

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

B621/02

Unit 1 Modules B1 C1 P1 (Higher Tier)

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)

**Thursday 13 January 2011
Morning**

Duration: 1 hour



| | | | |
|--------------------|--|-------------------|--|
| Candidate forename | | Candidate surname | |
|--------------------|--|-------------------|--|

| | | | | | | | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre number | | | | | | Candidate number | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|

MODIFIED LANGUAGE

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. 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.
- 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.
- A list of physics equations is printed on page two.
- 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.

EQUATIONS

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{fuel energy input} = \text{waste energy output} + \text{electrical energy output}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{energy (kilowatt hours)} = \text{power (kW)} \times \text{time (h)}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

BLANK PAGE

Question 1 begins on page 4.

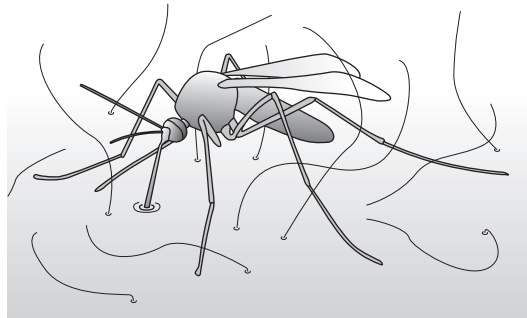
PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module B1

1 This question is about a disease called malaria.

Mosquitoes spread malaria.



(a) (i) Microscopic protozoa called *Plasmodium* cause malaria. They live in human blood.

Mosquitoes carry *Plasmodium* from human to human.

Draw straight lines to connect each **organism** to its **role** in the spread of malaria.

| organism | role |
|-------------------|-------------|
| human | vector |
| <i>Plasmodium</i> | host |
| mosquito | parasite |

[2]

(ii) How do mosquitoes spread malaria from one human to another?

.....
 [1]

(b) Malaria causes a fever.

During a fever the body temperature is very high and this may cause death.

How can a high body temperature cause death?

..... [1]

(c) A drug called quinine can control *Plasmodium*.

Quinine binds to *Plasmodium* DNA.

(i) DNA contains chemicals called bases.

How many different types of base are found in DNA?

.....

[1]

(ii) The spread of malaria can be reduced by blocking the life cycle of mosquitoes.

Female mosquitoes feed on human blood when producing eggs.

The eggs can be laid in stagnant water.

Use this information to suggest **two** ways of reducing the spread of malaria.

1

.....

2

..... [2]

[Total: 7]

2 Look at the picture of lasu.



He is five years old and lives in an African country called Ethiopia.

lasu suffers from a disorder called kwashiorkor.

He is much smaller than a healthy child of his age.

His diet is missing protein needed for growth.

(a) (i) Proteins from animals are called ‘**first class** proteins’.

Explain why first class proteins are important in balanced diets.

..... [1]

(ii) The recommended daily average (RDA) intake for protein can be calculated.

lasu has a body mass of 16.0 kg.

Calculate lasu’s RDA intake for protein using the formula

$$\text{RDA in g} = 0.75 \times \text{body mass in kg}$$

Show your working.

.....
.....

lasu’s RDA = g [1]

(b) Sickle cell anaemia is another disorder that occurs in Africa.

Sickle cell anaemia is caused by a **mutation**.

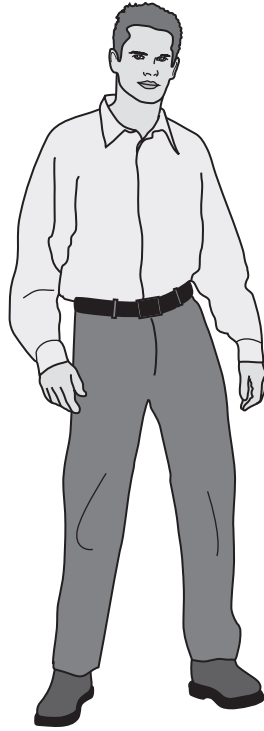
What is a mutation?

..... [1]

[Total: 3]

3 Look at the picture of Steve.

He has many different characteristics.



(a) (i) Steve is **1.90 m** tall and has a mass of **89.0 kg**.

Steve's height and mass can be used to calculate his body mass index (BMI).

