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Thursday 26 January 2012 – Morning

GCSE GATEWAY SCIENCE
CHEMISTRY B

B641/02 Unit 1 Modules C1 C2 C3 (Higher Tier)

B620840112

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

B641102

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 number of marks is given in brackets **[ ]** at the end of each question or part question.
- The Periodic Table is printed on the back page.
- 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.

Section A – Module C1

1 This question is about polymers.

Polymers are made by polymerisation.

Small molecules join together to make a polymer.

(a) One condition used is a high temperature.

Write down two **other** conditions needed for polymerisation.

1.....

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

(b) Look at the table. It shows some information about polymers.

polymer	density in g/cm^3	melting point in °C	solubility in oil
A	0.92	85	insoluble below 80 °C, soluble above 80 °C
B	0.96	120	insoluble below 80 °C, soluble above 80 °C
C	1.05	65	soluble
D	1.39	60	soluble
E	0.90	150	insoluble

Which polymer would be best for making a pipe to carry oil at 100 °C?

Choose **A**, **B**, **C**, **D** or **E**.

.....

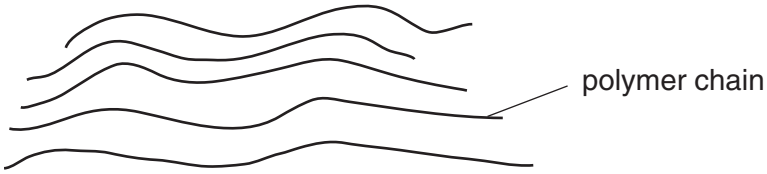
Explain your answer.

.....

.....

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

(c) Look at the structure of polymer **D**.



Polymer **D** has a low melting point and can be stretched easily.

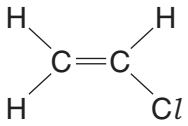
Explain why.

Use ideas about its structure.

.....

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

(d) Look at the displayed formula of chloroethene.



Chloroethene is used to make a polymer.

Draw the displayed formula of this polymer.

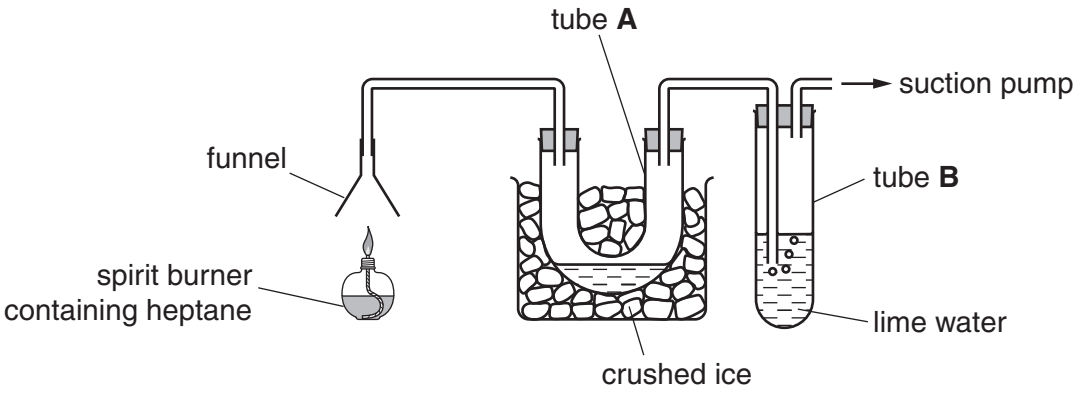
[1]

[Total: 7]

2 Heptane is a fuel.

(a) Tim investigates the burning of heptane.

The diagram shows the apparatus he uses.



(i) Write down the name of the liquid which condenses in tube **A**.

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

(ii) What happens to the lime water in tube **B**?

Explain your answer.

.....

.....

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

(b) The burning of heptane is an **exothermic** reaction.

During the reaction bonds are broken and new bonds are made.

Energy is needed to break bonds.

Explain why the burning of heptane is an exothermic reaction.

.....

