Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9-1)

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Paper 1

Higher Tier

Additional Sample Assessment Material for first teaching September 2016

Time: 1 hour 45 minutes

Paper Reference
1CH0/1H

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an asterisk (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- There is a periodic table on the back cover of the paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) Hydrogen sulphide, H_2S, is a simple molecular, covalent compound.

(i) A hydrogen atom has one electron in its outer shell.
A sulfur atom has six electrons in its outer shell.

Which of the following is the dot and cross diagram of a molecule of hydrogen sulfide?

(1)

☒ **A** 

☒ **B** 

☒ **C** 

☒ **D** 

(ii) Which row in Figure 1 shows the properties of a simple molecular, covalent compound such as hydrogen sulfide?

(1)

		melting point	boiling point	conduction of electricity
☒	**A**	high	high	poor conductor
☒	**B**	high	high	good conductor only when liquid
☒	**C**	low	low	poor conductor
☒	**D**	high	high	good conductor

Figure 1

(b) A compound of sulfur was analysed to determine its empirical formula.

(i) State the meaning of the term **empirical formula**.

(1)

.....

.....

(ii) A compound of sulfur and fluorine contains 4.8 g of sulfur and 17.1 g of fluorine.

Calculate the empirical formula of this compound.

You must show your working.
(relative atomic masses: F = 19, S = 32)

(3)

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empirical formula = ...

(c) 48.0 g of sulfur dioxide is provided.

Calculate the number of sulfur dioxide molecules, SO_2, in this sample.

(relative atomic masses: O = 16.0, S = 32.0;
Avogadro constant = 6.02×10^{23} mol^{-1})

(3)

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number of molecules = ...

(Total for Question 1 = 9 marks)

2 (a) A Bunsen burner has a base and a chimney as shown in Figure 2.

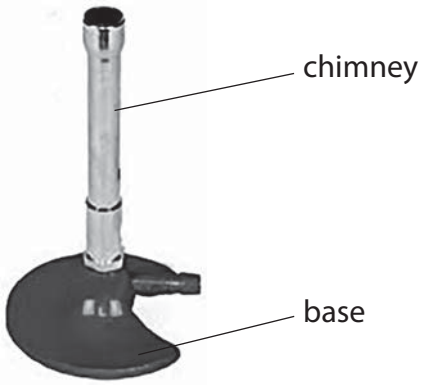

Figure 2

The base can be made of steel.

Explain why steel is a suitable material for the base.

Do not consider cost.

(2)

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(b) When iron rusts it forms hydrated iron oxide, $Fe_2O_3.H_2O$.

$$4Fe + 3O_2 + 2H_2O \rightarrow 2Fe_2O_3.H_2O$$

(1)

In this reaction iron is

☒ **A** decomposed

☒ **B** neutralised

☒ **C** oxidised

☒ **D** reduced

(c) Ships made of steel have blocks containing magnesium fixed to their hulls, as shown in Figure 3.

