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Centre number						Candidate number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

A322/01

**TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A**

Unit 2: Modules C4 C5 C6 (Foundation Tier)

WEDNESDAY 19 JANUARY 2011: Morning

DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

**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)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **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).**
- **Answer ALL the questions.**

INFORMATION FOR CANDIDATES

- **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 42.**
- **The Periodic Table is provided.**

Answer ALL the questions.

1 Gemma makes science films for schools.

She is making a film about the reactions of Group 1 elements.

(a) Gemma wants to show the names and symbols of the Group 1 elements.

She includes this table in her film.

(i) Complete the table by filling in the two bits of missing information. [2]

NAME OF ELEMENT	PROTON NUMBER	SYMBOL
_____	11	Na
potassium	19	K
rubidium	37	Rb
caesium	55	_____

(ii) Give the name of another Group 1 element that is NOT shown in the table.

_____ [1]

(b) Gemma films the reactions of Group 1 elements with water.

She adds universal indicator solution to a bowl of water.

The film shows what happens when she drops a small piece of rubidium into the water.

As soon as the rubidium hits the water there is a huge flash and the universal indicator solution turns purple.

The flash happens because a flammable gas is made. It catches fire because the reaction produces a lot of heat.



- (i) What is the name of the gas that is formed in the reaction?

Put a **ring** around the correct answer.

CARBON DIOXIDE

HYDROGEN

NITROGEN

SULFUR DIOXIDE

[1]

- (ii) Why does the universal indicator solution turn purple?

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

The reaction makes an acid.

The rubidium neutralises the water.

An alkali is made.

The temperature increases.

[1]

(c) Gemma makes another film. This time she adds caesium to the water instead of rubidium.

When caesium hits the water, there is an explosion and the glass bowl breaks.

Why do caesium and rubidium react differently with water?

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

Caesium is more reactive than rubidium.

Caesium is not a metal.

Rubidium reacts much faster than caesium.

Caesium has a lower mass than rubidium.

[1]

(d) Gemma then adds a small piece of potassium to a bowl of water that contains universal indicator solution.

(i) Describe what she will see.

Your answer should include

- how the reaction is similar to the reaction of the other Group 1 elements**
- any differences between the reaction of potassium and the other Group 1 elements.**

[3]

(ii) Gemma used a safety screen when she was carrying out these experiments.

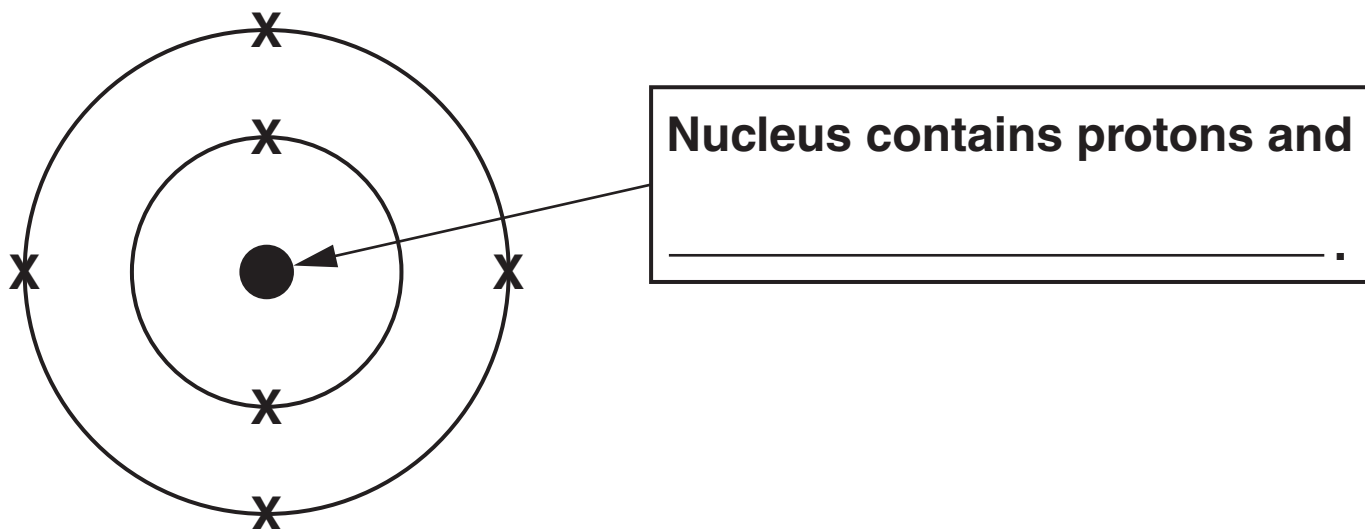
Explain why this was necessary.