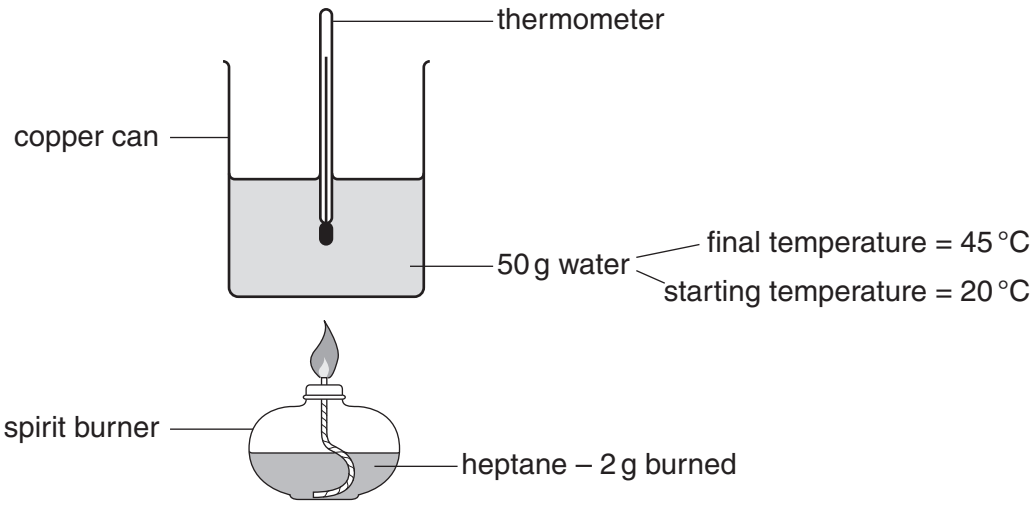
.....

.....

.....

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

(c) Tim uses heptane to heat water.



Tim uses 2 g of heptane to heat 50 g of water.

Calculate the energy given out when Tim heats the water.

Use the equation

energy = mass × specific heat capacity × temperature change

The specific heat capacity of water is 4.2 J / g °C.

.....

.....

.....

.....

answer ..... J **[2]**

[Total: 7]

3 This question is about perfumes.

(a) Perfumes must have certain properties.

One property that perfumes must have is that they evaporate easily.

This is so the perfume particles can easily reach your nose.

Complete the table to explain why each property is needed by a perfume.

One has been done for you.

property	why it is needed
evaporates easily	so that the perfume particles can easily reach your nose
non-toxic	....
insoluble in water	....

[2]

(b) When a perfume evaporates, it changes from a liquid to a gas.

Explain what happens to the particles of a perfume during evaporation.

Use ideas about

- forces between perfume particles
- movement of perfume particles.

.....

.....

.....

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

[Total: 4]

4 Baking powder is added to a cake mixture.

Baking powder contains sodium hydrogencarbonate, $NaHCO_3$.

When sodium hydrogencarbonate is heated, it makes sodium carbonate, Na_2CO_3, carbon dioxide and water.

Write a **balanced symbol** equation for this reaction.

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

[Total: 2]

Section B – Module C2

5 This question is about paints and dyes.

Paint is made up of a binding material, a solvent and a pigment.

(a) Jane paints a wall with emulsion paint.

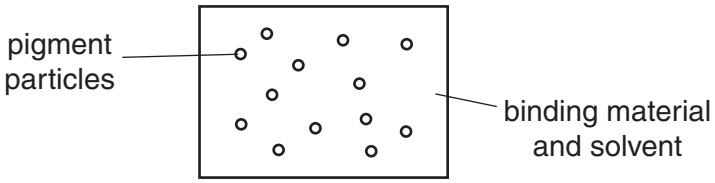
The paint dries slowly.

Describe how the paint dries.

.....

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

(b) Look at the diagram of oil paint in a can.



(i) Paint is a **colloid** not a solution.

What is a colloid?

The diagram may help you.

.....

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

(ii) The **pigment** particles do not fall to the bottom of the can.

Explain why.

.....

