

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A**

A322/02

Unit 2: Modules C4 C5 C6
(Higher Tier)

**Wednesday 24 June 2009
Morning**

Duration: 40 minutes

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)



| | | | |
|--------------------|--|-------------------|--|
| Candidate Forename | | Candidate Surname | |
|--------------------|--|-------------------|--|

| | | | | | | | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre Number | | | | | | Candidate Number | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use 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, however additional paper may be used if necessary.

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**.
- This document consists of **20** pages. Any blank pages are indicated.
- The Periodic Table is printed on the back page.

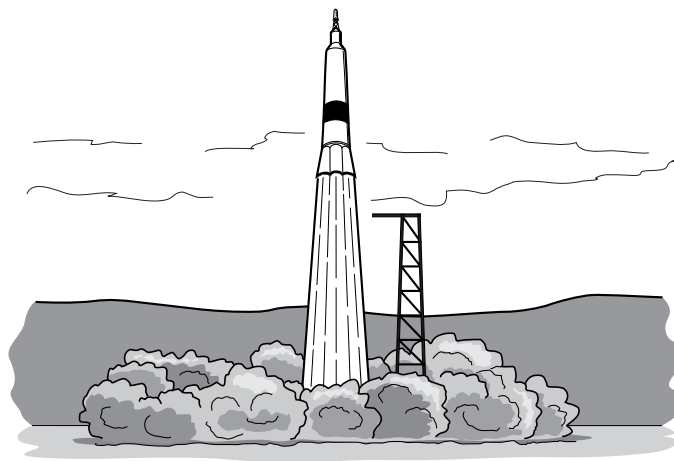
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PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

- 1 Lithium is an element in Group 1.

It can be added to rocket fuel to give an extra boost for take off.



- (a) Lithium works well in rocket fuels because it is very reactive.

Which of the following statements about the reactivity of lithium are **true** and which are **false**?

Put ticks (✓) in the correct boxes.

| | true | false |
|---|------|-------|
| Lithium reacts with cold water. | | |
| Lithium reacts with other group 1 elements to form compounds. | | |
| Lithium tarnishes in moist air more quickly than potassium. | | |
| Lithium chloride is very unstable. | | |

[2]

- (b) When the fuel burns, the lithium also burns.

Complete the balanced symbol equation to show what happens when lithium burns.

word equation lithium + oxygen → lithium oxide

balanced symbol equation + → 2Li₂O [2]

[Total: 4]

2 Iodine solution can be used as a treatment for cuts.



(a) Solid iodine is used to make iodine solution.

Solid iodine is kept in sealed jars because it easily changes into iodine gas.

Iodine gas is very harmful to people.

(i) Draw straight lines to show the correct **colour** for solid iodine and for iodine gas.

| | |
|--------------|-----------|
| | dark grey |
| solid iodine | red-brown |
| | orange |
| | purple |
| iodine gas | yellow |
| | green |

[2]

5

(ii) Draw straight lines to show the correct **symbols** for solid iodine and for iodine gas.

| | |
|--------------|--------------------|
| | I(g) |
| solid iodine | I(s) |
| | I(aq) |
| | I ₂ (l) |
| iodine gas | I ₂ (s) |
| | I ₂ (g) |

[2]

(b) Iodine is used on cuts because it stops the cuts from becoming infected.

Which two statements **when put together** explain why iodine stops infection?

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

Iodine is in group 7.

Iodine is a non-metal.

Iodine tablets purify water.

All group 7 elements kill bacteria.

All group 7 elements form negative ions.

[1]

[Total: 5]

3 Astronomers study the light from the outer layers of the Sun during an eclipse.

They use spectroscopes to look at this light.

This is what they see.



(a) Why does the spectrum show a pattern of lines?

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

Light is lost due to the distance from the Sun.

The Sun emits light in a series of flashes.

Different elements in the Sun give out light of different colours.

Planets orbiting the Sun make shadows on its surface.

Elements in the Sun are very hot and so emit light.

[2]

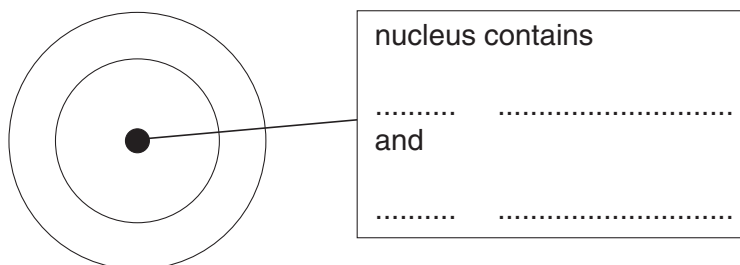
(b) Beryllium is one of the elements in the Sun.