[2]

[Total: 11]

2 (a) The diagram shows the structure of an atom of an element in Group 4 of the Periodic Table.

(i) Complete the label on the diagram by filling in the box. [1]



(ii) What is the electronic arrangement of the atom?

Put a **ring** around the correct answer.

6 4.2 2.4 2.2.2

[1]

(iii) How many PROTONS are in the nucleus of the atom?

Put a **ring** around the correct answer.

2 4 6 12

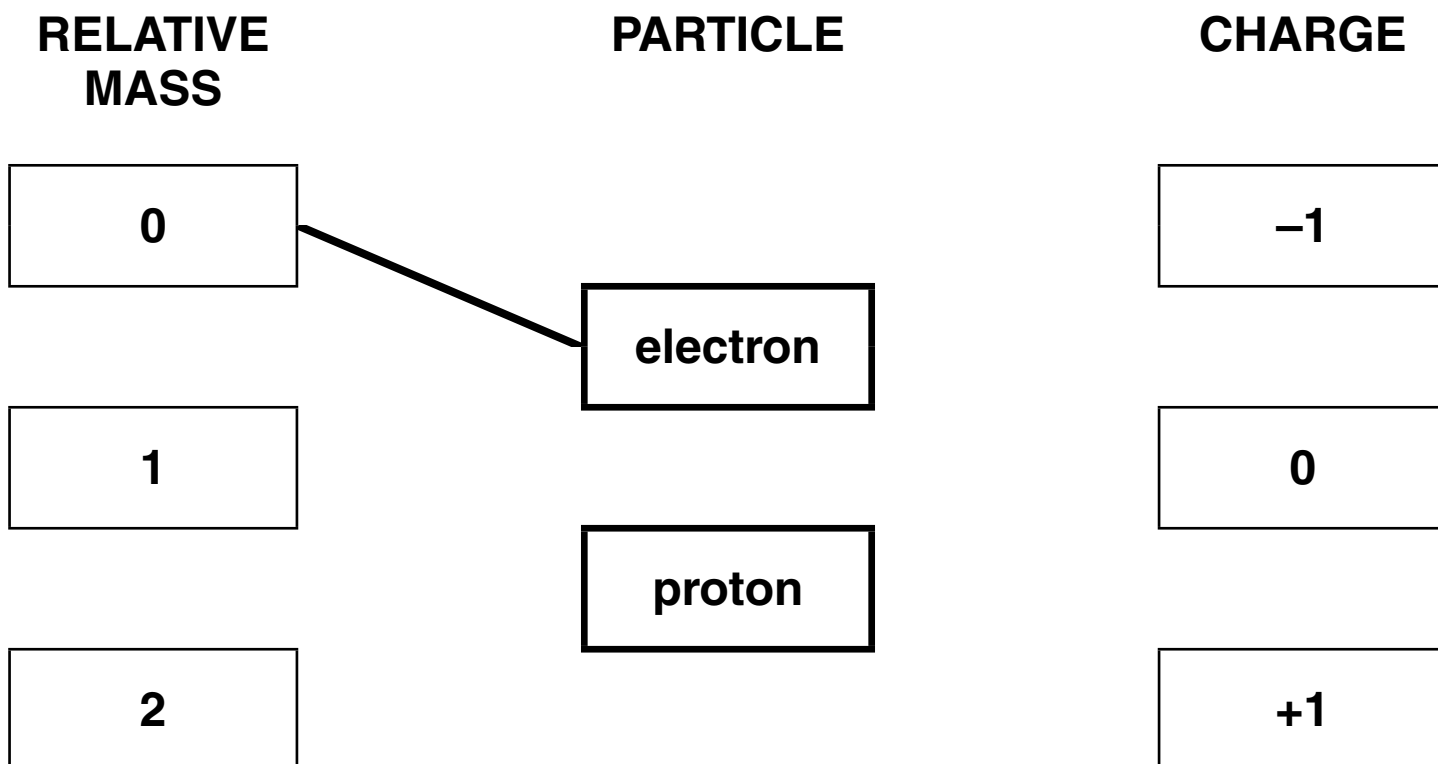
[1]

(b) The atom contains electrons and protons.

