

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**GATEWAY SCIENCE**  
**ADDITIONAL SCIENCE B**

Unit 1 Modules B3 C3 P3 (Higher Tier)

**WEDNESDAY 21 MAY 2008**

Afternoon  
Time: 1 hour

Candidates answer on the question paper.

**Additional materials (enclosed):**  
None

Calculators may be used.

**Additional materials:** Pencil  
Ruler (cm/mm)



Candidate  
Forename

Candidate  
Surname

Centre  
Number

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Candidate  
Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- 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 **60**.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Section	Max.	Mark
A	20	
B	20	
C	20	
<b>TOTAL</b>	<b>60</b>	

This document consists of **20** printed pages.

## 2

### EQUATIONS

$$\text{speed} = \frac{\text{distance}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2} mv^2$$

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

Answer **all** the questions.

**Section A – Module B3**

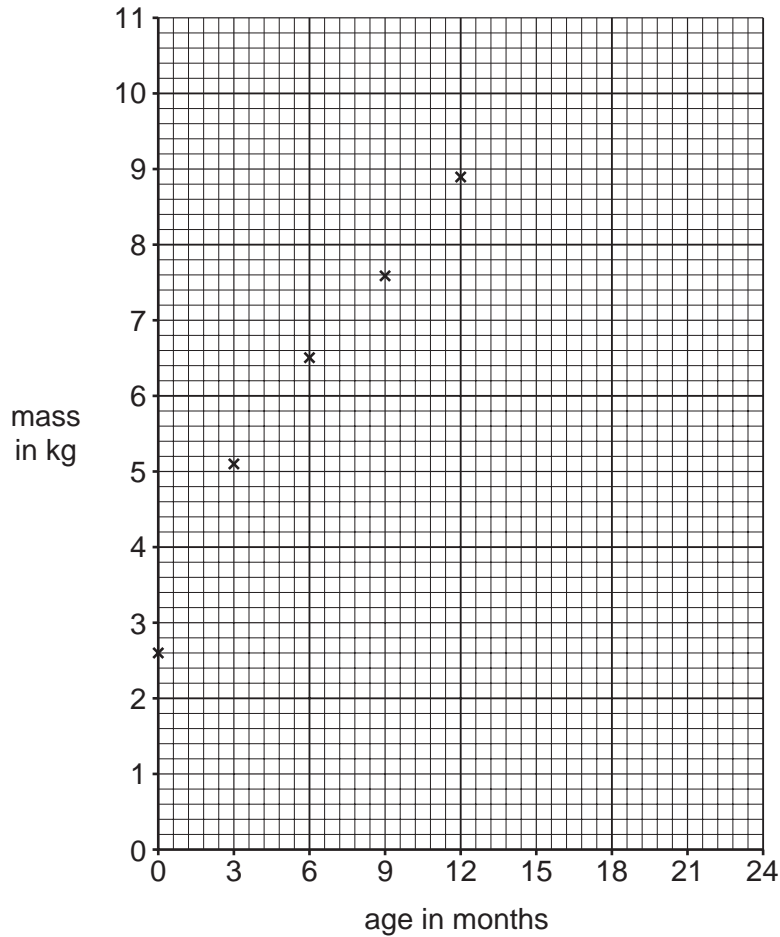
1 (a) Katy is 2 years old.

The table shows how her mass changed as she grew.

<b>age in months</b>	0	3	6	9	12	15	18	21	24
<b>mass in kg</b>	2.6	5.1	6.5	7.6	8.9	9.7	9.9	10.1	10.2

(i) Use the data in the table to complete the graph.

Finish the graph by drawing the best curve through the points.



[2]

(ii) Between which ages did Katy grow at the quickest rate?

..... [1]

(b) It is important to check Katy's mass regularly as she grows.

Explain why.

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

(c) As Katy grows, she produces more body cells.

(i) How are her new body cells produced?

Put a ring around the correct answer.

**fertilisation**

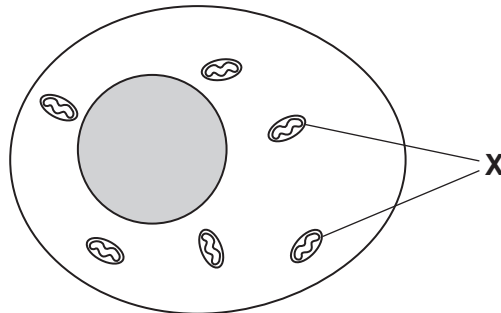
**meiosis**

**mitosis**

**variation**

[1]

(ii) The diagram shows a human body cell.