Calculate Steve's body mass index (BMI) using the formula

$$\text{BMI} = \frac{\text{mass in kg}}{(\text{height in m})^2}$$

Show your working.

.....
.....

Steve's BMI = [2]

(ii) People with a BMI in the range of 18.5 to 25 are described as being **normal**.

What word is used to describe someone with a BMI below 18.5?

..... [1]

(b) Steve's genes control many of his characteristics including eye colour, blood group and skin colour.

The information for these characteristics is stored in his DNA.

How does DNA **control** the function of cells?

.....

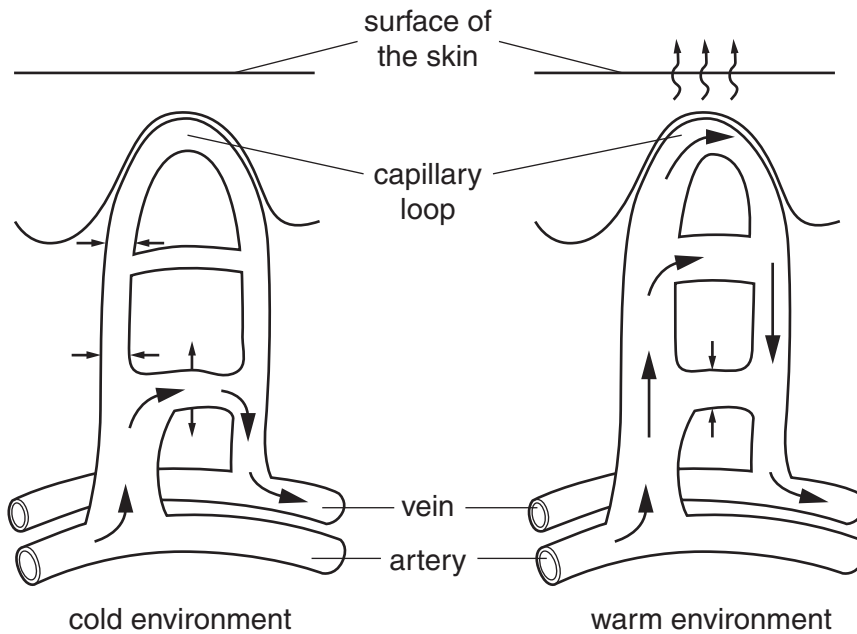
.....

..... [2]

[Total: 5]

4 This question is about controlling body temperature.

Look at the diagram.



The diagram shows changes in the skin when the body is in different environments.

(a) These changes help people cool down if they are getting too warm.

Describe how.

In your answer include

- how the blood vessels change
- how these changes help the body cool down.

.....

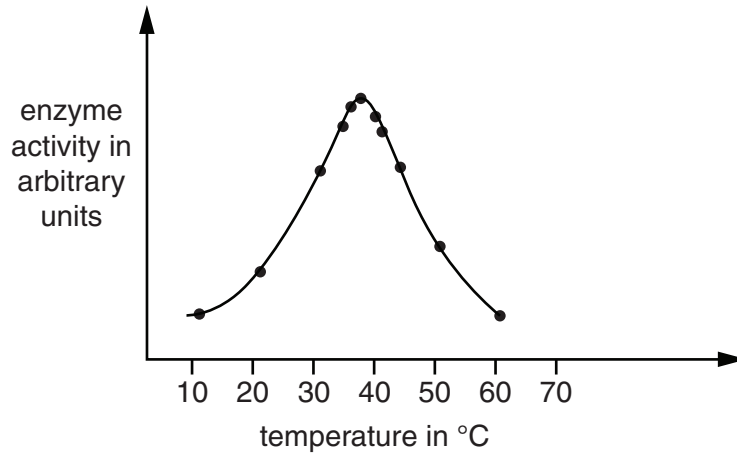
.....

.....

[2]

(b) Body cells contain important substances called enzymes.

Look at the graph.



It is important to keep body temperature close to 37°C.

Explain why.

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

(c) Sometimes the body temperature is **higher than normal**.

How does the brain detect that the body temperature is higher than normal?

..... [1]

(d) The control of body temperature is an example of **negative feedback**.

What is meant by negative feedback?