This is how beryllium is shown in the Periodic Table.

| |
|-----------|
| 9 |
| Be |
| beryllium |
| 4 |

Complete the diagram to show the structure of a beryllium atom. You need to show

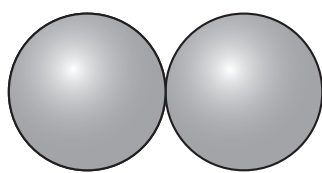
- the **numbers** and **names** of the particles in the nucleus.
- the **arrangement of electrons** in the electron shells (show each electron as **x**).



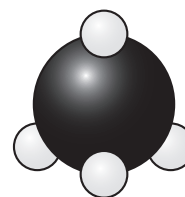
[3]

[Total: 5]

4 These diagrams show the arrangement of atoms in oxygen and methane molecules.



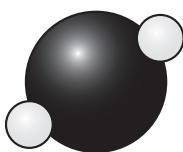
oxygen
 O_2

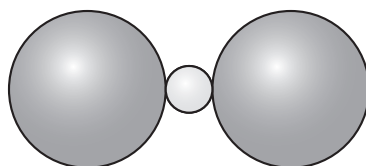


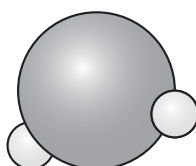
methane
 CH_4

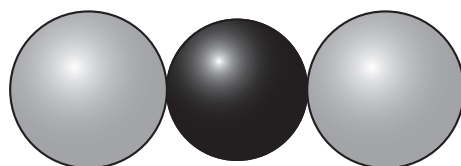
(a) Which of the diagrams below shows a molecule of water, H_2O ?

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



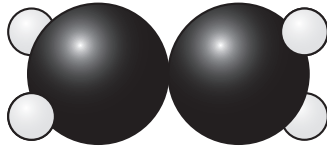






[1]

(b) What is the formula for this molecule?

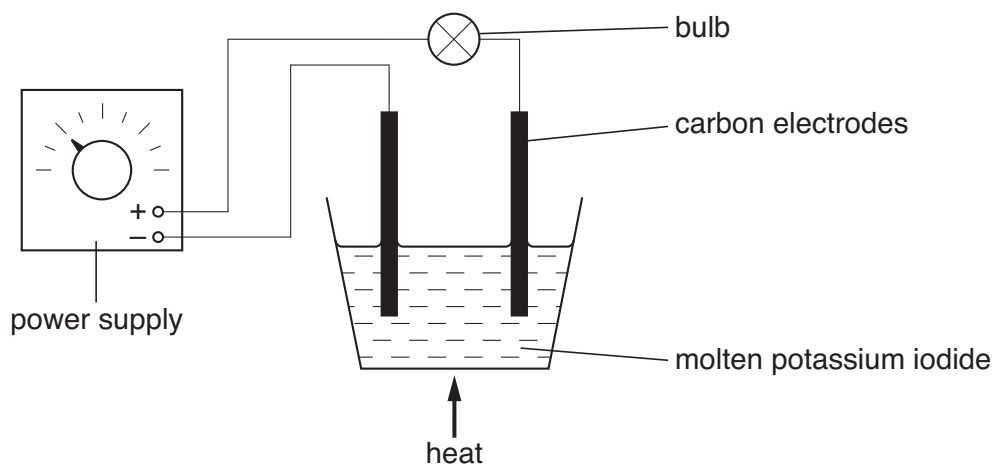


formula [2]

[Total: 3]

5 Joe does an experiment. He passes electricity through molten potassium iodide.

The diagram shows how he sets up his experiment.



(a) Why does molten potassium iodide conduct electricity?

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

Atoms can move freely between electrodes.

Potassium iodide is an ionic compound.

Ions in the liquid are free to move.

Ions in the liquid are randomly arranged.

Electrons can move freely through the liquid.

The positive electrode is attracted to the negative electrode.

[2]

(b) Molten lead bromide also conducts electricity.

What is the name of the element that forms at the **negative** electrode?

..... [1]

- (c) Joe finds out that atoms of sodium metal can be made from sodium chloride by electrolysis of molten sodium chloride.