Draw straight lines to join each type of **PARTICLE** to its correct **RELATIVE MASS** and correct **CHARGE**.

One line has been drawn for you.

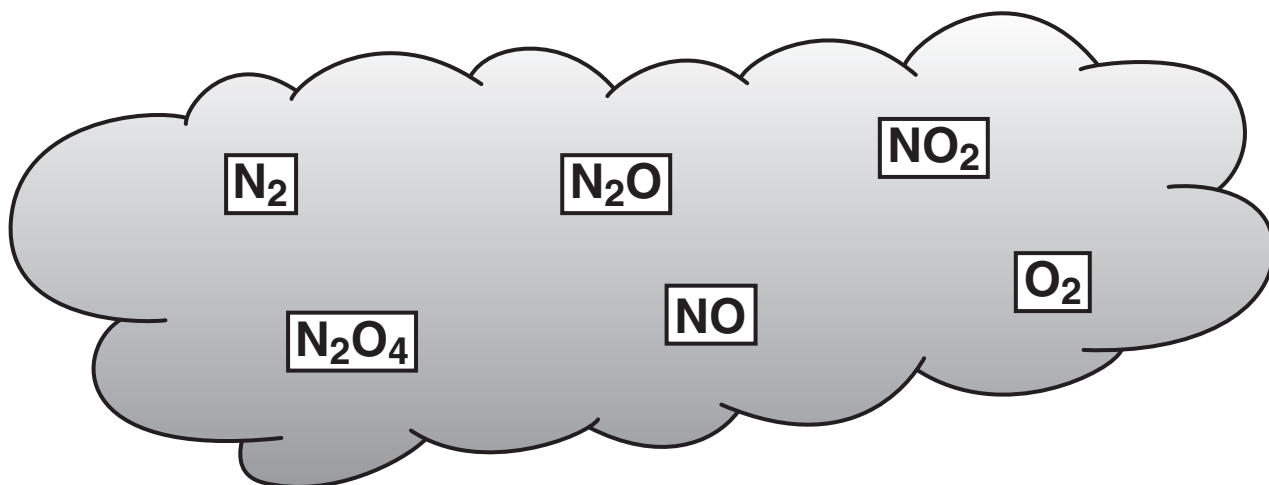
[1]



[Total: 4]

3 Some gases in air contain nitrogen and oxygen atoms.

The formulae of these gases are shown in the boxes.



(a) Which TWO gases are elements?

Put a **ring** around each correct answer.

N_2 N_2O NO_2 N_2O_4 NO O_2 [1]

(b) Which gas molecule contains the largest number of atoms?

Put a **ring** around the correct answer.

N_2 N_2O NO_2 N_2O_4 NO O_2 [1]

(c) Put a **ring** around the correct word to complete each of the following sentences.

The melting points of these gases are

ABOVE / BELOW room temperature.

Their boiling points are **ABOVE / BELOW** room temperature.

Gases in the air have **MOLECULAR / IONIC** structures.

They have **STRONG / WEAK** forces between their molecules. [2]