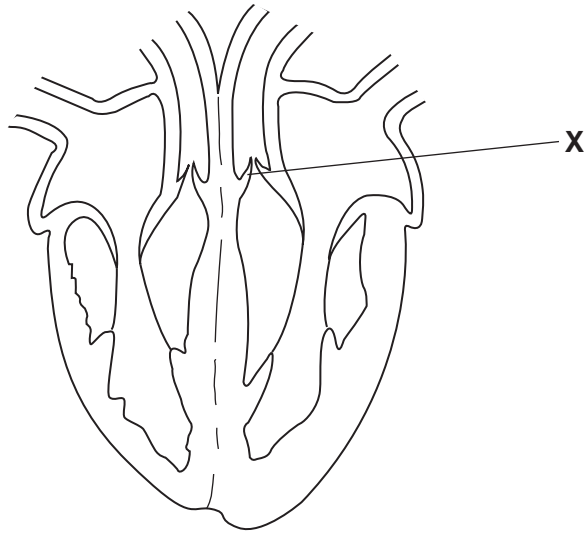
Respiration happens in the parts labelled X.

What is the name of the parts labelled X?

..... [1]

[Total: 6]

2 The diagram shows the heart.



(a) Part X is a valve.

Write down the name of part X.

..... [1]

(b) Arteries do **not** contain valves, but veins do.

Explain why veins need valves.

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

(c) Bob has a problem with his heart.  
One of the valves is **not** working properly.

This affects how his heart works.  
Suggest how.

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

(d) One way of treating heart problems is by heart transplants.  
Another way is by using mechanical replacements for the damaged parts.

Describe **one disadvantage** of heart transplants compared to using mechanical replacements.

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

[Total: 4]

[Turn over

3 Doug grows strawberries.

The diagram shows one of his strawberry plants.



(a) When strawberry plants photosynthesise, carbon dioxide enters the plant.

(i) Write down the name of the process by which carbon dioxide enters the plant.

..... [1]

(ii) Carbon dioxide enters plants through their leaves.

Describe **two** ways leaves are adapted for efficient absorption of carbon dioxide.

1 .....

.....

2 .....

..... [2]

(b) Doug's strawberry plants can reproduce asexually by growing runners.

Doug can also grow new strawberry plants from seeds instead of letting them reproduce asexually.

Suggest **one disadvantage** of growing new strawberry plants from seeds.

.....

..... [1]

(c) Strawberry plants can be damaged by frost.

Doug notices that other species of plants are resistant to frost damage.

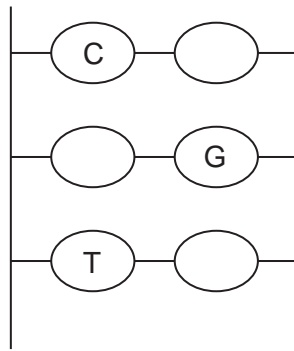
He can **not** transfer frost resistance to his strawberry plants by breeding them with these other species.

How can frost resistance be transferred from one plant species to another?

..... [1]

[Total: 5]

4 (a) The diagram shows some bases in a section of DNA.



**Complete** the diagram by writing in the missing letters. [1]

(b) How does DNA replicate (make copies of itself)?

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

(c) Genes are sections of DNA that code for the production of proteins.

Mutations are changes to genes that can cause them to code for different proteins.

Explain how a change to a section of DNA can lead to a change in the protein it codes for.

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

[Total: 5]

8  
Section B – Module C3

5 This question is about the elements in the Periodic Table.

Look at the list of elements.

- |                  |                  |
|------------------|------------------|
| <b>boron</b>     | <b>bromine</b>   |
| <b>carbon</b>    | <b>copper</b>    |
| <b>gold</b>      | <b>magnesium</b> |
| <b>neon</b>      | <b>oxygen</b>    |
| <b>potassium</b> | <b>sodium</b>    |

Answer the questions.

Choose **all** your answers from the list.

Each element can be used **once, more than once or not at all**.

The Periodic Table on the back page may help you.

(a) Write down the **name** of an element with eight electrons in its outer shell.

..... [1]

(b) Write down the **name** of an element in the **fourth period** of the Periodic Table.

..... [1]

(c) Write down the **name** of an element with an electronic structure of 2.4.

