



IGCSE CHEMISTRY

0620

ATOMIC STRUCTURE

Theory: Structured Questions

2026 EDITION

Q1

0620/41/M/J/21/Q2

Atomic Structure

Complete the table to:

- deduce the number of protons, electrons and neutrons in the magnesium atom and copper ion shown
- identify the atom or ion represented by the final row.

	number of protons	number of electrons	number of neutrons
$^{25}_{12}\text{Mg}$	12		
$^{65}_{29}\text{Cu}^{2+}$			36
	17	18	20

[Total: 5]

Q2

0620/43/M/J/21/Q2

Atomic Structure

Complete the table to:

- deduce the number of protons, electrons and neutrons in the boron atom and chloride ion shown
- identify the atom or ion represented by the final row.

formula	number of protons	number of electrons	number of neutrons
$^{11}_5\text{B}$		5	
$^{35}_{17}\text{Cl}^{-}$	17		
	24	21	30

[Total: 5]

Q3

0620/42/O/N/21/Q3

Atomic Structure

Atoms contain protons, neutrons and electrons.

- (a) Complete the table to show the relative mass and the relative charge of a proton, a neutron and an electron.

	relative mass	relative charge
proton		
neutron		
electron	$\frac{1}{1840}$	

[3]

- (b) The table shows the number of protons, neutrons and electrons in some atoms and ions.

Complete the table.

atom or ion	number of protons	number of neutrons	number of electrons
$^{32}_{16}\text{S}$			
$^{39}_{19}\text{K}^+$			
	35	44	36

[5]

Q4

0620/43/O/N/21/Q4(a)

Atomic Structure

(a) Carbon exists as the isotopes $^{12}_6\text{C}$ and $^{13}_6\text{C}$.

Complete the table.

isotope	number of protons in one atom	number of electrons in one atom	number of neutrons in one atom
$^{12}_6\text{C}$			
$^{13}_6\text{C}$			

[2]

Q5

0620/42/F/M/22/Q1(b)

Atomic Structure

This question is about the first 30 elements in the Periodic Table.

Name the element which:

(b) has atoms with an electronic structure of 2,8,1 [1]

Atoms and ions are made from small particles called electrons, neutrons and protons.

(a) Complete the table.

particle	relative charge	relative mass
electron	-1	$\frac{1}{1840}$
neutron		
proton		

[2]

(b) Information about atoms and ions, **A**, **B** and **C**, is shown in the table.

Complete the table.

atom or ion	number of electrons	number of neutrons	number of protons	symbol
A	18		20	${}_{20}^{42}\text{Ca}^{2+}$
B		18		${}_{17}^{35}\text{Cl}$
C	18	16	16	

[6]

[Total: 8]

Q7

0620/41/M/J/23/Q2(a)(ii)-(iii)

Atomic Structure

The symbols of the elements in Period 2 of the Periodic Table are shown.

Li Be B C N O F Ne

Use the symbols of the elements in Period 2 to answer the questions that follow.
Each symbol may be used once, more than once or not at all.

Give the symbol of the element that:

(ii) contains atoms with only three electrons in the outer shell [1]

(iii) contains atoms with only nine protons [1]

Q8

0620/43/M/J/23/Q2(a)(ii)

Atomic Structure

(a) The symbols of the elements in Period 3 of the Periodic Table are shown.

Na Mg Al Si P S Cl Ar

Use the symbols of the elements in Period 3 to answer the questions that follow.
Each symbol may be used once, more than once, or not at all.

Give the symbol of the element that:

(ii) contains atoms with a full outer shell of electrons [1]

Q9

0620/41/O/N/23/Q2(a)

Atomic Structure

(a) Boron has only two naturally occurring isotopes, ^{10}B and ^{11}B .

Complete Table 2.1 to show the numbers of protons, neutrons and electrons in an atom of ^{11}B .

Table 2.1

number of protons	number of neutrons	number of electrons

[2]

Q10

0620/42/O/N/23/Q2(a)(i)

Atomic Structure

- (a) Copper has two naturally occurring isotopes, ^{63}Cu and ^{65}Cu . Cobalt has only one naturally occurring isotope, ^{59}Co .
- (i) Complete Table 2.1 to show the number of protons, neutrons and electrons in the ^{59}Co atom and the $^{65}\text{Cu}^{2+}$ ion.

Table 2.1

	^{59}Co	$^{65}\text{Cu}^{2+}$
protons		
neutrons		
electrons		

[3]

Q11

0620/42/F/M/24/Q2(c)

Atomic Structure

- (c) Use the Periodic Table to:

- give the symbol of the halogen with the highest atomic number

.....

- deduce the number of occupied electron shells in an atom of this element.

.....

[2]

Q12

0620/41/M/J/24/Q2

Atomic Structure

Complete Table 2.1.

Table 2.1

atom or ion	number of protons	number of electrons	number of neutrons
$^{37}_{17}\text{Cl}$		17	
$^{63}_{29}\text{Cu}^+$			34
	16	18	17

[5]

Q13

0620/43/M/J/24/Q2

Atomic Structure

Complete Table 2.1.

Table 2.1

atom or ion	number of protons	number of electrons	number of neutrons
$^{63}_{29}\text{Cu}$	29		
$^{37}_{17}\text{Cl}^-$			20
	30	28	34

[5]

Q14

0620/42/F/M/25/Q1(d)

Atomic Structure

Using numbers only, state the:

(d) maximum number of electrons in the second electron shell of an atom [1]

Q15

0620/42/F/M/25/Q3(e)-(f)

Atomic Structure

(e) State how many occupied electron shells there are in a bromine atom.

..... [1]

(f) Name the noble gas which has the same electronic configuration as a Br^- ion.

..... [1]

Q16

0620/42/F/M/25/Q5(a)

Atomic Structure

Manganese is the element with atomic number 25 in the Periodic Table.

Calcium is the element with atomic number 20 in the Periodic Table.

(a) Complete Table 5.1 to show the number of protons, neutrons and electrons in the ^{55}Mn atom and the $^{42}\text{Ca}^{2+}$ ion.

