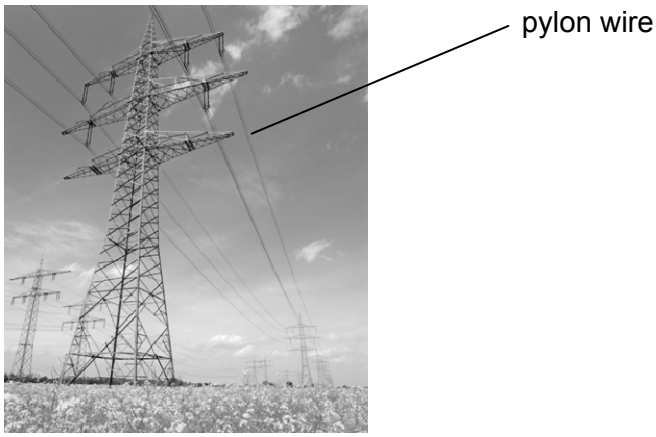
Section B – Module C2

6 This question is about metals.

Look at the table. It shows the properties of some metals.

metal	melting point in °C	density in g/cm^3	relative electrical conductivity	cost per tonne in £
aluminium	660	2.7	40	1350
copper	1083	8.9	64	3800
iron	1535	7.9	11	400
silver	962	10.5	67	20 000
zinc	420	7.1	18	870

(a) Aluminium is used to make pylon wires.



Silver is not used because it is too expensive.

Explain why aluminium is the most suitable metal for using to make pylon wires.

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

(b) Which metal would be the best to use for a door stop for keeping doors open?

Choose from the table.

metal .....

Write down **two** reasons why.

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

(c) Brass is an alloy.

Which **two** metals make up brass?

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

[Total: 5]

7 This question is about fertilisers.

Fertilisers can be made by **neutralisation**.

(a) Sulfuric acid, H_2SO_4, will neutralise ammonia solution, NH_3, to make ammonium sulfate.

Construct the **balanced symbol** equation for this neutralisation reaction.

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

(b) Sodium hydroxide reacts with phosphoric acid.

Construct the **word equation** for this reaction.

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

(c) Elizabeth and Anna are farmers. They use fertilisers to increase their crop yields.

Elizabeth uses only potassium sulfate fertiliser.

Anna uses a fertiliser that is a mixture of ammonium nitrate and phosphorus(**V**) oxide.

Explain why Anna's fertiliser will result in better plant growth than Elizabeth's.

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

(d) One disadvantage of using too much fertiliser is that some of it runs off into rivers and lakes.

This causes eutrophication which kills the aquatic organisms living in the rivers and lakes.

Explain how eutrophication leads to the death of aquatic organisms.

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..... **[3]**

[Total: 8]

8 This question is about the manufacture of nitric acid.

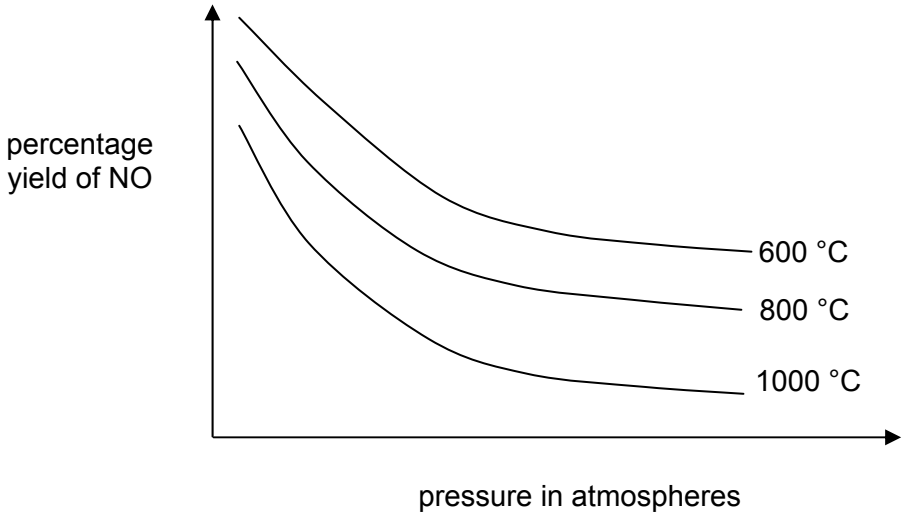
Nitric acid is made from ammonia.

The first reaction in this process involves the oxidation of ammonia.

$$\text{ammonia} + \text{oxygen} \rightleftharpoons \text{nitrogen(II) oxide} + \text{water}$$

Look at the sketch graph.

It shows the percentage yield of nitrogen(II) oxide (NO) at different temperatures and pressures.



(a) How does increasing the **temperature** change the percentage yield?

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

(b) How does increasing the **pressure** change the percentage yield?

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

(c) A low pressure of 10 atmospheres and a high temperature of 950 ^{o}C are used for the production of nitrogen oxide.

Suggest why.

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

[Total: 4]

9 The surface of the Earth is made up of tectonic plates.

The plates move very slowly.

A process called subduction can happen at plate boundaries.

(a) Describe the theory of plate tectonics and use it to explain how subduction happens.

✎ *The quality of written communication will be assessed in your answer to this question.*

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(b) The theory of plate tectonics is widely accepted by scientists.

Give **two** reasons why.