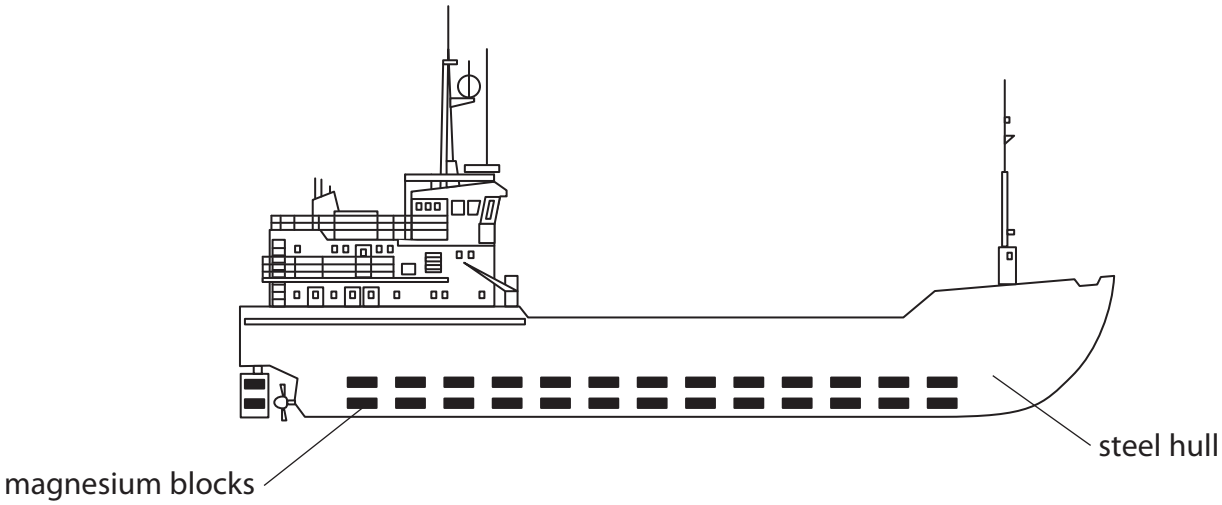

Figure 3

The magnesium prevents the steel hulls from rusting.

Explain how the magnesium prevents the steel from rusting.

(2)

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(d) An alloy is made when copper is mixed with aluminium.
This alloy is stronger than pure aluminium.

Figure 4 shows the structures of pure aluminium and this alloy.

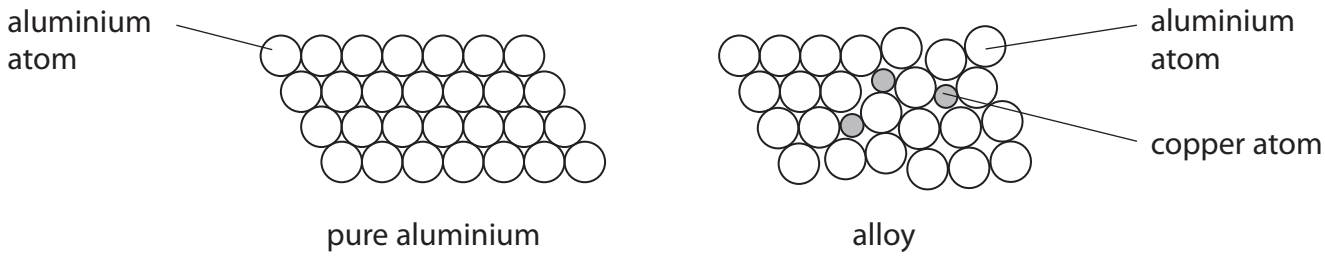

Figure 4

Explain, in terms of these structures, how the presence of copper atoms in the alloy results in the alloy being stronger than pure aluminium.

(3)

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(Total for Question 2 = 8 marks)

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3 (a) The compound ammonium chloride is used as a fertiliser.

Starting with a dilute solution of ammonia, describe how you could prepare a pure solution of ammonium chloride in the laboratory.

(3)

(b) In an experiment to prepare some ammonium chloride crystals, it is calculated that the maximum mass of ammonium chloride produced from the mass of ammonia used should be 24.60 g.

In the experiment, the actual yield was 17.73 g.

Calculate the percentage yield, giving your answer to **three** significant figures.

(3)

percentage yield = ...

(c) Ammonia is manufactured in the Haber process.

In this process, hydrogen reacts with nitrogen under a pressure of about 200 atmospheres and at 450 °C.

A dynamic equilibrium can be reached.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Explain the effect on the **rate of attainment of equilibrium**, of carrying out the process at the same temperature but at a pressure higher than 200 atmospheres.

(3)

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(Total for Question 3 = 9 marks)

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4 (a) Calcium nitrate solution can be made by adding solid calcium carbonate to dilute nitric acid in a beaker.

The solid calcium carbonate is added until some remains at the bottom of the beaker.

(i) After this reaction the liquid in the beaker is

(1)

☒ **A** acidic

☒ **B** alkaline

☒ **C** neutral

☒ **D** pure water

(ii) Explain why the calcium carbonate is added until some solid remains at the bottom of the beaker.