Table 5.1

	^{55}Mn	$^{42}\text{Ca}^{2+}$
protons		
neutrons		
electrons		

[3]

Atoms are made of electrons, neutrons and protons.

(a) Complete Table 2.1.

Table 2.1

particle	relative charge	relative mass
electron		$\frac{1}{1840}$
neutron	0	
proton		

[2]

(b) Atoms of the same element are known as isotopes.

${}_{19}^{39}\text{K}$ and ${}_{19}^{41}\text{K}$ are isotopes of potassium.

(i) Complete Table 2.2 to show the number of electrons, neutrons and protons in one atom or ion of these isotopes.

Table 2.2

isotope	electrons	neutrons	protons
${}_{19}^{39}\text{K}$			
${}_{19}^{41}\text{K}^+$			

[3]

Q18

0620/43/M/J/25/Q2(a),(b)(i)

Atomic Structure

Atoms are made of electrons, neutrons and protons.

(a) State which of these particles are found in the nucleus of an atom.

..... [1]

(b) Atoms of the same element are known as isotopes.

$^{32}_{16}\text{S}$ and $^{34}_{16}\text{S}$ are isotopes of sulfur.

(i) Complete Table 2.1 to show the number of electrons, neutrons and protons in one atom or ion of these isotopes.

Table 2.1

isotope	electrons	neutrons	protons
$^{34}_{16}\text{S}$			
$^{32}_{16}\text{S}^{2-}$			

[3]

Q19

0620/41/O/N/25/Q1(d)

Atomic Structure

(d) The term mass number is defined as the total number of protons and neutrons in the nucleus of an atom.

State the name of **one other** term which is defined as the total number of protons and neutrons in the nucleus of an atom.

..... [1]

Q20

0620/41/O/N/25/Q2(a)

Atomic Structure

Calcium is an element in Group II of the Periodic Table.

(a) Identify the element in Group II which has only five occupied electron shells.

..... [1]

Atoms and ions are made from particles called electrons, neutrons and protons.

(a) Complete Table 1.1.

Table 1.1

particle	relative charge	relative mass
electron	-1	$\frac{1}{1840}$
neutron		
proton		

[2]

(b) Table 1.2 shows information about some atoms or ions.

Complete Table 1.2.

Table 1.2

atom or ion	number of electrons	number of neutrons	number of protons
$^{40}_{20}\text{Ca}^{2+}$		20	20
$^{19}_9\text{F}$	9		9
	10	9	8

[5]

The table shows the numbers of protons, neutrons and electrons in particles **A** to **I**.

particle	protons	neutrons	electrons
A	1	0	0
B	6	6	6
C	6	8	6
D	10	10	10
E	16	16	18
F	17	18	17
G	18	22	18
H	19	20	19
I	20	20	18

Answer the following questions about particles **A** to **I**. Each letter may be used once, more than once or not at all.

(a) State which of the particles **A** to **I**:

(vi) have the same nucleon number and [1]

(b) Explain why **B** and **C** are isotopes of the same element.

.....
 [2]

[Total: 12]

Q24

0620/41/M/J/21/Q3(b)

Atomic Structure

(b) Potassium chloride is an ionic compound.

Complete the diagram to show the electron arrangement in the outer shells of the ions present in potassium chloride.

Give the charges on both ions.



[3]

Q25

0620/42/M/J/21/Q2(a)(i)-(ii)

Atomic Structure

Silver has an atomic number of 47.

(a) Naturally occurring atoms of silver are $^{107}_{47}\text{Ag}$ and $^{109}_{47}\text{Ag}$.

(i) State the name given to atoms of the same element with different nucleon numbers.

..... [1]

(ii) Complete the table to show the number of protons, neutrons and electrons in each atom and ion of silver shown.

	$^{107}_{47}\text{Ag}$	$^{109}_{47}\text{Ag}^+$
protons		
neutrons		
electrons		

[3]

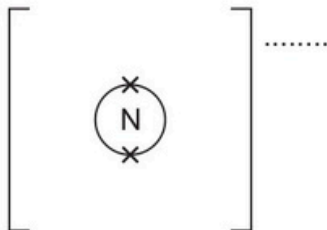
Q26

0620/42/M/J/21/Q5(a)(ii)

Atomic Structure

(ii) Lithium nitride is ionically bonded.

Complete the diagram to show the electronic structure of the nitride ion.
Show the charge on the nitride ion.



[2]

Q27

0620/43/M/J/21/Q3(b)

Atomic Structure

(b) Sodium fluoride is an ionic compound.

Complete the diagram to show the electron arrangement in the outer shells of the ions present in sodium fluoride.

Give the charges on both ions.



[3]

2 This question is about copper and its compounds.

(a) Copper has two different naturally occurring atoms, ^{63}Cu and ^{65}Cu .

(i) State the term used for atoms of the same element with different nucleon numbers.

..... [1]

(ii) The atomic number of copper is 29.

Complete the table to show the number of protons, neutrons and electrons in the particles of copper shown.

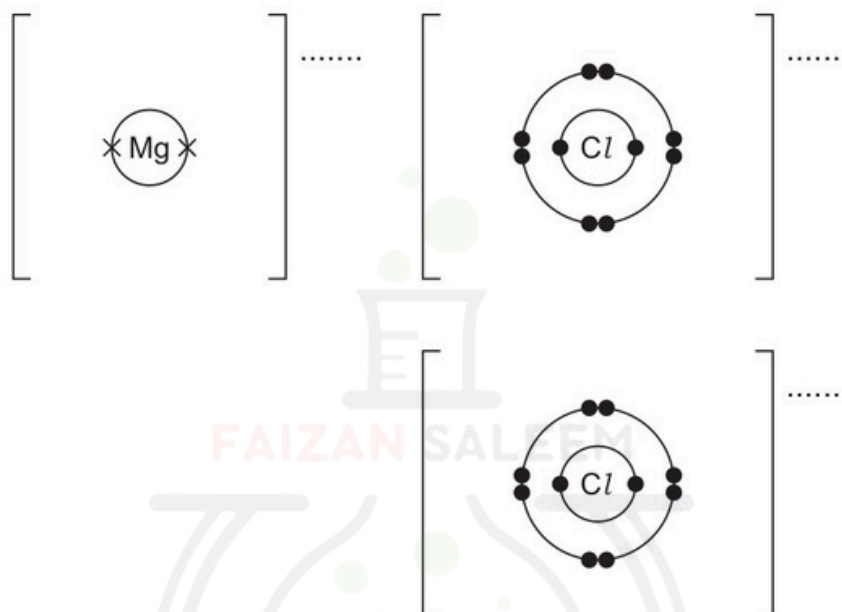
	^{63}Cu	$^{65}\text{Cu}^{2+}$
protons		
neutrons		
electrons		

[3]

- (b) Complete the dot-and-cross diagram to show the electron arrangement of the ions in magnesium chloride.