Complete the equation to show what happens when a sodium ion forms a sodium atom.



[1]

[Total: 4]

6 The table shows information about some chemicals.

| chemical | melting point in °C | boiling point in °C | does it conduct electricity when it is a solid? | does it conduct electricity when it is a liquid? |
|----------|---------------------|---------------------|---|--|
| A | -95 | 69 | no | no |
| B | 1261 | 2239 | no | yes |
| C | 1240 | 2100 | yes | yes |
| D | 1650 | 2230 | no | no |
| E | -138 | 0 | no | no |

(a) Which chemical is most likely to be a metal?

answer [1]

(b) Which chemical is a liquid at room temperature?

answer [1]

(c) Which chemical is most likely to be silicon dioxide?

answer [1]

(d) Chemical **E** is a **molecular** compound.

Which statements about the bonding in chemical **E** are correct?

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

Electrons are gained or lost to form a full outer shell.

Electrons are shared between atoms.

The nucleus of each bonded atom attracts electrons.

Charged ions are attracted together.

The nuclei of the atoms attract each other.

[2]

(e) One of the chemicals is magnesium fluoride.

Magnesium fluoride contains magnesium ions (Mg^{2+}) and fluoride ions (F^-).

What is the formula for magnesium fluoride?

formula [1]

[Total: 6]

7 Ben makes some magnesium sulfate crystals for a school display.

(a) He makes magnesium sulfate by reacting a solid with an acid.

(i) Give the name of the acid Ben should use.

..... [1]

(ii) Two of the following compounds react with the acid to make magnesium sulfate.

Put a (ring) around the **two** correct compounds.

magnesium carbonate

magnesium chloride

magnesium bromide

magnesium oxide

magnesium nitrate

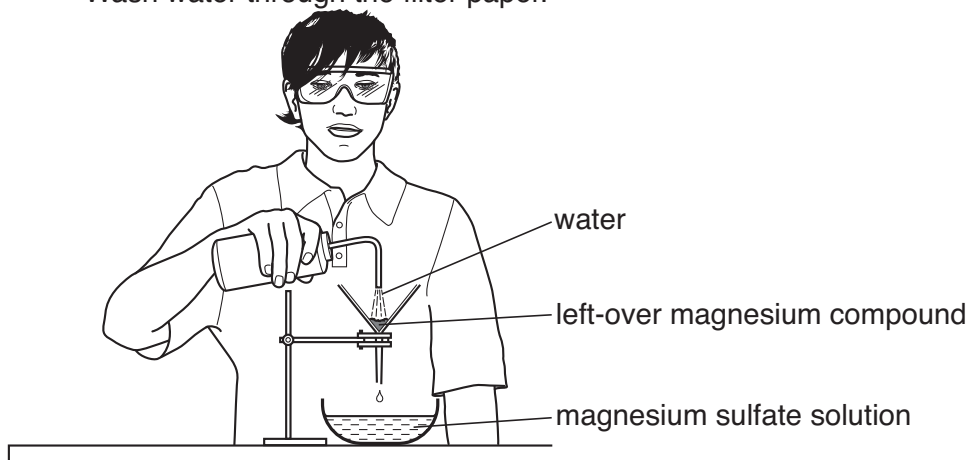
[2]

(b) The flow chart shows how Ben makes his crystals.

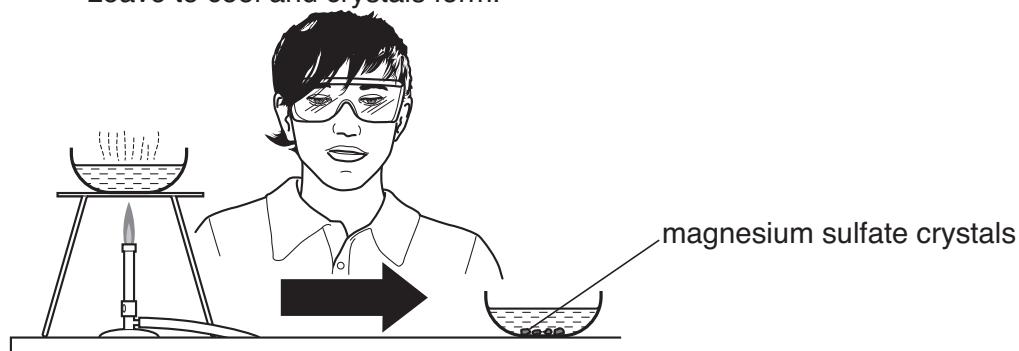
Step 1 Add the solid magnesium compound to the acid until no more reacts.