(2)

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(iii) Write the balanced equation for the reaction between calcium carbonate and nitric acid to form calcium nitrate, $Ca(NO_3)_2$.

(3)

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(b) Calcium nitrate, $Ca(NO_3)_2$, is an ionic solid.

State the formulae of the ions in calcium nitrate.

(2)

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(c) Calcium nitrate is a soluble salt.

Using the rules of solubility, suggest the name of a solution that will react with calcium nitrate solution to form an insoluble solid.

(1)

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(Total for Question 4 = 9 marks)

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5 Figure 5 shows the apparatus that can be used to electrolyse sodium chloride solution in the laboratory.

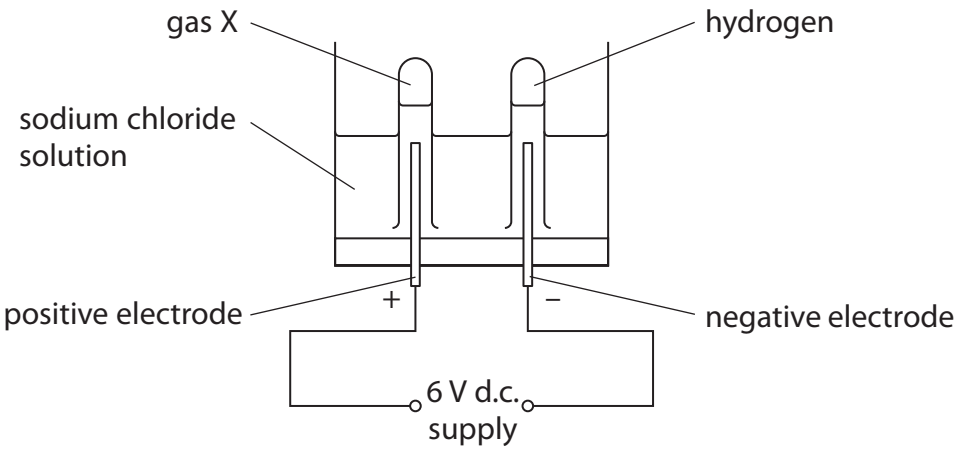

Figure 5

(a) Gases are produced at both electrodes.

(i) State the name of the yellow-green gas X formed at the positive electrode.

(1)

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(ii) Describe the test to show that the gas formed at the negative electrode is hydrogen.

(2)

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(b) Explain why sodium chloride solution can conduct electricity.

(2)

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(c) Some of the solution remaining after the electrolysis was tested with litmus paper. The paper turned blue.

Explain why the litmus paper turned blue.

(2)

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(d) Write the half equation for the formation of hydrogen gas from hydrogen ions at a negative electrode.

(2)

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(Total for Question 5 = 9 marks)

6 A student was asked to plan a titration experiment to find the exact volume of hydrochloric acid that would neutralise 25.0 cm^3 of sodium hydroxide solution.

(a) The student's plan is

1. use a measuring cylinder to pour 25 cm^3 of sodium hydroxide solution into a conical flask
2. add a few drops of an indicator to the sodium hydroxide solution
3. use a burette to add hydrochloric acid to the sodium hydroxide solution until the indicator changes colour

(i) State the name of the piece of apparatus that should be used, instead of the measuring cylinder in step 1, in order to improve the accuracy of the experiment.

(1)

.....

(ii) Suggest the name of a suitable indicator and state the colour change that would occur at the end point in this experiment.

(2)

name of indicator .....

colour change .....

.....

(iii) Suggest **two** details that could be added to the plan to make the experiment more accurate.

(2)

1. .....

.....

2. .....

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(b) The student used 25.0 cm^3 of 0.50 mol dm^{-3} sodium hydroxide solution, NaOH, in the titration.

22.85 cm^3 of hydrochloric acid was required to neutralise the sodium hydroxide solution.

The equation for the reaction is

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Calculate the concentration, in mol dm^{-3}, of the hydrochloric acid, HCl.
Give your answer to 3 significant figures.

