

GENERAL CERTIFICATE OF SECONDARY EDUCATION
GATEWAY SCIENCE
SCIENCE B

Unit 1 Modules B1 C1 P1 (Higher Tier)

B621/02



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	
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Centre number							Candidate number				
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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

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

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

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

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

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

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

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

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

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Question 1 begins on page 4.

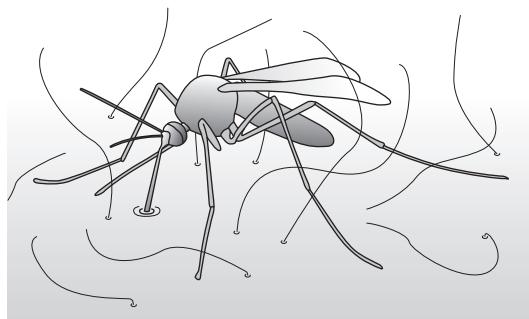
PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module B1

- 1** This question is about a disease called malaria.

Malaria is spread by mosquitoes.



- (a) (i)** Malaria is caused by microscopic protozoa called *Plasmodium* living in human blood.

Plasmodium is carried from human to human by mosquitoes.

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) *Plasmodium* can be controlled by a drug called quinine.

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 Iasu.



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

Iasu 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.

Iasu has a body mass of 16.0 kg.

Calculate Iasu's RDA intake for protein using the formula

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

Show your working.

.....
.....

Iasu's RDA = g

[1]

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

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

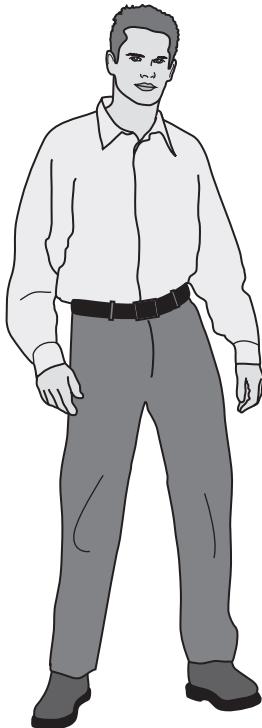
What is a mutation?

..... [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?

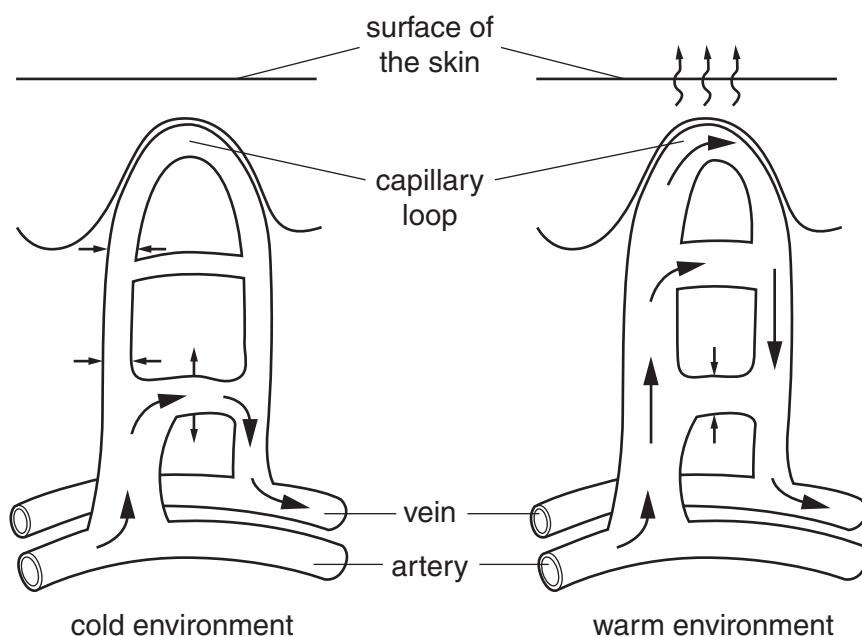
.....
.....
.....