Step 2 Filter off the left-over magnesium compound.
Wash water through the filter paper.



Step 3 Heat the magnesium sulfate solution until about half has evaporated away.
Leave to cool and crystals form.



(i) Why does the solid compound stop reacting?

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

The pH of the acid falls.

All the gas is used up.

The magnesium compound becomes less reactive.

All the acid is used up.

[1]

(ii) Why does Ben wash water through the filter paper?

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

to dilute the solution

to stop the reaction

to get more magnesium sulfate through the filter

to remove impurities

[1]

(iii) Ben evaporates the solution. He stops heating when about half the solution is left.

Read the following statements and decide whether they are **true** or **false**.

Put ticks (✓) in the correct boxes.

| | true | false |
|---|------|-------|
| Heating the solution to dryness gives the largest crystals. | | |
| The solution becomes more concentrated as he heats it. | | |
| The more water left after heating, the faster the crystals form. | | |
| Heating the solution for too long makes the solid salt evaporate. | | |

[2]

(c) Ben thinks the rate of reaction between the solid and the acid is too fast.

Which of the following changes will **slow down** the rate of reaction?

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

increase the temperature

use a catalyst

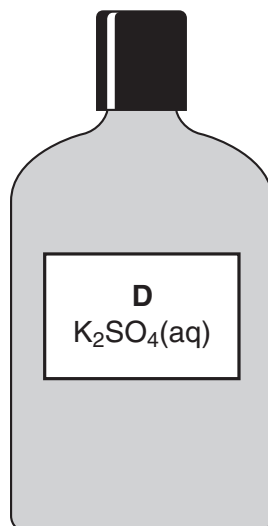
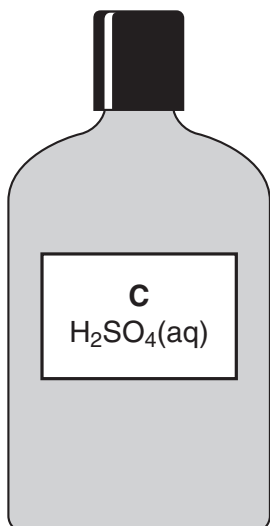
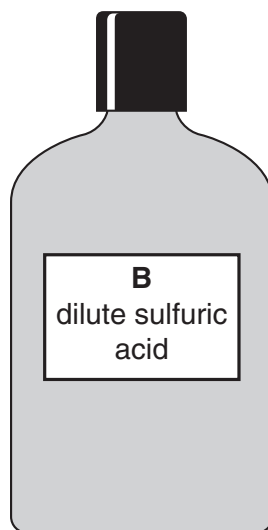
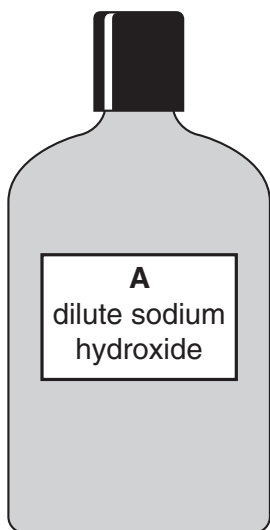
use acid that is more dilute

grind the solid into smaller pieces

[1]

[Total: 8]

8 Look at the labels on the following solutions of chemicals.



(a) (i) Which chemical has a high pH?

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

A **B** **C** **D**

[1]

(ii) Which **two** solutions contain the same compound?

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

A **B** **C** **D**

[1]

(b) What ions are present in K_2SO_4 ?

Put **rings** around the correct ions.



[2]

(c) Sodium hydroxide reacts with sulfuric acid to make a soluble salt.

Which of the following statements about the reaction are **true**, and which are **false**?

