Specimen Paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
TOTAL	

AQA Level 1/2 Certificate in Science: Double Award Specimen Paper

Double Award

Chemistry Paper 2H

For this paper you must have:
- a ruler
- the Periodic Table (enclosed).

You may use a calculator.

Time allowed
- 60 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

Answer **all** questions in the spaces provided.

1 (a) Chlorine exists as $^{35}_{17}Cl$ and $^{37}_{17}Cl$

1 (a) (i) Describe the structure of an atom of $^{35}_{17}Cl$

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(4 marks)

1 (a) (ii) What name is given to atoms such as $^{35}_{17}Cl$ and $^{37}_{17}Cl$ that have the same atomic numbers but different mass numbers?

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(1 mark)

1 (b) Chlorine exists as diatomic molecules with the formula Cl_2. The covalent bond between the chlorine atoms is strong. The boiling point of chlorine is $-35\,^{o}C$.

Explain why chlorine has a low boiling point although the covalent bond between chlorine atoms is strong.

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(3 marks)

1 (c) Chlorine reacts with hot sodium hydroxide solution.

A sample of a compound formed in the reaction was found to contain 10.8 g of sodium atoms, 16.7 g of chlorine atoms and 22.5 g of oxygen atoms.

Calculate the empirical formula of the compound formed.

empirical formula .....

(4 marks)

12

Turn over for the next question

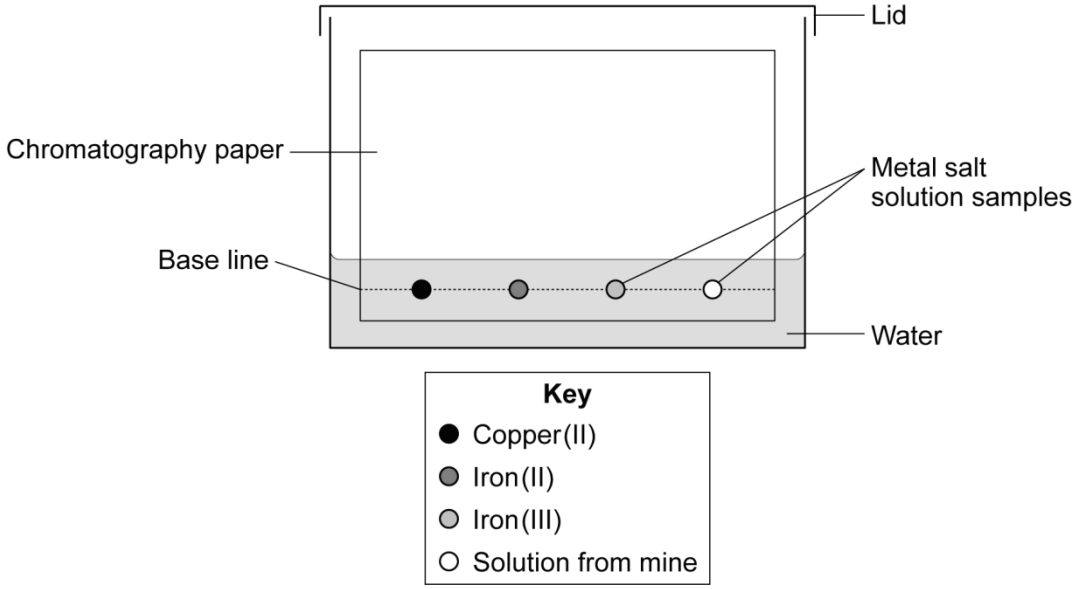
There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

2 A student analysed a sample of water from a disused mine to find out which metal ions were in the water.

He used paper chromatography of the sample of water from the mine and of solutions containing known metal ions.

He set the apparatus up as shown in the diagram.



2 (a) The student used too much water. What problem would this error cause?