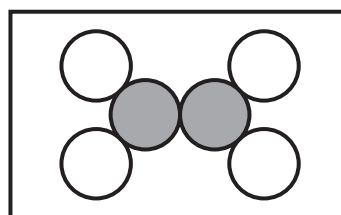
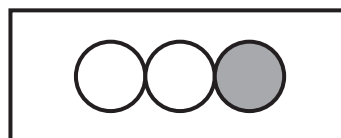
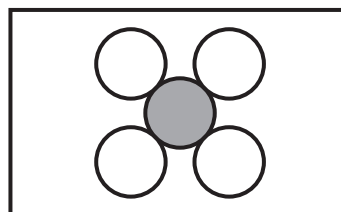
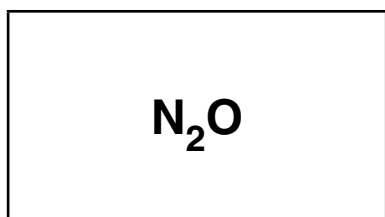
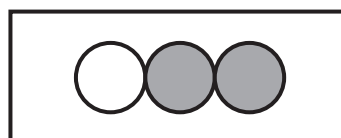
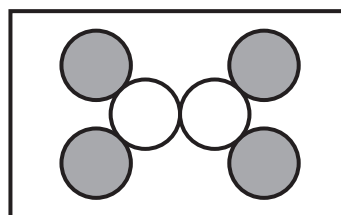
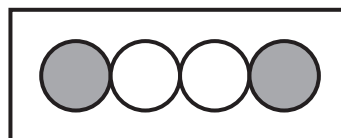
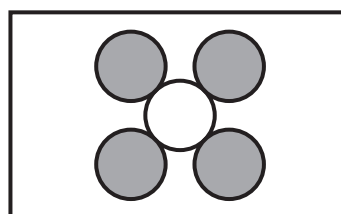
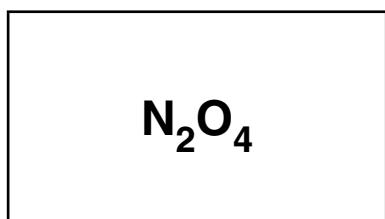
(d) Look at this diagram of a molecule of NO_2 .



Draw straight lines to join each **FORMULA** to the correct **DIAGRAM**. [2]

FORMULA

DIAGRAM



[Total: 6]

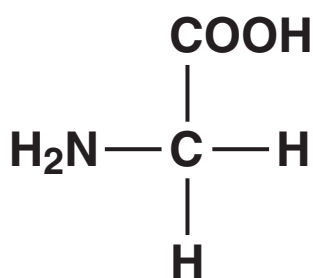
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TURN OVER FOR QUESTION 4

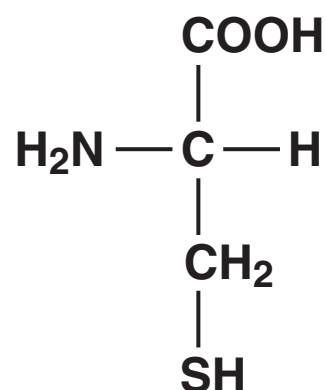
4 Read the information in the box.

MOLECULES IN LIVING THINGS

Molecule A and molecule B are both amino acids. You can see how similar they are by looking at the atoms in their molecules.



MOLECULE A



MOLECULE B

(a) The formula for molecule B is $\text{C}_3\text{H}_7\text{NO}_2\text{S}$.

What is the formula for MOLECULE A?

_____ [2]

(b) Look at the ELEMENTS in molecules A and B.

(i) In what ways are molecules A and B typical of those that come from living things?

_____ [2]

(ii) Write down two DIFFERENCES between molecule A and molecule B.

[2]

(c) Which of the following chemicals are made by living things?

Put a **ring** around each of the TWO correct answers.

CARBOHYDRATES

MINERALS

PROTEINS

QUARTZ

SILICON

[2]

[Total: 8]

5 Joe investigates vinegar.

(a) Joe knows that vinegar is an acid.

One way of showing that vinegar is an acid is by using an indicator.

What else can Joe use to show that vinegar is an acid?