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

[Total: 3]

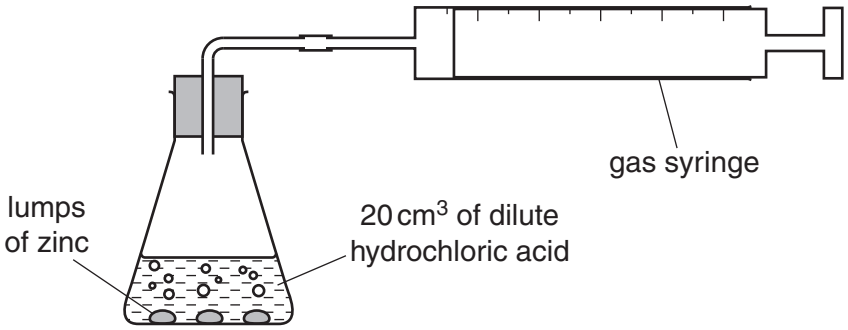
6 Luke and Sophie investigate the reaction between zinc, Zn, and hydrochloric acid, HC*l*.

Zinc chloride, $ZnCl_2$, and hydrogen are made.

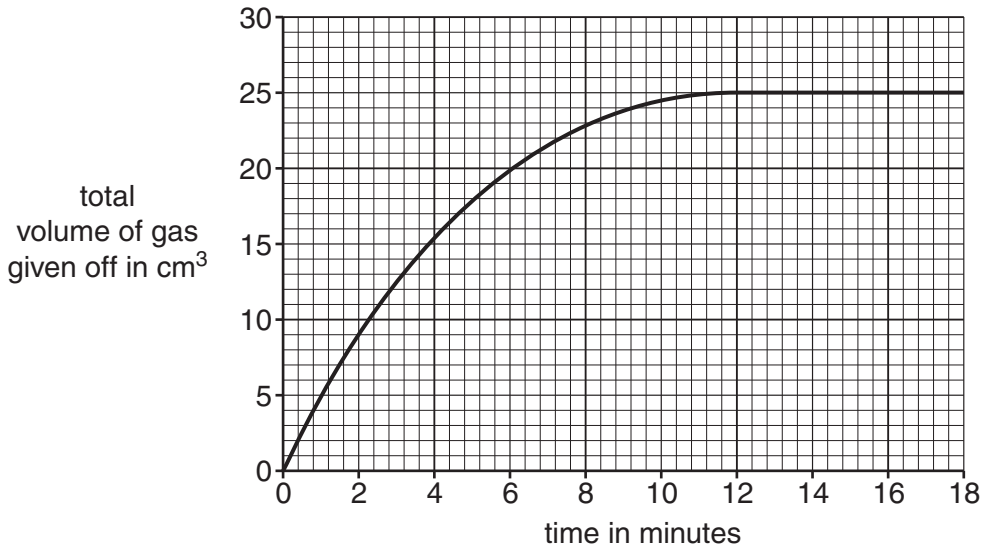
(a) Write down the **balanced symbol** equation for this reaction.

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

(b) The diagram shows the apparatus they use.



Look at the graph of their results.



Write down the time at which the reaction stops.

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

(c) Luke and Sophie do the experiment again.

This time they use **powdered** zinc.

They keep the volume of acid and mass of zinc the same.

Sketch on the **graph** what their new results will look like. **[2]**

[Total: 5]

7 This question is about the air.

(a) Look at the table. It shows some of the gases in clean air.

Complete the table to show the percentages of nitrogen and oxygen in clean air.

gas	percentage in clean air
nitrogen	.....
oxygen	.....
other gases including carbon dioxide	1.0

[1]

(b) The percentages of carbon dioxide and oxygen in the air remain fairly constant.

Photosynthesis and respiration help to keep these fairly constant.

Explain how.

photosynthesis .....

.....

respiration .....

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

(c) The origin of the Earth's atmosphere (air) is not fully known.

Look at the following statements.

They describe 5 possible steps in the formation of the atmosphere.

They are not in the correct order.

A	green plants photosynthesise
B	oxygen and nitrogen levels increase
C	initial atmosphere of carbon dioxide and ammonia
D	water made
E	gases escape from the Earth's crust

Put the steps in the correct order.

The first one has been done for you.

E				

[2]

[Total: 5]

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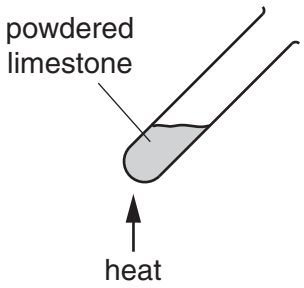
8 The chemical name for limestone is calcium carbonate, $CaCO_3$.