The inner shells have been drawn.

Give the charges on the ions.



[3]

- (a) Atoms are made of protons, neutrons and electrons. Atoms of the same element are known as isotopes.

(i) Complete the table.

particle	relative charge	relative mass
electron		$\frac{1}{1840}$
neutron		
proton	+1	

[2]

- (ii) ${}^{24}_{12}\text{Mg}$ and ${}^{25}_{12}\text{Mg}$ are isotopes of magnesium.

Complete the table to show the numbers of electrons, neutrons and protons in these isotopes of magnesium.

isotope	number of electrons	number of neutrons	number of protons
${}^{24}_{12}\text{Mg}$			
${}^{25}_{12}\text{Mg}$			

[2]

- (iii) Explain why magnesium ions have a charge of 2+.

.....
 [1]

Q31

0620/42/M/J/22/Q3(a)

Atomic Structure

(a) Chromium has several isotopes. Manganese has only one isotope.

(i) State what is meant by the term *isotopes*.

.....
 [2]

(ii) State the nucleon number of manganese.

..... [1]

(iii) Complete the table to show the number of protons, neutrons and electrons in a $^{52}_{24}\text{Cr}^{3+}$ ion.

protons	neutrons	electrons

[3]

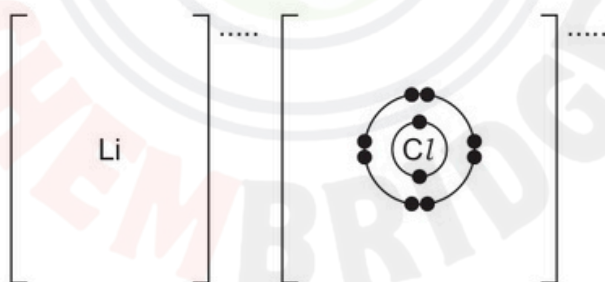
Q32

0620/42/M/J/22/Q4(d)

Atomic Structure

(d) Lithium chloride, LiCl , is an ionic compound.

Complete the dot-and-cross diagram to show the electron arrangement and charges of the ions in lithium chloride.



[3]

- 2 (a) $^{32}_{16}\text{S}$ and $^{33}_{16}\text{S}$ are isotopes of sulfur.

Use your knowledge of protons, neutrons and electrons to answer the following questions.

- (i) Describe how these isotopes of sulfur are the same and how they are different.

same

.....

different

.....

[3]

- (ii) Explain why each of these isotopes have an overall charge of zero.

.....

..... [1]

- (iii) Explain why both isotopes have the same chemical properties.

.....

..... [1]

- (b) Sulfide ions, S^{2-} , have the electronic structure 2,8,8.

- (i) Explain why sulfide ions have a charge of 2-.

.....

..... [1]

- (ii) Give the formula of:

- an anion which has the same electronic structure as S^{2-}

.....

- a cation which has the same electronic structure as S^{2-} .

.....

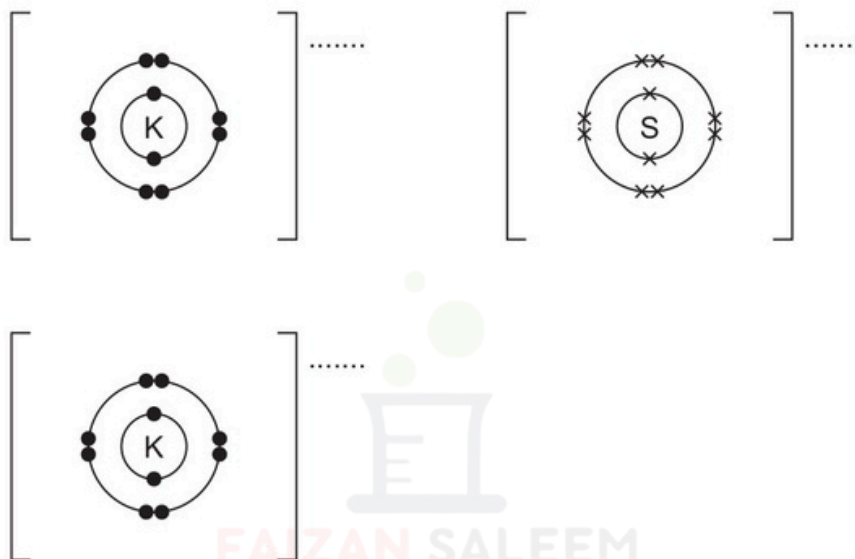
[2]

Q34

0620/41/O/N/22/Q2(b)(ii)

Atomic Structure

- (ii) Complete the dot-and-cross diagram to show the electron arrangement and charges of the ions in potassium sulfide.