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

[Total: 5]

Section B – Module C1

- 5 Look at the food label found on a box of cake-mix.

Ingredients:

Wheat flour, Cane juice, Sugar, Vanilla flavouring, Sodium hydrogencarbonate, Cornstarch, Sea salt, Citric acid (E300)

The cake-mix contains sodium hydrogencarbonate.

The sodium hydrogencarbonate makes the cake rise.

Sodium hydrogencarbonate breaks down when heated.

Sodium carbonate, carbon dioxide and water are made.

- (a) (i) Write a **word** equation for this reaction.

..... [1]

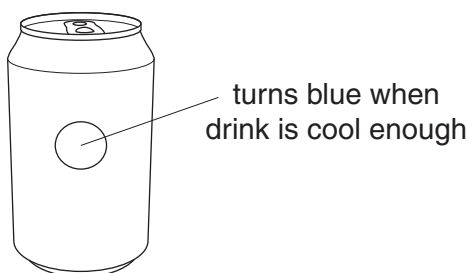
- (ii) Carbon dioxide is made in this reaction.

What is the chemical test for carbon dioxide?

test

result [2]

- (b) Some soft drinks in cans taste better if they are cooled.



The spot on the can turns blue when the drink is cold.

This can uses a new type of packaging.

What is the name of this **type** of packaging?

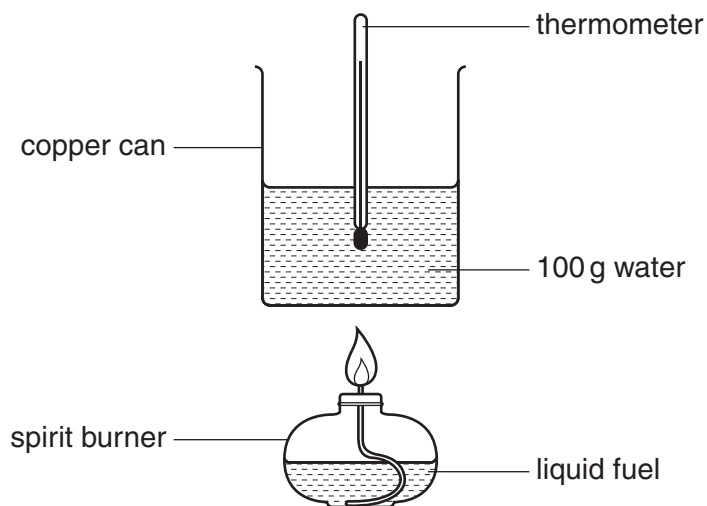
..... [1]

[Total: 4]

6 Zoe and Olivia test three fuels.

Look at the diagram.

It shows the apparatus they use to measure the energy given out by the fuels.



(a) Look at the table. It shows their results.

| fuel | temperature of water at start in °C | temperature of water at end in °C | mass of fuel burned in grams |
|----------|-------------------------------------|-----------------------------------|------------------------------|
| meths | 18 | 38 | 1.1 |
| propanol | 22 | 42 | 0.9 |
| petrol | 16 | 36 | 0.6 |

Which fuel gives out the **most** energy for each gram of fuel used?

.....

Explain your answer.

.....

..... [3]

(b) Look at the results for petrol.

Burning 0.6 g of petrol transfers 8400J of energy.

Calculate the energy transferred **per gram** of petrol.

.....

.....

answer J/g

[1]

(c) When petrol burns, some bonds are broken and new bonds are made.

Burning petrol is an exothermic reaction.

Explain why. Use ideas about breaking and making bonds.

.....

.....

.....

.....

.....

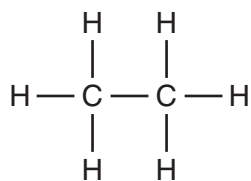
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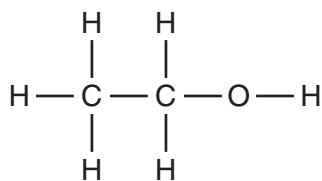
..... [3]

[Total: 7]

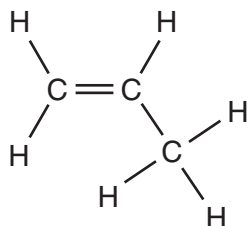
7 Look at the displayed formulas of some compounds.