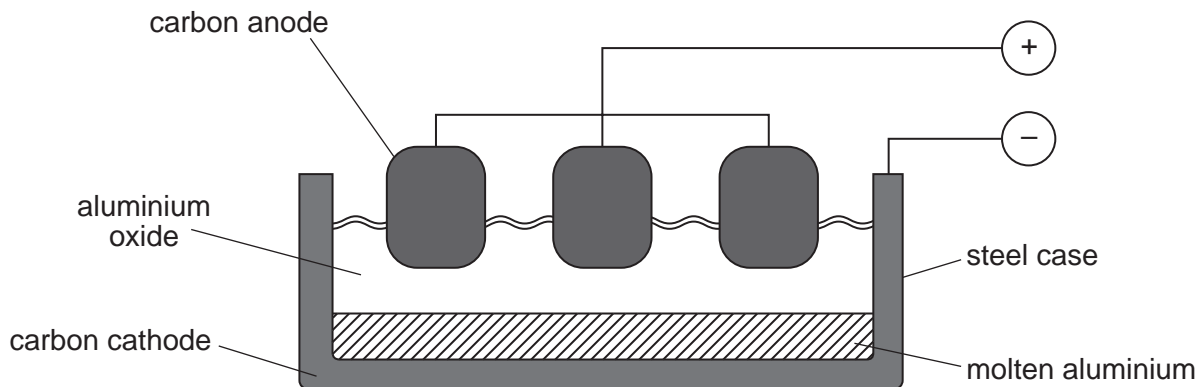
..... [1]

[Total: 3]



6 This question is about the extraction of aluminium.

Look at the diagram. It shows how aluminium is extracted using **electrolysis**.



(a) Complete the table to show what is made at the two electrodes.

electrode	product
anode (positive electrode)	oxygen
cathode (negative electrode)	.....

[1]

(b) The anodes are made of carbon.

They are gradually worn away.

Explain why.

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

(c) The extraction of aluminium is expensive.

Suggest why.

..... [1]

(d) At the anode, oxide ions,  $O^{2-}$ , lose electrons.

Oxygen gas,  $O_2$ , is made.

Write a balanced **symbol** equation for this reaction. Use  $e^-$  to represent an electron.

..... [2]

[Total: 5]

[Turn over

7 This question is about metals.

Copper and iron are metals.

(a) Metals are good conductors of electricity.

Explain how metals conduct electricity.

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

(b) Zoe is choosing a metal to make the bottom of a saucepan.

Write down **one** property a metal must have to be useful for making the bottom of a saucepan.

..... [1]

(c) Metals are good conductors of electricity.

Some metals can be **superconductors**.

(i) Write down **one** advantage of using superconductors.

..... [1]

(ii) Superconductors are expensive to make.

Write down **one** other disadvantage of superconductors.

..... [1]

[Total: 5]

8 The formula for calcium hydroxide is  $\text{Ca(OH)}_2$ .

(a) How many **oxygen** atoms are there in the formula  $\text{Ca(OH)}_2$ ?

..... [1]

(b) What is the **total number** of atoms in the formula  $\text{Ca(OH)}_2$ ?

..... [1]

[Total: 2]

9 This question is about transition elements.

(a) The compounds of the transition elements are often coloured.

Match each transition element to the usual colour of its compounds.

One has been done for you.

transition element	colour of compound
copper	orange/brown
iron(II)	blue
iron(III)	light green

[1]

(b) Roy is investigating the thermal decomposition of copper carbonate.

When copper carbonate is heated, copper oxide and carbon dioxide are made.

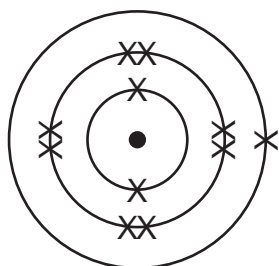
Write the **word** equation for this reaction.

..... [1]

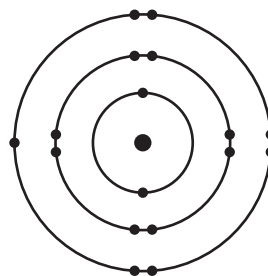
[Total: 2]

10 This question is about chemical bonding.

(a) Look at the diagrams. They show the electronic structures of sodium and of chlorine.



Na 2.8.1.



Cl 2.8.7.

Describe the bonding in **sodium chloride**, NaCl.

Include in your answer

- a dot and cross diagram
- the charges on the ions formed.

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

(b) Another type of bonding involves the sharing of electron pairs between atoms.