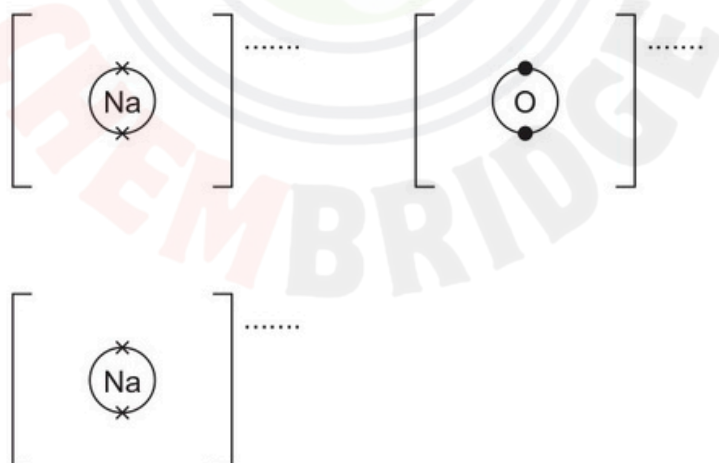
[3]

Q35

0620/42/O/N/22/Q2(b)(iv)

Atomic Structure

- (iv) Complete the dot-and-cross diagram to show the electron arrangement and charges of the ions in sodium oxide.



[3]

Q36

0620/42/F/M/23/Q2(c)(i)-(ii)

Atomic Structure

(c) Lithium has two naturally occurring types of atoms, ${}^6\text{Li}$ and ${}^7\text{Li}$.

(i) State the name given to atoms of the same element with different nucleon numbers.

..... [1]

(ii) Complete Table 2.1 to show the number of protons, neutrons and electrons in the atom and ion of lithium shown.

Table 2.1

	${}^6\text{Li}$	${}^7\text{Li}^+$
protons		
neutrons		
electrons		

[3]

Q37

0620/42/F/M/23/Q2(d)

Atomic Structure

(d) Potassium oxide, K_2O , is an ionic compound.

Complete Fig. 2.1 to show the electronic configurations of the ions in potassium oxide. Show the charges on the ions.

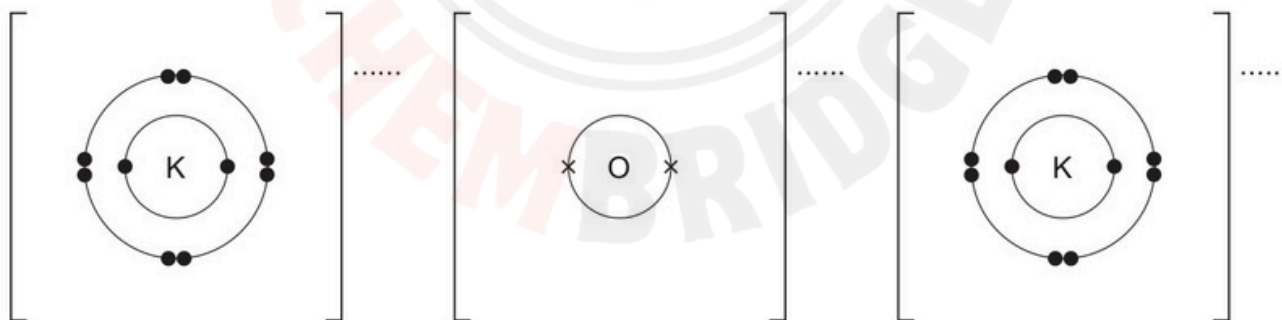


Fig. 2.1

[3]

[Total: 16]

Q38

0620/41/M/J/23/Q2(b)(i)

Atomic Structure

(b) Boron, B, has two isotopes.

(i) State the meaning of the term isotopes.

.....
 [2]

Q39

0620/41/M/J/23/Q3(a)(i)

Atomic Structure

(a) (i) Sodium reacts with oxygen to form the ionic compound sodium oxide. The electronic configurations of an atom of sodium and an atom of oxygen are shown in Fig. 3.1.



Fig. 3.1

Ions are formed by the transfer of electrons from sodium atoms to oxygen atoms.

Complete the dot-and-cross diagrams in Fig. 3.2 to show the electronic configuration of **one** sodium ion and **one** oxide ion. Show the charges on the ions.

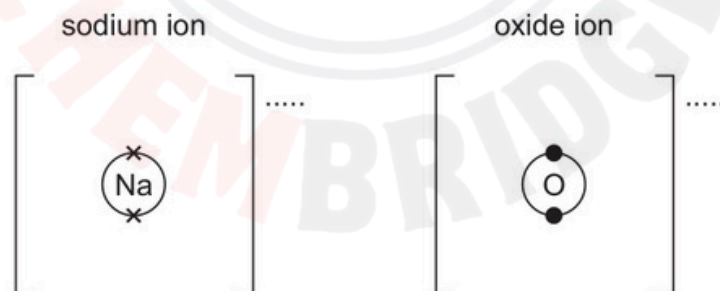


Fig. 3.2

[3]

Q40

0620/42/M/J/23/Q2(d)(i)-(iii)

Atomic Structure

(d) Bromine has two naturally occurring isotopes, ^{79}Br and ^{81}Br .

(i) State the term given to the numbers 79 and 81 in these isotopes of bromine.

..... [1]

(ii) Complete Table 2.2 to show the number of protons, neutrons and electrons in the atom and ion of bromine shown.

Table 2.2

	^{79}Br	$^{81}\text{Br}^-$
protons		
neutrons		
electrons		

[3]

Q41

0620/43/M/J/23/Q2(c)

Atomic Structure

(c) An ion contains 10 electrons, 13 protons and 14 neutrons.

(i) State the nucleon number of the ion.

..... [1]

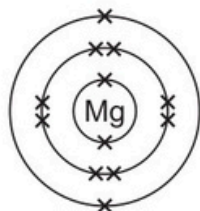
(ii) Identify the element that forms this ion.

..... [1]

[Total: 11]

- (a) Magnesium reacts with fluorine to form the ionic compound magnesium fluoride. The electronic configurations of an atom of magnesium and an atom of fluorine are shown in Fig. 3.1.

magnesium atom



fluorine atom

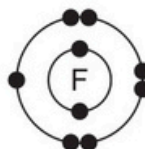
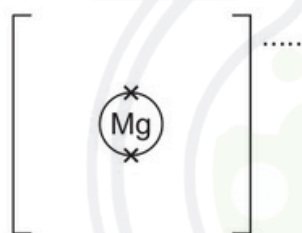


Fig. 3.1

- (i) Ions are formed by the transfer of electrons from magnesium atoms to fluorine atoms.