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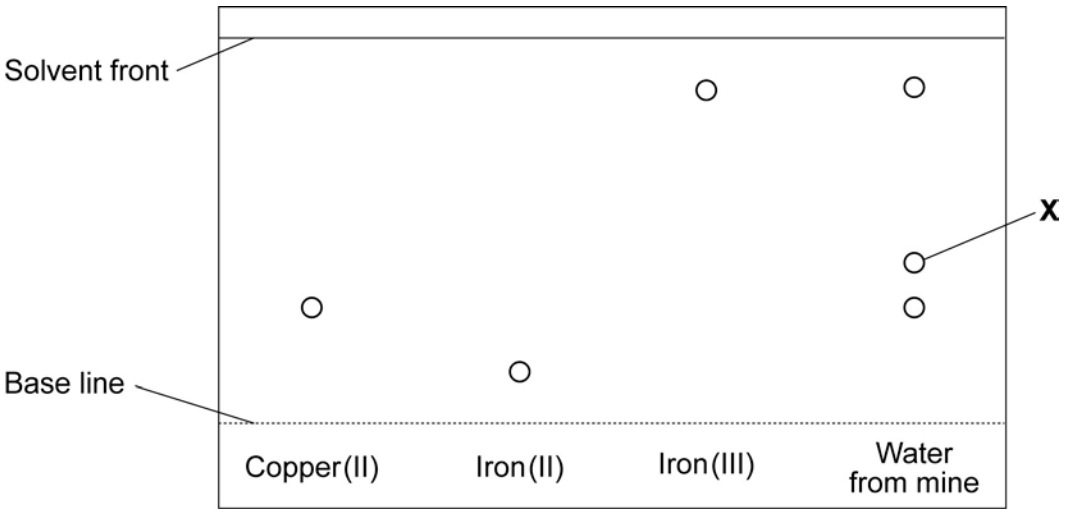
(1 mark)

Question 2 continues on the next page

2 (b) Another student repeated the experiment, but without making any errors.

After the water had soaked up the chromatography paper he sprayed it with a dilute solution of sodium hydroxide. Coloured spots appeared on the paper.

The results he obtained are shown in the diagram.



2 (b) (i) Identify **two** of the metal ions in the sample of water from the mine.

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(1 mark)

2 (b) (ii) State the colour of the spot formed from the iron(III) ions.

.....

(1 mark)

2 (b) (iii) Give the formula of the iron(III) compound responsible for the colour you stated in **(b)(ii)**.

.....

(1 mark)

2 (c) Spots obtained by chromatography can be compared by their R_f values.

2 (c) (i) Use the diagram of the results to calculate the R_f value for spot **X**.

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R_f value = ...

(2 marks)

2 (c) (ii) State how this R_f value could be used to identify the metal ion present.

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(1 mark)

2 (d) Suggest why the presence of Al^{3+} could **not** be detected using this experiment.

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(2 marks)

9

Turn over for the next question

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

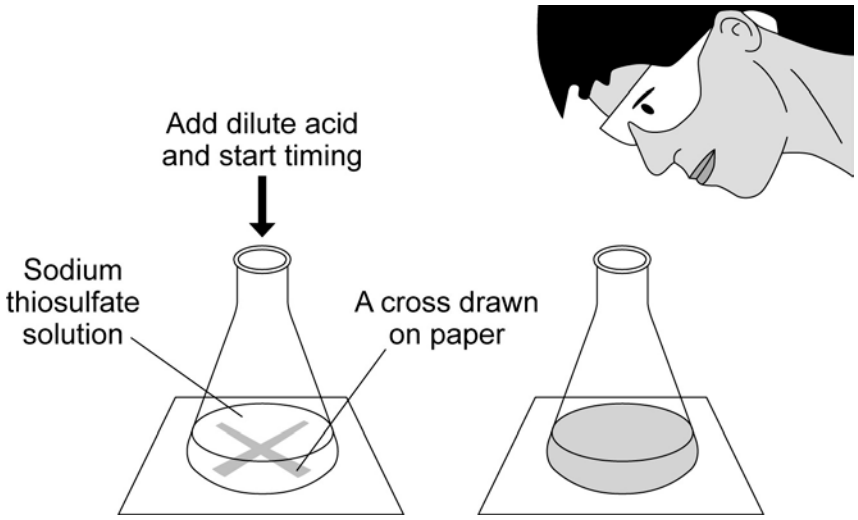
3 Sodium thiosulfate solution reacts slowly with dilute hydrochloric acid.