[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

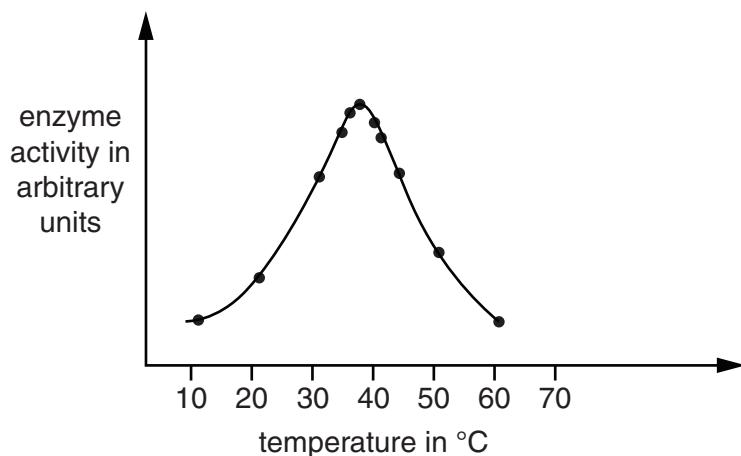
- how the blood vessels change
- how these changes help the body cool down.

.....
.....
.....

[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]

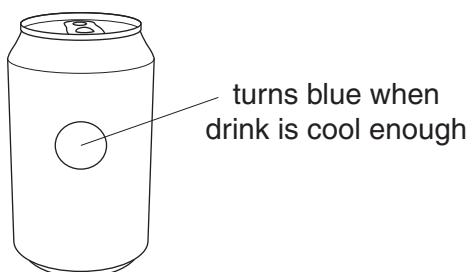
- (ii) Carbon dioxide is made in this reaction.

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?

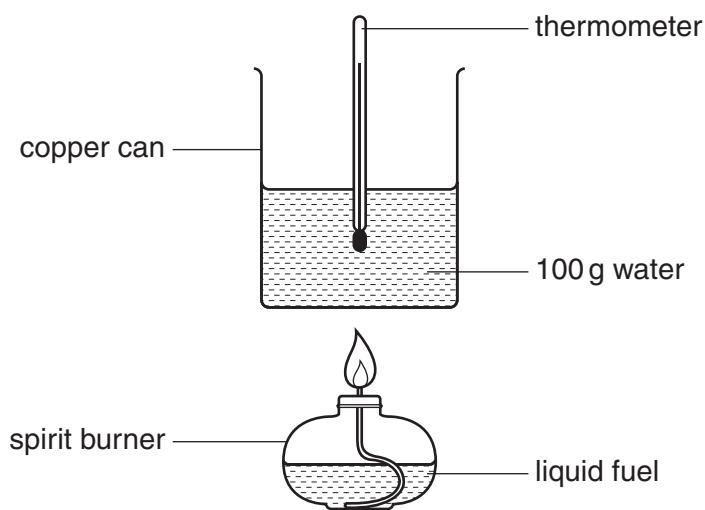
..... [1]

[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 8400 J of energy.

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

.....

answer J/g

[1]

12

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

Burning petrol is an exothermic reaction.

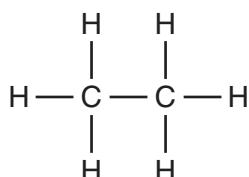
Explain why. Use ideas about breaking and making bonds.

.....
.....
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.....
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.....

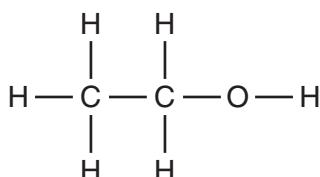
[3]

[Total: 7]

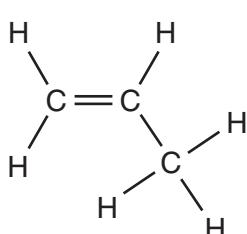
- 7 Look at the displayed formulas of some compounds.



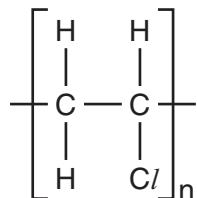
ethane



ethanol



propene



poly(chloroethene)

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

- (i) What is meant by unsaturated?