Complete the dot-and-cross diagrams in Fig. 3.2 to show the electronic configurations of **one** magnesium ion and **one** fluoride ion. Show the charges on the ions.

magnesium ion



fluoride ion

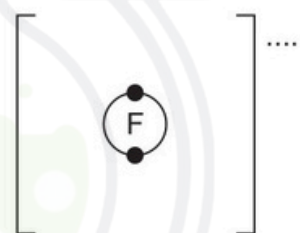


Fig. 3.2

[3]

- (ii) Complete Fig. 2.2 to show the electronic configuration of one aluminium ion and one fluoride ion.
Show the charges on the ions.

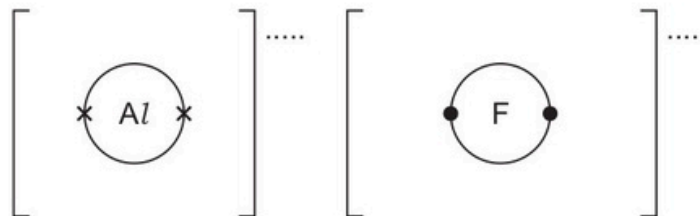


Fig. 2.2

[3]

[Total: 21]

- 1 Table 1.1 gives the electronic configurations of some atoms and ions, **A** to **G**.

Table 1.1

	electronic configuration
A	2,5
B	2,8
C	2,8,2
D	2,8,4
E	2,8,5
F	2,8,6
G	2,8,18,7

Answer the following questions about **A** to **G**.

Each letter may be used once, more than once or not at all.

State which of the atoms or ions, **A** to **G**, could be:

- (a) a noble gas atom

..... [1]

- (b) an atom of an element in Group VI

..... [1]

- (c) an atom with an atomic number of 14

..... [1]

- (d) atoms from the same group

..... and [1]

- (e) a halogen atom

..... [1]

- 2 Table 2.1 gives information about particles **A**, **B**, **C**, **D**, **E** and **F**.

Table 2.1

particle	number of electrons	number of neutrons	number of protons
A	5	6	5
B	10	11	10
C	10	14	13
D	18	17	16
E	18	17	17
F	15	16	15

- (a) Give the letters of **all** the particles which are:

(i) atoms

..... [1]

(ii) ions with a charge of 2–

..... [1]

(iii) cations.

..... [1]

- (b) State the atomic number of **A**.

..... [1]

- (c) Determine the number of nucleons in **D**.

..... [1]

- (d) State the electronic configuration of **D**.

..... [1]

Q46

0620/42/F/M/24/Q1(f)

Atomic Structure

(f) Both iron(III) oxide and aluminium oxide contain metal ions with a 3+ charge.

(i) Write the electronic configuration of an Al^{3+} ion.

..... [1]

(ii) Deduce the number of protons and electrons in an Fe^{3+} ion.

protons	electrons

[2]

[Total: 19]

Q47

0620/42/M/J/24/Q5(a)(i)-(ii)

Atomic Structure

(a) A sample of sulfur contains two isotopes, ^{32}S and ^{34}S .

(i) Complete Table 5.1 to show the number of protons and neutrons in one atom of each isotope of sulfur.

Table 5.1

	^{32}S	^{34}S
protons		
neutrons		

[2]

(ii) State why these isotopes have identical chemical properties.

..... [1]

Q48

0620/41/O/N/24/Q2(a)-(d)

Atomic Structure

2 This question is about atomic structure and the Periodic Table.

(a) Define the term nucleon number.

..... [1]

(b) State the connection between the number of occupied electron shells in an atom and the period number of that element.

..... [1]

(c) Write the electronic configuration of the following atom and ion.

$^{28}_{14}\text{Si}$

$^{37}_{17}\text{Cl}^-$

[2]

(d) Complete Table 2.1.

Table 2.1

atom or ion	number of protons	number of neutrons	number of electrons
$^{23}_{11}\text{Na}$	11		
$^{19}_9\text{F}^-$	9	10	
	31	38	28

[5]

Q49

0620/41/O/N/24/Q2(e)(i)

Atomic Structure

(e) A sample of thallium, Tl , contains two isotopes, ^{203}Tl and ^{205}Tl .

(i) Define the term isotopes.

.....

..... [2]

Q50

0620/41/O/N/24/Q2(e)(iii)

Atomic Structure

(iii) Suggest why these two isotopes have identical chemical properties.

..... [1]

Q51

0620/42/F/M/25/Q2(b)

Atomic Structure

(b) Potassium sulfide, K_2S , is an ionic compound.

Complete the dot-and-cross diagram in Fig. 2.1 of the ions in potassium sulfide.

Show the charges on the ions.

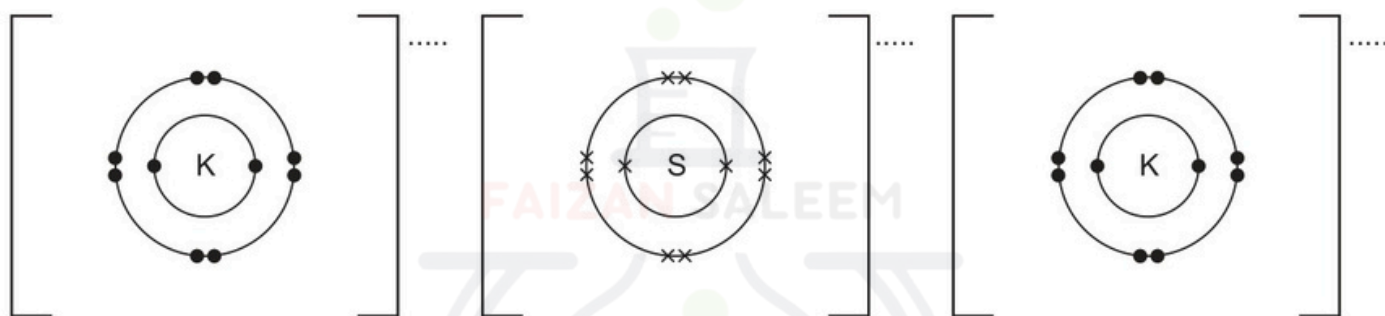


Fig. 2.1

[3]

Q52

0620/41/M/J/25/Q2(c)

Atomic Structure

(c) A calcium atom has the electronic configuration of 2,8,8,2.