$$Na_2S_2O_3 + 2HCl \longrightarrow 2NaCl + S + SO_2 + H_2O$$

During the reaction a solid is formed. This makes the reaction mixture cloudy. The speed of the reaction can be followed by timing how long it takes for the reaction mixture to become too cloudy to be able to see through.

The student is investigating how temperature affects the speed of the reaction.

- A student used a measuring cylinder to measure out 10 cm^3 of sodium thiosulfate solution and 30 cm^3 of water. She mixed them together in a conical flask.
- She stood the conical flask on a cross drawn on a sheet of paper.
- She then added 5 cm^3 of dilute hydrochloric acid to the mixture and started her stopwatch.
- Once the mixture became so cloudy she could no longer see the cross, she recorded the time taken.
- She repeated the experiment at different temperatures by warming or cooling the reagents before she mixed them.



3 (a) Use the equation to help identify the insoluble product that makes the mixture cloudy.

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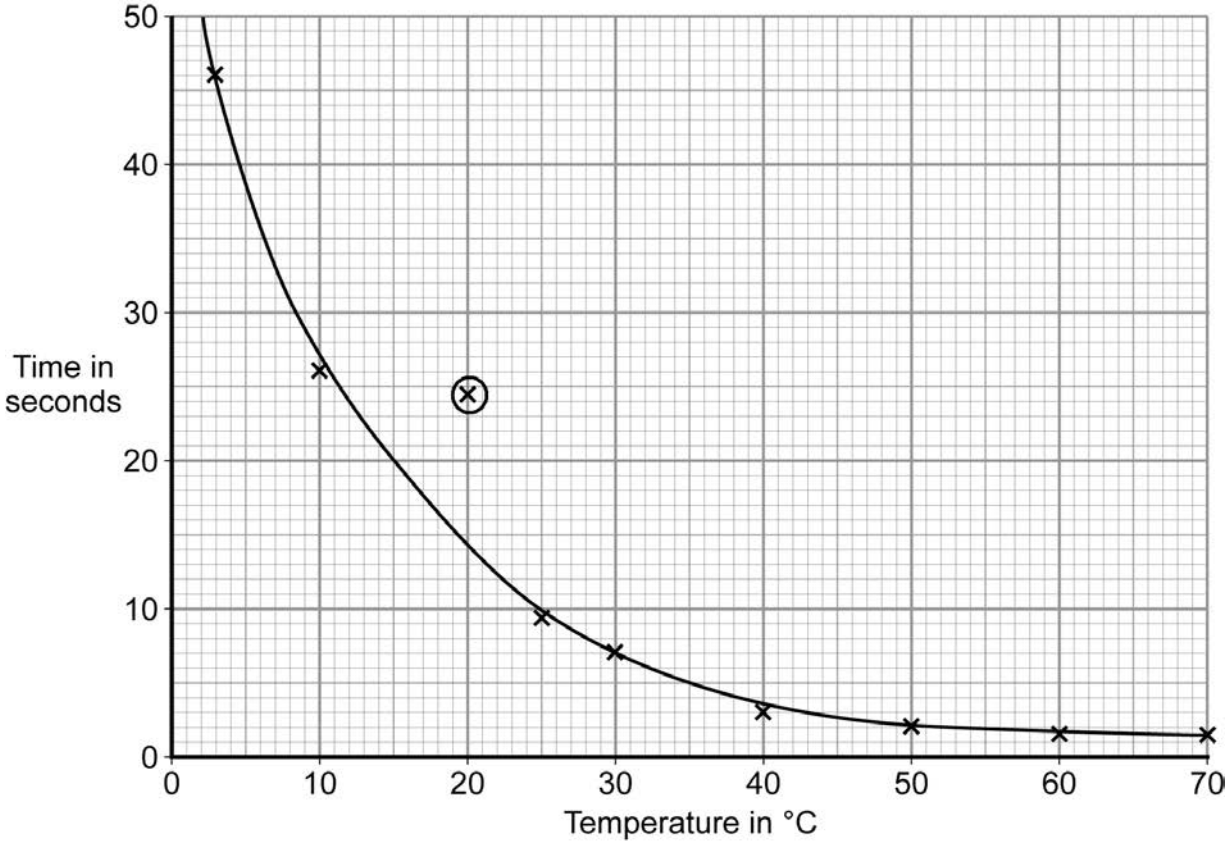
(1 mark)