(a) Jim heats some limestone.



Carbon dioxide, CO_2, is made.

Calcium oxide, CaO, remains in the test tube.

Write down the **balanced symbol** equation for this reaction.

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

(b) Limestone is used to make cement. Cement is used to make concrete.

Reinforced concrete is made by allowing concrete to set around a steel support.

Look at the picture. It shows a bridge made of reinforced concrete.

Reinforced concrete is a **better** construction material than non-reinforced concrete.

Explain why.

Use ideas about the properties of steel and concrete.

.....

.....

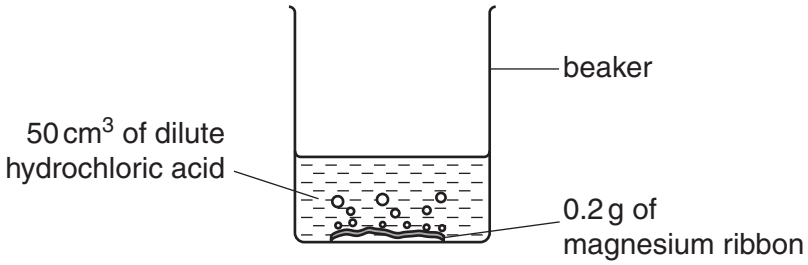
..... **[2]**

[Total: 3]

9 Magnesium reacts with hydrochloric acid.

Ray and Sue investigate this reaction.

Look at the apparatus they use.



They do the experiment four times.

Each time they use

- the same volume of acid
- the same temperature
- the same mass of magnesium.

They time how long it takes for the magnesium ribbon to react.

In each experiment they use a different concentration of hydrochloric acid.

Look at their results.

experiment	reaction time in seconds
A	40
B	60
C	120
D	70

(a) In which experiment was the **concentration** of hydrochloric acid the highest?

Choose **A**, **B**, **C** or **D**.

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

(b) Sue does experiment **C** again.

This time she uses acid at a **higher** temperature.

The reaction goes faster.

Explain why.

Use ideas about collisions between particles.

.....

.....

.....

.....

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

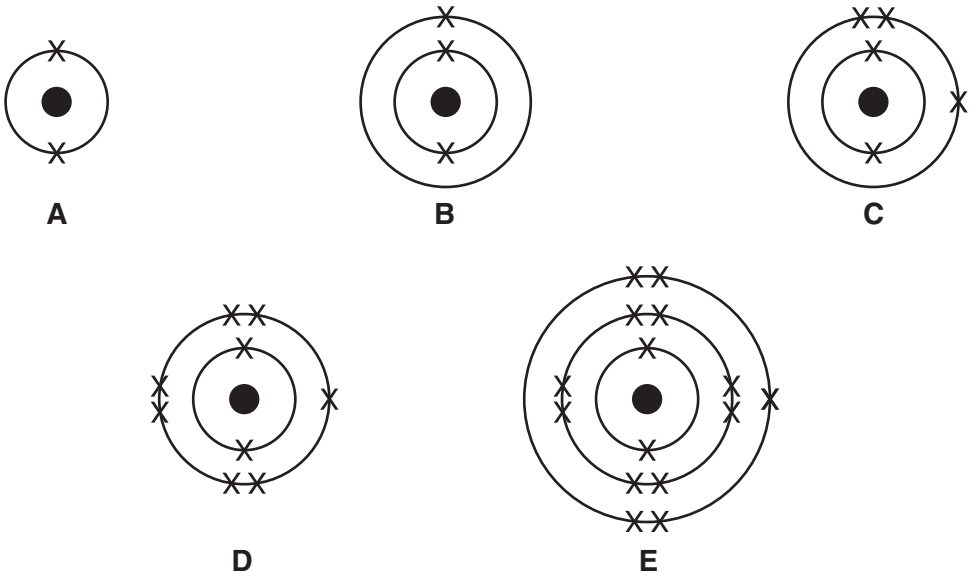
[Total: 4]

Section C – Module C3

10 This question is about atoms.

Look at the diagrams. They show the atoms of some elements.

The letters do not represent the symbols for the elements.



(a) (i) Element **B** is in Group 1.

How can you tell?

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

(ii) Element **E** is in Period 3.