..... [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.



.....
.....
.....

- (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]

- 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.

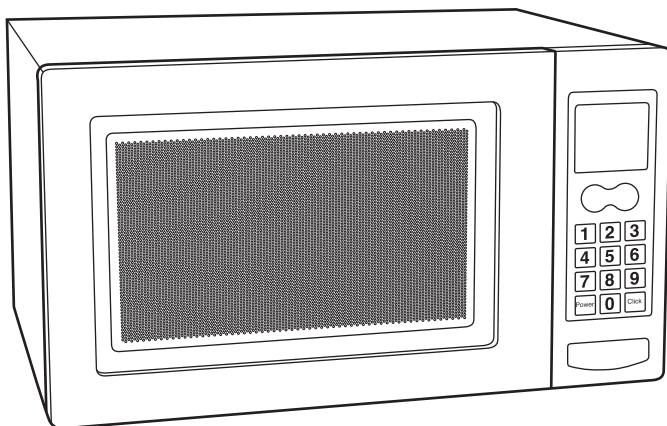
.....
.....

[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.

.....

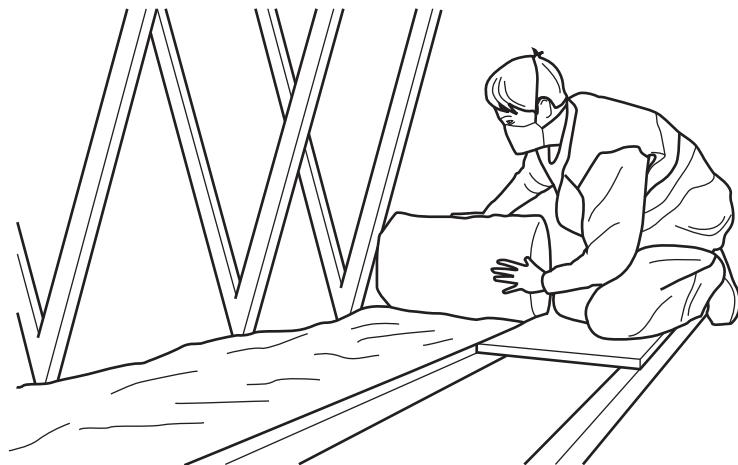
[1]

[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.

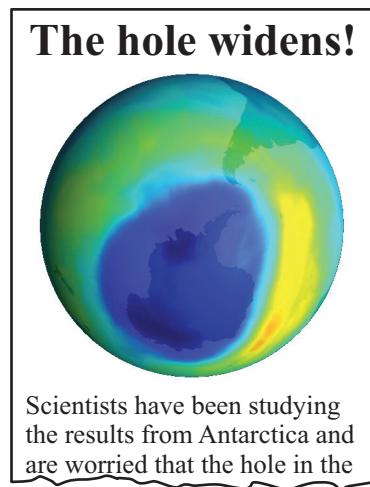
Explain why.

.....
.....