(4)

concentration = ... mol dm^{-3}

(c) The concentration of a solution of potassium hydroxide, KOH, is 0.625 mol dm^{-3}.

Calculate the concentration of this solution in g dm^{-3}.
(relative atomic masses: H = 1.0, O = 16, K = 39)

(2)

concentration = ... g dm^{-3}

(Total for Question 6 = 11 marks)

7 The elements beryllium, magnesium, calcium, strontium and barium are in group 2 of the periodic table.

(a) Each calcium atom contains 20 electrons.

Which of the following is the electronic configuration of a calcium atom?

(1)

☒ **A** 2.8.10

☒ **B** 2.8.8.2

☒ **C** 2.2.8.8

☒ **D** 8.10.2

(b) State how the position of barium in the periodic table shows that it is a metal.

(1)

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(c) Barium has a melting point of 714 °C.

Explain, in terms of structure and bonding, why barium has a high melting point.

(3)

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(d) There are three common isotopes of magnesium.

(i) These isotopes are shown in Figure 6.

Complete Figure 6 to show the number of protons and neutrons in an atom of each of the other two isotopes.

(2)

isotope	mass number	number of protons in an atom	number of neutrons in an atom
magnesium-24	24	12	12
magnesium-25	25		
magnesium-26	26		

Figure 6

(ii) A sample of magnesium contains 78.60% magnesium-24, 10.11% magnesium-25 and 11.29% magnesium-26.

Use this information to calculate the relative atomic mass of magnesium in this sample.
Give your answer to 3 significant figures.

(4)

relative atomic mass = ...

(Total for Question 7 = 11 marks)

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8 (a) Students **A**, **B**, **C** and **D** carry out experiments to find the mass of oxygen that combines with a given mass of magnesium, when the magnesium burns completely.

They use the apparatus shown in Figure 7.

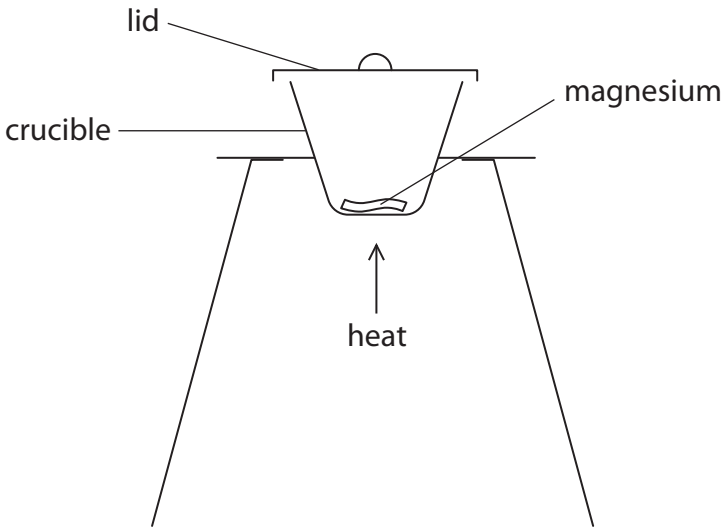

Figure 7

(i) During heating the students raise the lid slightly from time to time.

Explain why this is necessary.

(2)

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(ii) The table shows the results obtained by the four students.

Which student obtained an anomalous result?

(1)

student	mass of magnesium used / g	mass of magnesium oxide formed / g	mass of oxygen reacted / g
☒ **A**	0.12	0.20	0.08
☒ **B**	0.24	0.40	0.16
☒ **C**	0.36	0.56	0.20
☒ **D**	0.48	0.80	0.32

(iii) A student is asked to prove that the reaction that has taken place in the crucible is complete.

Describe an additional step that a student could carry out to prove that all the magnesium had reacted.

(2)

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*(b) Explain how, in this reaction, magnesium and oxygen atoms form a solid that has a high melting point.

(6)

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(Total for Question 8 = 11 marks)

9 (a) Ethanol can be produced by a process called fermentation.
Carbon dioxide is formed during fermentation.