Write down the **name** of this type of bonding.

..... [1]

[Total: 3]

Section C – Module P3

11 We use **fossil fuels** to power our cars.

These fuels produce fumes.

(a) Bill's car has a fuel consumption of 8 km per litre.

Bill needs to travel 72 km.

How much fuel will the car use to travel 72 km?

Choose from the list.

8 litres

9 litres

64 litres

72 litres

80 litres

answer ..... [1]

(b) Bill needs a new car.

He thinks about buying an electrically powered car.

(i) Electric cars do not fill up with fossil fuels.

How do electric cars **renew** their supply of energy?

..... [1]

(ii) Electric cars do not produce waste gases when they are driven.

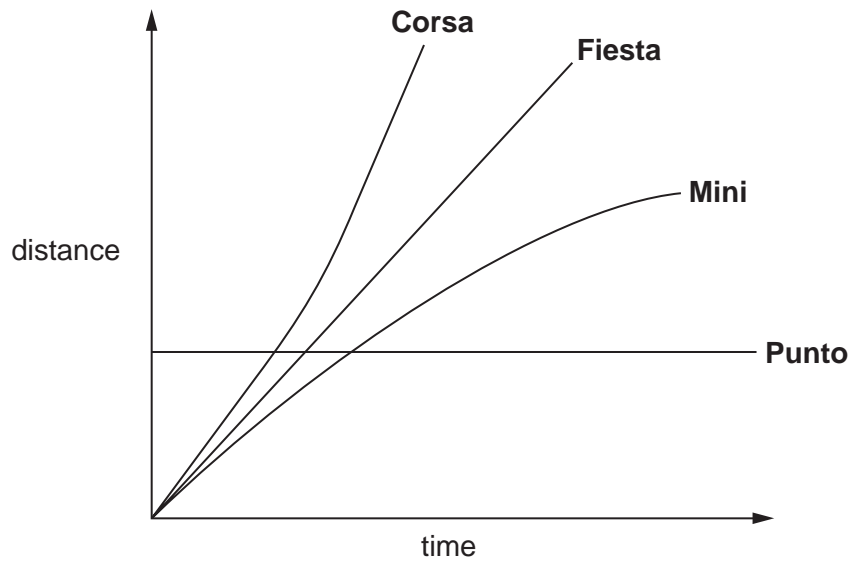
The use of electric cars can still pollute the air.

Suggest how.

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

[Total: 3]

12 Look at the distance-time graphs for the four cars.



(a) Which car has the **highest speed**?

Choose from the list.

- Corsa      Fiesta      Mini      Punto**

answer ..... [1]

(b) The Fiesta travels at a speed of 110 km/h.

How far will it travel in 3 hours?

The equations on page 2 may help you.

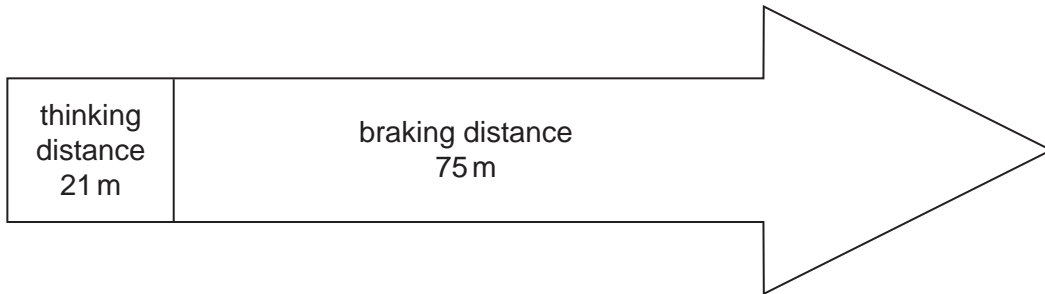
.....  
 .....

answer ..... km [2]

[Total: 3]

13 This question is about force and motion.

(a) Look at the information on stopping distance.



(i) Write down **two** things that can **increase** thinking distance.

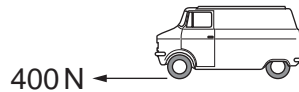
- 1 .....
- 2 ..... [2]

(ii) Bald tyres and poor brakes can increase **braking distance**.

Write down **one** other thing that can increase **braking distance**.

..... [1]

(b) Look at the information in the diagram.



The van moves a distance of 125 m.

The force on the van is 400 N.

Calculate the work done on the van.