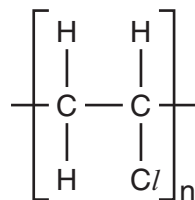
ethane



ethanol



propene



poly(chloroethene)

(a) Propene is an **unsaturated** hydrocarbon.

(i) What does unsaturated mean?

..... [1]

(ii) Bromine water can be used to test for unsaturation.

Bromine water is added to the hydrocarbon.

What would you **see** when bromine water is added to an unsaturated hydrocarbon?

..... [1]

(b) Poly(chloroethene) is a polymer. It is made by **polymerisation**.

(i) What are the conditions needed for polymerisation?

.....

 [2]

(ii) Draw the displayed formula of the **monomer**, chloroethene.

[1]
 [Total: 5]

Turn over

8 Look at the table. It shows information about some fuels.

| fuel | energy value in megajoules per kg | availability | cost in £ per kg | state |
|------|-----------------------------------|--------------|------------------|--------|
| A | 48.0 | good | £1.30 | liquid |
| B | 49.0 | limited | £0.80 | liquid |
| C | 89.5 | good | £0.33 | solid |
| D | 37.0 | good | £1.30 | gas |

(a) Which fuel is best for powering a car?

.....

Explain your answer.

.....

.....

..... [2]



(b) Methane, CH₄, is a fuel.

Methane burns in oxygen, O₂.

Carbon dioxide and water are made.

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

..... [2]

[Total: 4]

Section C – Module P1

9 Britain is going digital.



(a) Television signals are changing from **analogue** to **digital**.

Draw labelled diagrams to show the difference between analogue and digital signals.

analogue signal

digital signal

[2]

(b) Digital signals allow more information to be transmitted.

Describe how this is possible.

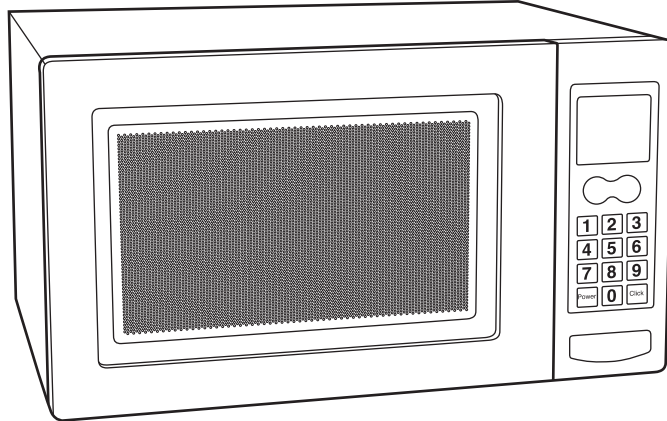
.....

..... [1]

[Total: 3]

10 Microwaves have many uses.

(a) Microwaves are used to cook food.



Look at the statements about microwaves.

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

statement

Microwaves do not pass through glass and plastic.

Microwaves are reflected by glass and plastic surfaces.

Microwaves are reflected by metal surfaces.

Microwaves cook from the centre of the food.

Microwaves penetrate about one centimetre into the food.

[2]

(b) Microwaves are also used to transmit mobile phone signals.

It is not always easy to receive a good signal.



Write down one way in which mobile phone companies try to **avoid** signal loss.

.....

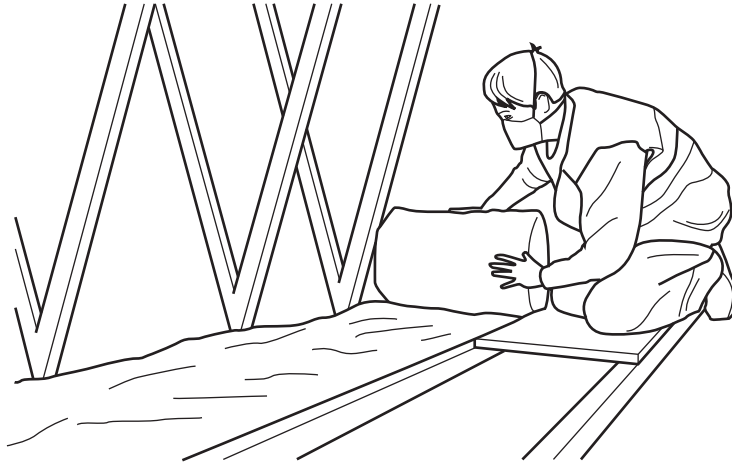
..... [1]

[Total: 3]

11 Houses can be insulated in different ways.

(a) Marie has fibreglass put in her loft.