[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

Key	relative atomic mass atomic symbol name atomic (proton) number
1	H hydrogen 1
2	Be beryllium 4
3	Na sodium 11
4	Mg magnesium 12
5	Ca calcium 20
6	Sc scandium 21
7	Li lithium 3
8	Rb rubidium 37
9	Sr strontium 38
10	Y yttrium 39
11	Zr zirconium 40
12	Nb niobium 41
13	Ta tantalum 73
14	Hf hafnium 72
15	Ta* lanthanum 57
16	La* lanthanum 139
17	Cs cesium 55
18	Fr francium 87
19	K potassium 19
20	Ca calcium 40
21	Sc scandium 41
22	Ac* actinium 89
23	Ra radium 88
24	Mg magnesium 39
25	Mn manganese 25
26	Fe iron 26
27	Co cobalt 27
28	Ni nickel 28
29	Cu copper 29
30	Zn zinc 30
31	P phosphorus 31
32	S sulfur 16
33	Cl chlorine 17
34	Se selenium 34
35	Br bromine 35
36	Xe xenon 54
37	Rn radon 86
38	He helium 2
39	Ar argon 18
40	Ne neon 10
41	F fluorine 9
42	O oxygen 8
43	N nitrogen 7
44	C carbon 6
45	B boron 5
46	Al aluminium 13
47	Si silicon 14
48	Ga gallium 31
49	In indium 49
50	Tl thallium 81
51	V vanadium 23
52	Cr chromium 24
53	Mn manganese 25
54	Fe iron 26
55	Mn manganese 55
56	Fe iron 56
57	Ru ruthenium 44
58	Pd palladium 46
59	Ni nickel 28
60	Ag silver 47
61	Cd cadmium 48
62	Ge germanium 32
63	As arsenic 33
64	Se selenium 34
65	Zn zinc 31
66	Sn tin 50
67	Ge germanium 32
68	As arsenic 33
69	Ge germanium 32
70	Ga gallium 31
71	Ge germanium 32
72	As arsenic 33
73	Ge germanium 32
74	Ir iridium 77
75	As arsenic 33
76	Os osmium 76
77	Ir iridium 77
78	Pt platinum 78
79	Hg mercury 80
80	Po polonium 84
81	Tl thallium 81
82	Pb lead 82
83	Bi bismuth 83
84	At astatine 85
85	[222] Rn radon 86
86	[210] At astatine 85
87	[222] Rn radon 86
88	[210] At astatine 85
89	[222] Rn radon 86
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106	[210] At astatine 85
107	[222] Rn radon 86
108	[210] At astatine 85
109	[222] Rn radon 86
110	[210] At astatine 85
111	[222] Rn radon 86

0	4 He helium 2	3	4	5	6	7	0
11	B boron 5	12	C carbon 6	14	N nitrogen 7	16	O oxygen 8
27	Si silicon 14	31	P phosphorus 15	32	S sulfur 16	35.5	Cl chlorine 17
28	Al aluminium 13	31	Si silicon 14	32	Ge germanium 32	35.5	Cl chlorine 17
29	Ge germanium 32	31	As arsenic 33	32	Te tellurium 52	127	I iodine 53
30	In indium 49	31	Sn tin 50	32	Bi bismuth 83	127	I iodine 53
31	Tl thallium 81	32	Ge germanium 32	33	Pb lead 82	209	[209] Po polonium 84
32	Ge germanium 32	33	As arsenic 33	34	Te tellurium 52	209	[209] Po polonium 84
33	Sn tin 50	34	Ge germanium 32	35	Bi bismuth 83	209	[209] Po polonium 84
34	Ge germanium 32	35	As arsenic 33	36	I iodine 53	131	Xe xenon 54
35	Ge germanium 32	36	Ge germanium 32	37	Te tellurium 52	127	I iodine 53
36	Ge germanium 32	37	As arsenic 33	38	Bi bismuth 83	209	[209] Po polonium 84
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99	As arsenic 33	100	As arsenic 33	101	As arsenic 33	209	[209] Po polonium 84
100	As arsenic 33	101	As arsenic 33	102	As arsenic 33	209	[209] Po polonium 84
101	As arsenic 33	102	As arsenic 33	103	As arsenic 33	209	[209] Po polonium 84
102	As arsenic 33	103	As arsenic 33	104	As arsenic 33	209	[209] Po polonium 84
103	As arsenic 33	104	As arsenic 33	105	As arsenic 33	209	[209] Po polonium 84
104	As arsenic 33	105	As arsenic 33	106	As arsenic 33	209	[209] Po polonium 84
105	As arsenic 33	106	As arsenic 33	107	As arsenic 33	209	[209] Po polonium 84
106	As arsenic 33	107	As arsenic 33	108	As arsenic 33	209	[209] Po polonium 84
107	As arsenic 33	108	As arsenic 33	109	As arsenic 33	209	[209] Po polonium 84
108	As arsenic 33	109	As arsenic 33	110	As arsenic 33	209	[209] Po polonium 84
109	As arsenic 33	110	As arsenic 33	111	As arsenic 33	209	[209] Po polonium 84

Elements with atomic numbers 112-116 have been reported but not fully authenticated