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

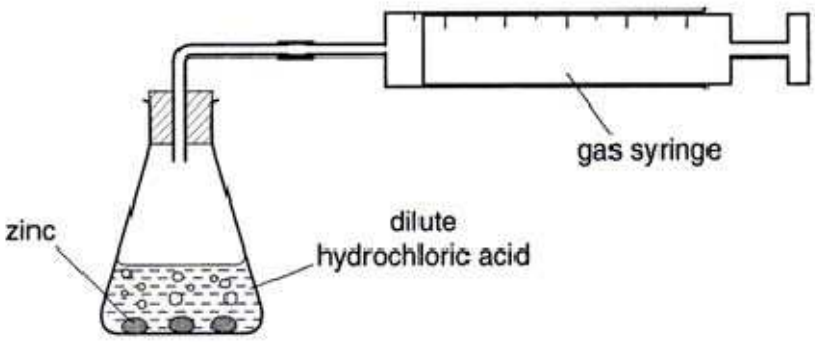
[Total: 8]

Section C – Module C3

10 Colin and Ann investigate the reaction between zinc lumps and hydrochloric acid.

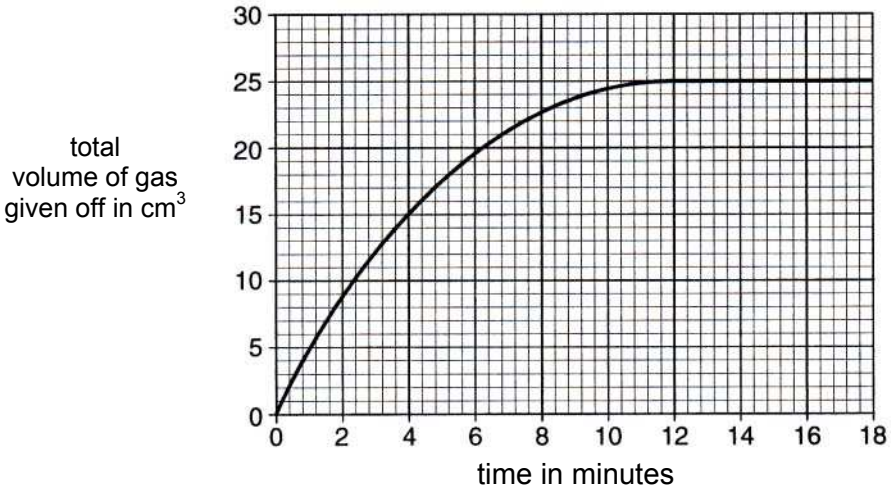
Hydrogen and a solution of zinc chloride are made.

The diagram shows the apparatus they use.



Look at the graph.

It shows their results when 1 g of zinc lumps reacts with 20 cm^3 of dilute hydrochloric acid.



(a) How long does it take for the reaction to stop?

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

(b) (i) Calculate the average rate of reaction during the first 4 minutes.

Quote your answer to **three** significant figures.

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answer ..... unit ..... **[2]**

(ii) How does the average rate of reaction for the first 4 minutes compare to the average rate between 4 and 8 minutes?

Show how you calculated your answer.

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

(c) Colin and Ann want the reaction to go faster.

They do not want to change the volume of acid or mass of zinc.

They say that they could:

- increase the temperature of the hydrochloric acid
- increase the concentration of the hydrochloric acid
- use powdered zinc instead of lumps of zinc.

Explain, using the reacting particle model, why **two** of these methods increase the rate of this reaction.

✎ *The quality of written communication will be assessed in your answer to this question.*

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

[Total: 10]

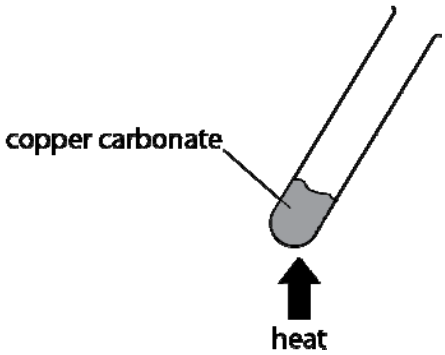
11 Copper carbonate decomposes when heated.

Copper oxide and carbon dioxide are made.

$$CuCO_3 \rightarrow CuO + CO_2$$

(a) Tim investigates this decomposition.

Look at the apparatus he uses.



Tim heats 1.24 g of copper carbonate in the test-tube.

He predicts that he should make 0.80 g of copper oxide.

He actually makes 0.70 g.

Calculate his percentage yield.

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answer .....% **[2]**

(b) A factory manufactures copper oxide by heating copper carbonate.

The carbon dioxide made is a waste product.

Look at the table of relative formula masses, M_r.

substance	relative formula mass, M_r
$CuCO_3$	124
CuO	80
CO_2	44

Calculate the atom economy for the manufacture of copper oxide.

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

(c) It is important for the factory to have a high percentage yield and a high atom economy.

Explain why each of these is important.

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

[Total: 6]

12 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) Mark decides to use graphite electrodes in the electrolysis of sodium chloride solution.

Use information in the table and your own knowledge to give reasons for his decision.

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

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

Explain why.

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

(c) Diamond does not conduct electricity.

Explain why.

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

[Total: 5]

13 Clare prepares calcium nitrate.

She reacts calcium hydroxide with nitric acid.

$$Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$$

(a) Calculate the mass of calcium nitrate that can be made from 3.15 g of pure nitric acid.

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answer ..... g **[3]**

(b) Clare reacts double the amount of nitric acid in an excess of calcium hydroxide.

What effect will this have on the amount of calcium nitrate made?

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

[Total: 4]

END OF QUESTION PAPER

PERIODIC TABLE

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 **A***l* aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **C***l* 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 **T***l* 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.