Give the formula of one atom and one negative ion that has the same electronic configuration as Ca^{2+} .

- atom
- negative ion

[2]

Q53

0620/42/M/J/25/Q5(c)

Atomic Structure

(c) Sodium sulfide, Na_2S , is an ionic compound.

Complete Fig. 5.1 to show the electronic configurations of the ions in sodium sulfide.

Show the charges on the ions.

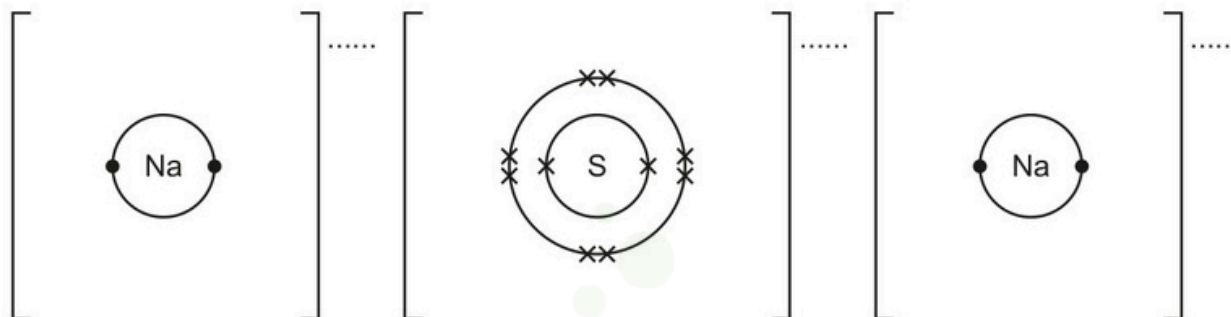


Fig. 5.1

[3]

Q54

0620/42/M/J/25/Q5(d)(i)-(ii)

Atomic Structure

(d) Rubidium has only two naturally occurring atoms, ^{85}Rb and ^{87}Rb .

(i) State the term given to these naturally occurring atoms of rubidium.

..... [1]

(ii) Complete Table 5.1 to show the number of protons, neutrons and electrons in the atom and ion of rubidium shown.

Table 5.1

	^{85}Rb	$^{87}\text{Rb}^+$
protons		
neutrons		
electrons		

[3]

(c) Ions are atoms or groups of atoms that have gained or lost one or more electrons.

An oxygen atom has the electronic configuration of 2,6.

Give the formula of **one** atom and **one** positive ion that has the same electronic configuration as O^{2-} .

- atom
- positive ion

[2]



Protons, neutrons and electrons are particles found in atoms.

- (a) Complete Table 1.1 to show the relative mass and relative charge of a proton, a neutron and an electron.

Table 1.1

particle	relative mass	relative charge
proton		+1
neutron		
electron	$\frac{1}{1840}$	

[2]

- (b) Some elements have many isotopes.

- (i) Define the term isotopes.

.....

.....

..... [2]

- (ii) Explain why all isotopes of the same element have the same chemical properties.

.....

..... [1]

- (c) Complete Table 1.2.

Table 1.2

atom or ion	number of protons	number of neutrons	number of electrons
$^{40}_{18}\text{Ar}$	18		18
$^{32}_{16}\text{S}^{2-}$		16	
	22	28	20

[5]

Q57

0620/42/O/N/25/Q2(b)

Atomic Structure

(b) Table 2.1 shows four different isotopes of iron, **A**, **B**, **C** and **D**.

Table 2.1

A	B	C	D
^{54}Fe	^{56}Fe	^{57}Fe	^{58}Fe

Explain why **A**, **B**, **C** and **D** are isotopes of iron.

.....
 [2]

Q58

0620/42/O/N/25/Q2(c)(i)

Atomic Structure

(c) Iron can form two different ions, Fe^{2+} and Fe^{3+} .

(i) Complete Table 2.2 to show the number of protons, neutrons and electrons in the two iron ions shown.

Table 2.2

	$^{54}\text{Fe}^{2+}$	$^{58}\text{Fe}^{3+}$
protons		
neutrons		
electrons		

[3]

Q1

0620/41/M/J/21/Q2

Marking Scheme

2	Mg: 12 and 13 (1) Cu ²⁺ : 29 and 27 (1) 37(above) and 17(below) (1) Cl (1) 1- (1)	5
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Q2

0620/43/M/J/21/Q2

Marking Scheme

2	B: 5 and 6 (1) Cl ⁻ : 18 and 18 (1) 54 and 24 (1) Cr (1) 3 ⁺ (1)	5
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Q3

0620/42/O/N/21/Q3

Marking Scheme

3(a)	1 mark for each correct row	3												
	<table><tr><td>Name</td><td>Relative mass</td><td>Relative charge</td></tr><tr><td>Proton</td><td>1</td><td>+1</td></tr><tr><td>Neutron</td><td>1</td><td>0</td></tr><tr><td>Electron</td><td>1 / 1840</td><td>-1</td></tr></table>	Name	Relative mass	Relative charge	Proton	1	+1	Neutron	1	0	Electron	1 / 1840	-1	
Name	Relative mass	Relative charge												
Proton	1	+1												
Neutron	1	0												
Electron	1 / 1840	-1												

3(b)	<table><tr><td>Particle</td><td>Number of protons</td><td>Number of neutrons</td><td>Number of electrons</td></tr><tr><td>$^{32}_{16}\text{S}$</td><td>16</td><td>16</td><td>16</td></tr><tr><td>$^{39}_{19}\text{K}^+$</td><td>19</td><td>20</td><td>18</td></tr><tr><td>$^{79}_{35}\text{Br}^-$</td><td>35</td><td>44</td><td>36</td></tr></table> M1 = row 1 (1) M2 = row 2 (1) M3 = Br (1) M4 = $^{79}_{35}$ (on left of any symbol) (1) M5 = charge (on any symbol) (1)	Particle	Number of protons	Number of neutrons	Number of electrons	$^{32}_{16}\text{S}$	16	16	16	$^{39}_{19}\text{K}^+$	19	20	18	$^{79}_{35}\text{Br}^-$	35	44	36	5
Particle	Number of protons	Number of neutrons	Number of electrons															
$^{32}_{16}\text{S}$	16	16	16															
$^{39}_{19}\text{K}^+$	19	20	18															
$^{79}_{35}\text{Br}^-$	35	44	36															