In the test for carbon dioxide, the gas is bubbled through limewater and a white precipitate forms.

What is the name of this white precipitate?

(1)

☒ **A** calcium oxide

☒ **B** calcium hydroxide

☒ **C** calcium hydrogencarbonate

☒ **D** calcium carbonate

(b) During fermentation glucose, $C_6H_{12}O_6$, reacts to form ethanol, C_2H_5OH, and carbon dioxide.

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$

(relative formula masses: $C_6H_{12}O_6 = 180$, $C_2H_5OH = 46$;
volume of 1 mol of gas at room temperature and pressure = 24 dm^3)

Calculate the maximum volume, in dm^3, of carbon dioxide that can be produced when 75 kg of glucose reacts completely.

(3)

volume = ... dm^3

(c) Ethanol can also be produced by the hydration of ethene, C_2H_4.

$$C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(g)$$

In one experiment, 500 cm^3 of ethene was reacted completely with 1000 cm^3 of water vapour and produced 500 cm^3 of ethanol vapour.
In another experiment, 500 cm^3 of ethene was reacted completely with 750 cm^3 of water vapour, and also produced 500 cm^3 of ethanol vapour.
(all volumes of gases were measured under the same conditions of temperature and pressure)

Explain why the volume of ethanol vapour produced was the same in both experiments.

(2)

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*(d) Large amounts of ethanol are produced in the chemical industry by fermentation and by hydration of ethene.

Figure 8 summarises the two processes for making ethanol on a large scale.

	fermentation of glucose	hydration of ethene
equation	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$	$C_2H_4 + H_2O \rightarrow C_2H_5OH$
raw materials	plants	crude oil
raw material renewable	yes	no
temperature	30 – 40 °C	300 °C
pressure	1 atmosphere	65 atmospheres
rate of reaction	slow	fast
purity of product	needs to be fractionally distilled to concentrate the ethanol	pure

Figure 8

Using this information, discuss the possible advantages and disadvantages of producing ethanol by fermentation rather than by hydration of ethene.

(6)

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(Total for Question 9 = 12 marks)

10 (a) A student has been asked to investigate how the pH changes when calcium oxide is added, a little at a time, to dilute hydrochloric acid.

Describe how the student should carry out this investigation.

(3)

(b) A strong acid reacts with a strong alkali to form a neutral solution.

Write the ionic equation for this reaction.

(2)

(c) A solution of hydrochloric acid has a pH of 1.

Explain the pH change when 10 cm^3 of this acid is diluted with water to make 100 cm^3 of solution.

(2)

(d) Acids are a hazard if a high concentration of hydrogen ions is present.

Hydrochloric acid is a strong acid, ethanoic acid is a weak acid.

Figure 9 shows the labels on bottles of dilute hydrochloric acid and concentrated ethanoic acid.

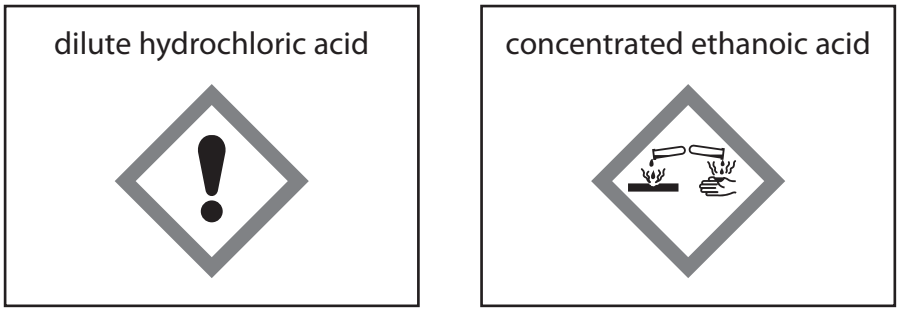

Figure 9

Explain why the hazard of the dilute hydrochloric acid is lower than the hazard of concentrated ethanoic acid, even though hydrochloric acid is a strong acid and ethanoic acid is a weak acid.

(4)

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

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.