Question 3 continues on the next page

3 (b) The student's results are shown on the graph.



3 (b) (i) The circled point on the graph is anomalous.
Suggest **two** possible reasons for this anomalous result.

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(2 marks)

3 (b) (ii) A teacher said the results would be more reproducible if the student used a light-meter to measure the amount of light passing through the reaction mixture rather than look to see when the cross disappeared.

Explain why using a light-meter would make the results more reproducible.

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(1 mark)

3 (b) (iii) Use the graph to estimate how long it would have taken for the cross on the paper to no longer be visible at 15 °C.

..... seconds
(1 mark)

3 (b) (iv) Use the equation

$$\text{rate} = \frac{1}{\text{time taken}}$$

to calculate the rate of reaction at 15°C.

.....

rate = ... s^{-1}
(1 mark)

3 (b) (v) How does the rate of reaction change as the temperature increases?

.....

.....
(1 mark)

3 (c) The student's teacher suggested that her results were least accurate at high temperatures.

3 (c) (i) Suggest **one** reason why the results may be least accurate at high temperatures.

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.....
(1 mark)

3 (c) (ii) Suggest **one** change that the student could make to reduce the error caused by the reason you have given in **(c)(i)**.

Explain why this change would make the results more accurate.

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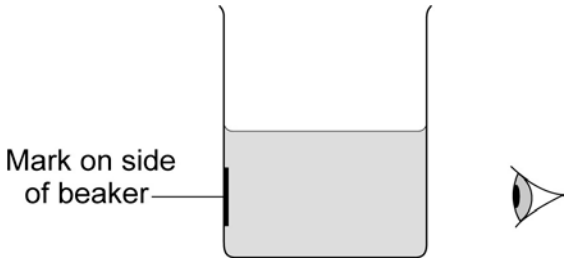
(2 marks)

Turn over ▶

3 (d) A second student did the experiment, but used apparatus that was slightly different.



Both students timed how long it would take for the mark to become invisible at 20 °C. The results they obtained are given in the table.

	time taken for mark to become invisible in seconds
first student using conical flask	18
second student using beaker	10

Both students then repeated the experiment using double the volume of all of the solutions.

3 (d) (i) The student using the conical flask found that the time taken for the mark to become invisible was much shorter.

Explain why the mark became invisible in a shorter time.

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(1 mark)

3 (d) (ii) What would happen to the result obtained by the student using the beaker?

Explain your answer.

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.....

(2 marks)

13

Turn over for the next question

4 Poly(propene) is a polymer made from propene. Propene is made by cracking long-chain saturated hydrocarbons from crude oil.

4 (a) (i) Describe the conditions used in cracking.

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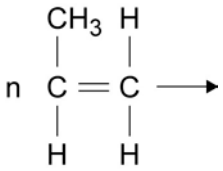
(2 marks)

4 (a) (ii) Complete the equation to represent the formation of poly(propene) from propene.