Q4 0620/43/O/N/21/Q4(a)

Marking Scheme

4(a)	1 mark for each row			2
	6	6	6	
	6	6	7	

Q5 0620/42/F/M/22/Q1(b)

Marking Scheme

1(b)	sodium	1
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Q6 0620/43/O/N/22/Q1

Marking Scheme

1(a)		M1 relative charge	M2 relative mass	2
		0	1	
		+1	1	
		1 mark for each correct column		
1(b)	M1 22 (1) M2 17 (1) M3 17 (1) M4 32 and 16 (1) M5 S (1) M6 2 ⁻ / ⁻ 2 / ⁻ (1)			6

Q7 0620/41/M/J/23/Q2(a)(ii)-(iii)

Marking Scheme

2(a)(ii)	B	1
2(a)(iii)	F	1

Q8 0620/43/M/J/23/Q2(a)(ii)

Marking Scheme

2(a)(ii)	Ar	1
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Q9 0620/41/O/N/23/Q2(a)

Marking Scheme

2(a)	M1 5p and 5e (1) M2 6n (1)	2
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Q10	0620/42/O/N/23/Q2(a)(i)	Marking Scheme
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2(a)(i)		^{59}Co	$^{65}\text{Cu}^{2+}$	3
	protons	27	29	
	neutrons	32	36	
	electrons	27	27	
	one mark for each correct row			

Q11	0620/42/F/M/24/Q2(c)	Marking Scheme
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2(c)	M1 Ts M2 7	2
------	-----------------------------	----------

Q12	0620/41/M/J/24/Q2	Marking Scheme
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2	M1 : Cl: 17 AND 20 (1) M2 Cu ⁺ : 29 AND 28 (1) M3 33(above) and 16(below) on left hand side of symbol (1) M4 S (1) M5 2 ⁻ (1)	5
---	---	----------

Q13 0620/43/M/J/24/Q2 Marking Scheme

2	M1 Cu: 29 and 34 M2 Cl ⁻ : 17 and 18 M3 ⁶⁴ ₃₀ to left of symbol M4 Zn M5 2 ⁺	5
---	--	---

Q14 0620/42/F/M/25/Q1(d) Marking Scheme

1(d)	8	1
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Q15 0620/42/F/M/25/Q3(e)-(f) Marking Scheme

3(e)	4	1
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3(f)	krypton	1
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Q16

0620/42/F/M/25/Q5(a)

Marking Scheme

5(a)	<table border="1"> <tr> <td></td><td>^{55}Mn</td><td>$^{42}\text{Ca}^{2+}$</td></tr> <tr> <td>protons</td><td>25</td><td>20</td></tr> <tr> <td>neutrons</td><td>30</td><td>22</td></tr> <tr> <td>electrons</td><td>25</td><td>18</td></tr> </table> Each row ✓		^{55}Mn	$^{42}\text{Ca}^{2+}$	protons	25	20	neutrons	30	22	electrons	25	18	3
	^{55}Mn	$^{42}\text{Ca}^{2+}$												
protons	25	20												
neutrons	30	22												
electrons	25	18												

Q17

0620/41/M/J/25/Q2(a),(b)(i)

Marking Scheme

2(a)	<table><tr><th>M1 charge (1)</th><th>M2 mass(1)</th></tr><tr><td>-1</td><td></td></tr><tr><td></td><td>1</td></tr><tr><td>+1</td><td>1</td></tr></table> 1 mark for each correct column	M1 charge (1)	M2 mass(1)	-1			1	+1	1	2
M1 charge (1)	M2 mass(1)									
-1										
	1									
+1	1									

2(b)(i)	<table><tr><th>electron</th><th>neutron</th><th>proton</th></tr><tr><td>19</td><td>20</td><td>19</td></tr><tr><td>18</td><td>22</td><td>19</td></tr></table> 1 mark for each correct column	electron	neutron	proton	19	20	19	18	22	19	3
electron	neutron	proton									
19	20	19									
18	22	19									

Q18

0620/43/M/J/25/Q2(a),(b)(i)

Marking Scheme

2(a)	protons and neutrons	1									
2(b)(i)	<table border="1"> <tr> <th>electron</th><th>neutron</th><th>proton</th></tr> <tr> <td>16</td><td>18</td><td>16</td></tr> <tr> <td>18</td><td>16</td><td>16</td></tr> </table> 1 mark for each correct column	electron	neutron	proton	16	18	16	18	16	16	3
electron	neutron	proton									
16	18	16									
18	16	16									

Q19 0620/41/O/N/25/Q1(d)

Marking Scheme

1(d)	nucleon number	1
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Q20 0620/41/O/N/25/Q2(a)

Marking Scheme

2(a)	strontium / Sr	1
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Q21 0620/43/O/N/25/Q1(a)-(b)

Marking Scheme

1(a)	<table><tr><td>neutron</td><td>0</td><td>1</td></tr><tr><td>proton</td><td>+1</td><td>1</td></tr></table>	neutron	0	1	proton	+1	1	2
neutron	0	1						
proton	+1	1						
1(b)	M1 18 M2 10 M3 17 above 8 to the left of the symbol M4 O M5 2- / -2 / – –	5						

Q22

0620/42/F/M/21/Q1(a)(i)-(vi)

Marking Scheme

1(v)(i)	G and I	1
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Q23

0620/42/F/M/21/Q1(b)

Marking Scheme

1(b)	same proton number different neutron number	2
------	--	---

Q24

0620/41/M/J/21/Q3(b)

Marking Scheme

3(b)	K outer shell with 8 crosses (1) Cl outer shell with 7 dots and 1 cross (1) + and - (1)	3
------	---	---