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

iodine

a pH meter

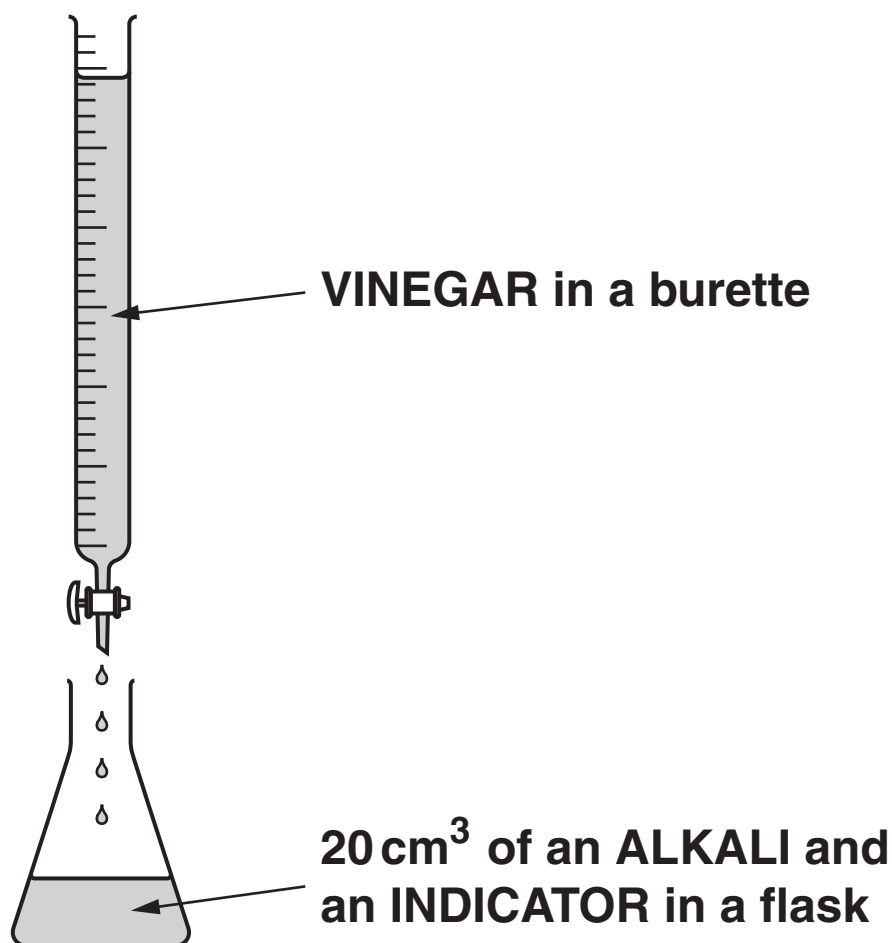
a lighted splint

a burette

limewater

[1]

(b) Joe does a titration to find the concentration of acid in the vinegar.



(i) What chemical could be used as the alkali in the flask?

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

calcium carbonate

sodium chloride

sulfuric acid

sodium hydroxide

[1]

- (ii) Write down a set of instructions to tell Joe how to do the titration.

[3]

- (c) Joe tests vinegar that he collects from different places.

Here is a table showing his results.

	CHIP SHOP VINEGAR	SUPER-MARKET VINEGAR	CAFE VINEGAR	CANTEEN VINEGAR
volume of vinegar that reacts with 20 cm³ alkali	15 cm³	21 cm³	19 cm³	25 cm³

(i) Which vinegar contains the highest concentration of acid?

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

chip shop vinegar

supermarket vinegar

cafe vinegar

canteen vinegar

[1]

- (ii) Joe calculates the concentration of acid in each vinegar.

His first step is to work out the relative formula mass of the acid in the vinegar.

Complete Joe's working to find the relative formula mass of the acid.

Use the Periodic Table to help you to find the missing relative atomic masses. [2]

FORMULA OF ACID COMPOUND		CH₃COOH
RELATIVE ATOMIC MASSES		
carbon, C	=	12
hydrogen, H	=	_____
oxygen, O	=	_____
RELATIVE FORMULA MASS OF CH₃COOH	=	_____

(iii) What other information does Joe need to work out the concentration of the acid in the vinegar?

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

an equation for the reaction

the cost of each bottle of vinegar

the concentration of alkali used

the temperature of the room

the rate of the reaction

[1]

[Total: 9]

6 Old copper coins are often covered with a layer of corrosion.

The corrosion contains copper carbonate.

Sulfuric acid can be used to clean the coin.

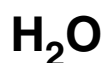
(a) Sulfuric acid reacts with copper carbonate to form a salt and two other products.

(i) What is the NAME of the salt that is formed when sulfuric acid reacts with copper carbonate?

_____ [1]

(ii) What are the formulae of the two OTHER products of the reaction?

Put a ring around each of the TWO correct answers.



[1]

(b) Eve uses sulfuric acid to remove copper carbonate from old coins.

She finds that the rate of reaction is very slow.

How can she speed up the reaction?

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

Add more water to the acid.

Heat the acid.

Add sodium chloride to the acid.

Add an alkali to the acid.

Use a higher concentration of acid.

[2]

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

	1	2	3	4	5	6	7	0										
	7 Li lithium 3	9 Be beryllium 4	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> 1 H hydrogen 1 </div>					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	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	127 I iodine 53	128 Te tellurium 52	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 hasium 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.