How can you tell?

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

(iii) Which element forms an ion with a charge of –1?

Choose **A**, **B**, **C**, **D** or **E**.

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

(b) The nucleus of an atom contains protons and neutrons.

(i) Complete the table to show the **relative charge** and **relative mass** of a neutron.

	relative charge	**relative mass**
proton	+1	1
neutron	.....	.....

[1]

(ii) There are two common types of chlorine atom, known as **isotopes**.

One isotope is called chlorine-35 and the other is called chlorine-37.

Look at the table.

It shows some information about chlorine-35.

	symbol	**number of protons**	**number of neutrons**	**number of electrons**
chlorine-35	$^{35}_{17}Cl$	17	18	17
chlorine-37				

Complete the table to show information about chlorine-37. **[2]**

[Total: 6]

11 Irene and Bert want to identify the metal in a substance called compound **Z**.

They know compound **Z** contains lithium, sodium or potassium.

They use a flame test.

(a) Write about how they do a flame test.

You may wish to draw a labelled diagram to help your answer.

.....

.....

.....

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

(b) Irene and Bert find out that compound **Z** contains potassium.

Potassium reacts with chlorine.

Write down the **name** of the compound made.

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

(c) Potassium also reacts with water.

Write about what you would **see** when potassium reacts with water.

.....

.....

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

[Total: 5]

12 Iron is a transition element.

Iron(II) sulfate contains iron(II) ions, Fe^{2+}.

Sodium hydroxide solution can be used to test for iron(II) ions.

The iron(II) ions react with OH^- ions from the sodium hydroxide solution.

A precipitate of iron(II) hydroxide, $Fe(OH)_2$, is made.

(a) Write a **balanced ionic** equation for the reaction.

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

(b) Write down the colour of the precipitate of iron(II) hydroxide.

Choose from the list.

blue

lilac

green

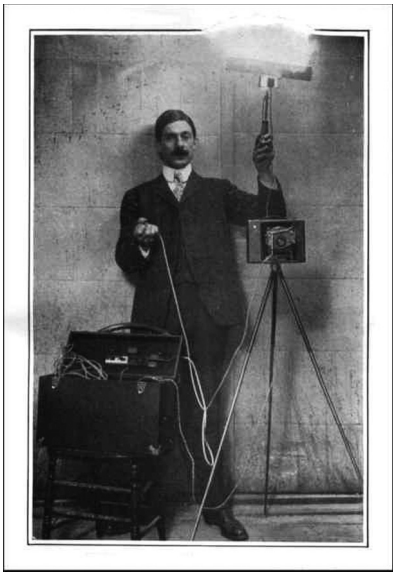
orange

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

[Total: 3]

13 In the late 1800s, photographers burned magnesium to produce a magnesium flashlight.

This was used for indoor photography.



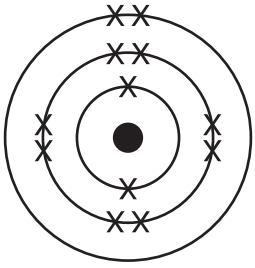
(a) Magnesium burns in oxygen to make magnesium oxide.

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

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

(b) The diagram shows the electronic structure of a magnesium atom.

The atomic (proton) number of magnesium is 12.



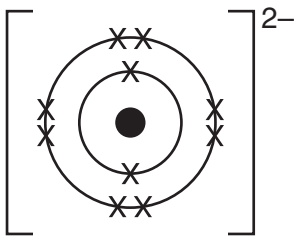
Draw a similar diagram to show the electronic structure of an oxygen atom.

The atomic (proton) number of oxygen is 8.

[1]

(c) When magnesium reacts with oxygen, **magnesium ions** and **oxide ions** are made.

The diagram shows the electronic structure of an oxide ion.



Draw a similar diagram to show the electronic structure of a magnesium ion.

[1]

(d) Magnesium oxide is a white solid with a high melting point.

Explain why magnesium oxide has a high melting point.

.....

.....

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

(e) Sodium oxide is another ionic compound.

Sodium ions, Na^+, combine with oxide ions, O^{2-}, to form sodium oxide.

Write down the **formula** for sodium oxide.

Use the formulas of the ions to help you.

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

[Total: 6]

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.