This reduces energy loss.



(i) Explain why fibreglass reduces energy loss by **conduction**.

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

(ii) Marie pays £250 for the fibreglass in her loft.

She will save £50 every year on her energy bills.

Calculate the payback time.

.....
.....

answer years

[1]

(b) Cavity wall insulation helps to reduce energy loss by **convection**.

Describe **how energy is transferred** by convection.

In your answer, use ideas about

- density
- air movement.

A diagram may help your answer.

.....

.....

..... [2]

[Total: 5]

12 (a) Diane wants to get a sun tan.



(i) Diane uses sun block to protect herself from the sun.

She knows that she can safely spend 15 minutes in the sun without sun block.

She uses sun block with a sun protection factor (SPF) of 20.

How many minutes can she safely spend in the sun using this sun block?

.....
.....

answer minutes [1]

(ii) Diane's friend, James, has darker skin than Diane.

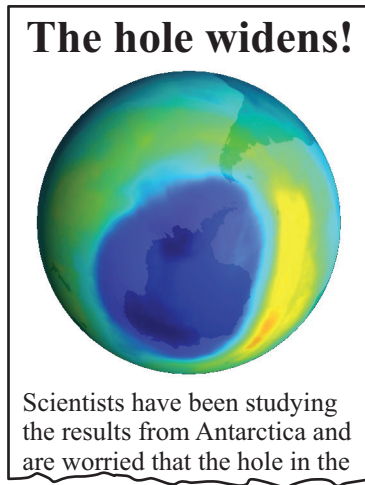
Because of this he has **less** chance of getting skin cancer.

Explain why.

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

(b) Some scientists are worried about part of our atmosphere becoming thinner.

Newspapers have dramatic headlines.



(i) Which part of our atmosphere causes scientists to be worried?

..... [1]

(ii) What does this layer do?

..... [1]

(iii) What causes the layer to become thinner?

..... [1]

[Total: 5]

13 This question is about uses of light.

(a) The picture shows Sheila using a signalling lamp.



Light messages must be sent using a code.

Describe how light signals are used to send messages in Morse code.

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

(b) CD players use laser light to extract information from a compact disc (CD).

(i) How does a CD store information?

..... [1]

(ii) How is the information recovered using laser light?

..... [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 | Li lithium 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Be beryllium 4 | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> 1 H hydrogen 1 </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Key relative atomic mass atomic symbol name atomic (proton) number </div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | Na sodium 11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | Mg magnesium 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 39 | K potassium 19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | Ca calcium 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 85 | Rb rubidium 37 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 88 | Sr strontium 38 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 133 | Cs caesium 55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 137 | Ba barium 56 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| [223] | Fr francium 87 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 139 | La* lanthanum 57 | 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 |
| 89 | Y yttrium 39 | [98] | Tc technetium 43 | 91 | Zr zirconium 40 | 93 | Nb niobium 41 | 96 | Mo molybdenum 42 | 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 | 127 | I iodine 53 | 131 | Xe xenon 54 | | | | |
| 178 | Hf hafnium 72 | 186 | Re rhenium 75 | 181 | Ta tantalum 73 | 184 | W tungsten 74 | 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 | [210] | At astatine 85 | [222] | Rn radon 86 | | | | | | |
| [261] | Rf rutherfordium 104 | [264] | Bh bohrium 107 | [271] | Hs hassium 108 | [268] | Mt meitnerium 109 | [274] | Ds darmstadtium 110 | [272] | Rg roentgenium 111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated | | | | | | | | | | | | | | | | | | | | | |
| [226] | Ra radium 88 | [227] | Ac* actinium 89 | [266] | Sg seaborgium 106 | [262] | Db dubnium 105 | [261] | Rf rutherfordium 104 | | | | | | | | | | | | | | | | | | | | | | | | |

* 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.