(3 marks)

4 (a) (iii) Propene and poly(propene) behave in different ways when shaken with bromine water. Complete the table to show the colour changes that are seen when poly(propene) and propene are shaken with bromine water.

	colour at start	**colour at end**
poly(propene)		
propene		

(3 marks)

4 (a) (iv) Explain why poly(propene) and propene behave differently with bromine water.

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(1 mark)

4 (b) Disposal of polymers such as poly(propene) can result in environmental problems. These problems can be avoided by using new polymers made from cornstarch. Explain how.

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(1 mark)

4 (c) Some polymers are described as being *thermosetting*.
Describe a simple experiment you could use to see if a polymer is a thermosetting polymer.
State the result you would expect to obtain if the polymer was thermosetting.

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(3 marks)

13

Turn over for the next question

5 (a) Sodium hydrogencarbonate decomposes when heated strongly. One of the products is carbon dioxide gas.

Describe the test for carbon dioxide gas.

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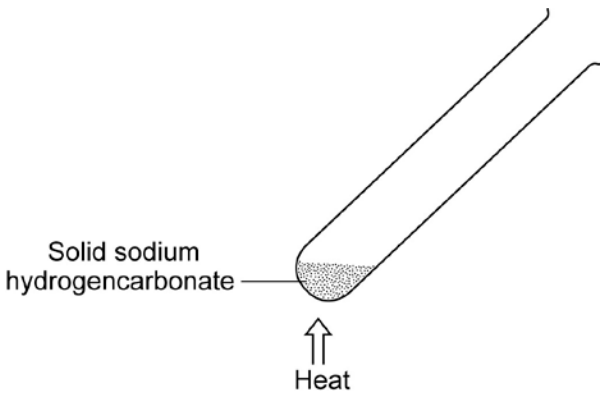
(2 marks)

5 (b) A student heated 0.672 g of sodium hydrogencarbonate and collected the carbon dioxide produced. She measured the volume of carbon dioxide she had collected every minute until the sodium hydrogencarbonate had all decomposed. The student's results are shown in **Table 1**.

Table 1

Time in minutes	Volume of carbon dioxide collected in cm^3
0	0
1	46
2	70
3	85
4	94
5	96
6	96
7	96

5 (b) (i) Complete the diagram to show how the student could collect the gas produced and measure its volume.



(2 marks)

5 (b) (ii) How do the results show that the sodium hydrogencarbonate had fully decomposed?

.....

.....

(1 mark)

5 (c) The student did the experiment twice more, starting with the same mass of sodium hydrogencarbonate as in the first experiment. Her results are shown in **Table 2**.

Table 2

Time in minutes	Volume of carbon dioxide collected in cm^3	
	First repeat	Second repeat
0	0	0
1	45	20
2	70	43
3	84	60
4	95	74
5	96	85
6	96	92
7	96	96

The gas volumes the student measured in the second repeat do not agree with either the data from the first repeat or the original data. The student suggested that this could be because there was a gas leak from the apparatus.

5 (c) (i) Explain how the results show that this suggestion must be wrong.

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(1 mark)

5 (c) (ii) Suggest what the student did differently that might have caused the difference in results.

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(1 mark)

Question 5 continues on the next page

5 (d) The equation for the decomposition of sodium hydrogencarbonate is:

$$2NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O$$

5 (d) (i) Calculate the mass of sodium carbonate (Na_2CO_3) that would be produced if 1.64 g of sodium hydrogencarbonate was fully decomposed.

The M_r of $NaHCO_3$ is 84.

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mass produced = ... g

(4 marks)

5 (d) (ii) A student heated 1.64 g of sodium hydrogencarbonate for five minutes. Instead of measuring the volume of carbon dioxide given off, she measured the mass of solid remaining in the test tube. The mass obtained was more than that calculated in **(d)(i)**.

Suggest a reason for the difference in mass, and suggest what the student should do to validate this reason.

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(2 marks)

13

END OF QUESTIONS

The 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 **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 Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Cu and **Cl** have not been rounded to the nearest whole number.