Put ticks (✓) in the correct boxes.

| | true | false |
|---|------|-------|
| The reaction produces a precipitate. | | |
| The reaction is a neutralisation reaction. | | |
| The acid produces OH^- ions. | | |
| An equation for the reaction is $H^+ + OH^- \rightarrow H_2O$. | | |
| Hydrogen gas is given off. | | |

[3]

[Total: 7]

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 | 11 Na sodium 11 | 12 C carbon 6 | 13 Al aluminium 13 | 14 N nitrogen 7 | 15 O oxygen 8 | 16 F fluorine 9 | 17 Ne neon 10 |
| 19 K potassium 19 | 20 Ca calcium 20 | 23 Na sodium 11 | 24 Mg magnesium 12 | 27 Co cobalt 27 | 28 Ni nickel 28 | 29 Cu copper 29 | 30 Zn zinc 30 | 35.5 Cl chlorine 17 |
| 37 Rb rubidium 37 | 38 Sr strontium 38 | 39 Y yttrium 39 | 40 Zr zirconium 40 | 41 Nb niobium 41 | 42 Mo molybdenum 42 | 43 Tc technetium 43 | 44 Ru ruthenium 44 | 45 Rh rhodium 45 |
| 55 Cs caesium 55 | 56 Ba barium 56 | 57 La* lanthanum 57 | 72 Hf hafnium 72 | 73 Ta tantalum 73 | 74 W tungsten 74 | 75 Re rhenium 75 | 76 Os osmium 76 | 77 Ir iridium 77 |
| [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 |
| 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 |
| 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 |
| 79 Kr krypton 36 | 80 Br bromine 35 | 84 Kr krypton 36 | 112 Cd cadmium 48 | 115 In indium 49 | 119 Sn tin 50 | 122 Sb antimony 51 | 127 I iodine 53 | 131 Xe xenon 54 |
| 101 Ag silver 47 | 106 Pd palladium 46 | 108 Ag silver 47 | 195 Pt platinum 78 | 197 Au gold 79 | 201 Hg mercury 80 | 204 Tl thallium 81 | 207 Pb lead 82 | [209] Po polonium 84 |
| 63.5 Cu copper 29 | 65 Zn zinc 30 | 65 Zn zinc 30 | 199 Pt platinum 78 | 201 Hg mercury 80 | [272] Rg roentgenium 111 | 209 Bi bismuth 83 | [210] At astatine 85 | [222] Rn radon 86 |
| 59 Co cobalt 27 | 59 Ni nickel 28 | 59 Co cobalt 27 | 271 Ds darmstadtium 110 | 272 Rg roentgenium 111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated | | | |
| 55 Mn manganese 25 | 56 Fe iron 26 | 56 Fe iron 26 | 110 Ag silver 47 | 112 Cd cadmium 48 | 115 In indium 49 | 119 Sn tin 50 | 127 I iodine 53 | 131 Xe xenon 54 |
| 45 Sc scandium 21 | 48 Ti titanium 22 | 48 Ti titanium 22 | 159 Lr lawrencium 103 | 161 Rf rutherfordium 104 | 162 Db dubnium 105 | 166 Sg seaborgium 106 | 168 Mt meitnerium 109 | 171 Ds darmstadtium 110 |
| 14 N nitrogen 7 | 16 O oxygen 8 | 16 O oxygen 8 | 171 Ds darmstadtium 110 | 172 Rg roentgenium 111 | 177 Hs hassium 108 | 184 W tungsten 74 | 192 Ir iridium 77 | 195 Pt platinum 78 |
| 31 P phosphorus 15 | 32 S sulfur 16 | 32 S sulfur 16 | 109 Mt meitnerium 109 | 110 Ds darmstadtium 110 | 111 Rg roentgenium 111 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 11 B boron 5 | 12 C carbon 6 | 12 C carbon 6 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 1 H hydrogen 1 | 2 He helium 2 | 2 He helium 2 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 27 Al aluminium 13 | 28 Si silicon 14 | 28 Si silicon 14 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 70 Ga gallium 31 | 73 Ge germanium 32 | 73 Ge germanium 32 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 115 In indium 49 | 119 Sn tin 50 | 119 Sn tin 50 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 127 I iodine 53 | 128 Te tellurium 52 | 128 Te tellurium 52 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 80 Br bromine 35 | 84 Kr krypton 36 | 84 Kr krypton 36 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 35.5 Cl chlorine 17 | 36 Ar argon 18 | 36 Ar argon 18 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 19 F fluorine 9 | 20 Ne neon 10 | 20 Ne neon 10 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |
| 4 He helium 2 | 4 He helium 2 | 4 He helium 2 | 104 Rf rutherfordium 104 | 105 Db dubnium 105 | 106 Sg seaborgium 106 | 209 Bi bismuth 83 | 209 Bi bismuth 83 | 209 Bi bismuth 83 |

* 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.