The equations on page 2 may help you.

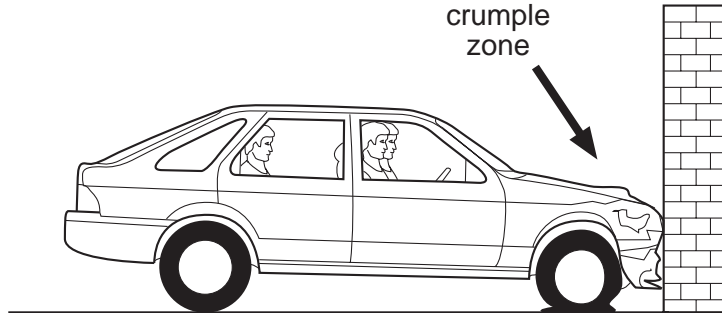
.....  
 .....

answer ..... J [2]

[Total: 5]

14 Cars have safety features to reduce injuries in a crash.

(a) Look at the diagram of the crash.



How does the crumple zone reduce injuries in a crash?

.....

.....

..... [2]

(b) When a car moves faster, it has more **kinetic energy**.

Look at the information in the table.

The braking distance increases with speed.

speed in m/s	braking distance in m
8	6
16	24
32	96

(i) Describe in detail the relationship between speed and the braking distance.

Use the numbers in the table to help you.

.....

.....

..... [1]



(ii) Explain this relationship in terms of kinetic energy.

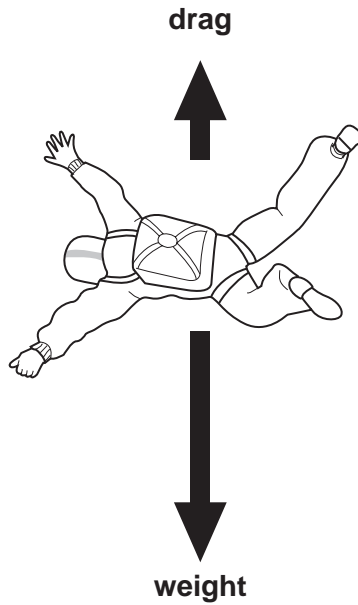
The equations on page 2 may help you.

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

[Total: 5]

15 Jane has a parachute.  
She jumps from an aeroplane.  
At first, her speed increases.

(a) Look at the diagram.



(i) What happens to the drag force as she accelerates?

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

(ii) Eventually she reaches terminal speed.

Explain why she reaches terminal speed.

Write about **forces** in your answer.

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

(b) At terminal speed, Jane has kinetic energy.

As she falls, her potential energy gets **less**.

(i) Explain what happens to this potential energy.

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

(ii) Describe what happens to the **kinetic energy** at terminal speed.

Choose from the list.

**becomes zero**

**remains constant**

**decreases**

**increases**

answer ..... [1]

[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 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">                     1 <b>H</b> hydrogen 1                 </div>					19 <b>F</b> fluorine 9	4 <b>He</b> helium 2									
	23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">                     relative atomic mass atomic symbol atomic (proton) number                 </div>					16 <b>O</b> oxygen 8	20 <b>Ne</b> neon 10									
	39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20	45 <b>Sc</b> scandium 21	48 <b>Ti</b> titanium 22	51 <b>V</b> vanadium 23	52 <b>Cr</b> chromium 24	55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26	59 <b>Co</b> cobalt 27	59 <b>Ni</b> nickel 28	63.5 <b>Cu</b> copper 29	65 <b>Zn</b> zinc 30	70 <b>Ga</b> gallium 31	73 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36
	85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	91 <b>Zr</b> zirconium 40	93 <b>Nb</b> niobium 41	96 <b>Mo</b> molybdenum 42	[98] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	115 <b>In</b> indium 49	119 <b>Sn</b> tin 50	122 <b>Sb</b> antimony 51	128 <b>Te</b> tellurium 52	127 <b>I</b> iodine 53	131 <b>Xe</b> xenon 54
	133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	197 <b>Au</b> gold 79	201 <b>Hg</b> mercury 80	204 <b>Tl</b> thallium 81	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	[209] <b>Po</b> polonium 84	[210] <b>At</b> astatine 85	[222] <b>Rn</b> radon 86
	[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[268] <b>Mt</b> meitnerium 109	[277] <b>Hs</b> hasium 108	[268] <b>Ds</b> darmstadtium 110	[271] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated							

\* 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.