Q25

0620/42/M/J/21/Q2(a)(i)-(ii)

Marking Scheme

2(a)(i)	isotopes	1												
2(a)(ii)	mark by row <table border="1"> <tr> <td></td><td>^{107}Ag</td><td>$^{109}\text{Ag}^+$</td></tr> <tr> <td>p</td><td>47</td><td>47</td></tr> <tr> <td>n</td><td>60</td><td>62</td></tr> <tr> <td>e</td><td>47</td><td>46</td></tr> </table>		^{107}Ag	$^{109}\text{Ag}^+$	p	47	47	n	60	62	e	47	46	3
	^{107}Ag	$^{109}\text{Ag}^+$												
p	47	47												
n	60	62												
e	47	46												

Q26

0620/42/M/J/21/Q5(a)(ii)

Marking Scheme

5(a)(ii)	new octet of 8 electrons consisting of 5 crosses and 3 dots in second shell (1) charge of 3^- (1)	2
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Q27

0620/43/M/J/21/Q3(b)

Marking Scheme

3(b)	Na outer shell with 8 crosses (1) F outer shell with 7 dots and 1 cross (1) Na^+ and F^- (1)	3
------	--	---

Q28

0620/41/O/N/21/Q2(a)(i)-(ii)

Marking Scheme

2(a)(i)	isotopes	1												
2(a)(ii)	1 mark for each correct row <table border="1"> <tr> <td></td><td>^{63}Cu</td><td>$^{65}\text{Cu}^{2+}$</td></tr> <tr> <td>p</td><td>29</td><td>29</td></tr> <tr> <td>n</td><td>34</td><td>36</td></tr> <tr> <td>e</td><td>29</td><td>27</td></tr> </table>		^{63}Cu	$^{65}\text{Cu}^{2+}$	p	29	29	n	34	36	e	29	27	3
	^{63}Cu	$^{65}\text{Cu}^{2+}$												
p	29	29												
n	34	36												
e	29	27												

Q29

0620/42/F/M/22/Q2(b)

Marking Scheme

2(b)	eight crosses in second shell of Mg 7 dots and 1 cross in third shell of both Cl 2+ charge on Mg and – charge on both Cl ions on correct answer line	3
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Q30

0620/41/M/J/22/Q2

Marking Scheme

2(a)(i)	<table><tr><td>charge</td><td>relative mass</td></tr><tr><td>−1</td><td></td></tr><tr><td>0</td><td>1</td></tr><tr><td></td><td>1</td></tr></table> (1) (1) Mark by column	charge	relative mass	−1		0	1		1	2
charge	relative mass									
−1										
0	1									
	1									
2(a)(ii)	<table><tr><td>12</td><td>12</td><td>12 (1)</td></tr><tr><td>12</td><td>13</td><td>12 (1)</td></tr></table> Mark by row	12	12	12 (1)	12	13	12 (1)	2		
12	12	12 (1)								
12	13	12 (1)								

Q31 0620/42/M/J/22/Q3(a)

Marking Scheme

3(a)(i)	atom(s) of the same element with different number of neutrons	2
3(a)(ii)	55	1
3(a)(iii)	24 protons; 28 neutrons; 21 electrons	3

Q32 0620/42/M/J/22/Q4(d)

Marking Scheme

4(d)	two crosses in first shell of Li 7 dots and 1 cross in third shell of Cl '+' charge on Li on correct answer line and '-' charge on Cl ion on correct answer line	3
------	---	----------

Q33 0620/43/M/J/22/Q2

Marking Scheme

2(a)(i)	number of protons (are the same) / 16 protons (1) number of electrons (are the same) / 16 electrons (1) number of neutrons (are different) / 16, 17 neutrons (1)	3
2(a)(ii)	number of protons is the same as (the number of) electrons	1
2(a)(iii)	same number of (outer shell) electrons	1
2(b)(i)	(they have) two more electrons than protons	1
2(b)(ii)	P ³⁻ OR Cl ⁻ (1) K ⁺ OR Ca ²⁺ (1)	2

Q34

0620/41/O/N/22/Q2(b)(ii)

Marking Scheme

2(b)(ii)	M1 eight dots in third shell of both K (1) M2 six crosses and two dots in third shell of S (1) M3 '+' charge on each K on correct answer line and '2-' charge on S ion on correct answer line (1)	3
----------	---	----------

Q35

0620/42/O/N/22/Q2(b)(iv)

Marking Scheme

2(b)(iv)	M1 eight crosses in second shell of both Na (1) M2 six dots and two crosses in second shell of O (1) M3 '+' charge on each Na ion on correct answer line and '2-' charge on O ion on correct answer line (1)	3
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Q36

0620/42/F/M/23/Q2(c)(i)-(ii)

Marking Scheme

2(c)(i)	isotope(s)	1												
2(c)(ii)	<table border="1"> <thead> <tr> <th></th><th>${}^6\text{Li}$</th><th>${}^7\text{Li}^+$</th></tr> </thead> <tbody> <tr> <td>protons</td><td>3</td><td>3</td></tr> <tr> <td>neutrons</td><td>3</td><td>4</td></tr> <tr> <td>electrons</td><td>3</td><td>2</td></tr> </tbody> </table> each row ✓		${}^6\text{Li}$	${}^7\text{Li}^+$	protons	3	3	neutrons	3	4	electrons	3	2	3
	${}^6\text{Li}$	${}^7\text{Li}^+$												
protons	3	3												
neutrons	3	4												
electrons	3	2												

Q37 0620/42/F/M/23/Q2(d) Marking Scheme

2(d)	M1 eight dots in third shell of both K (1) M2 six crosses and two dots in second shell of O (1) M3 '+' charge on each K on correct answer line and '2-' charge on O ion on correct answer line (1)	3
------	--	----------

Q38 0620/41/M/J/23/Q2(b)(i) Marking Scheme

2(b)(i)	M1 different atoms of the same element with the same number of protons (1) M2 different numbers of neutrons (1)	2
---------	--	----------

Q39 0620/41/M/J/23/Q3(a)(i) Marking Scheme

3(a)(i)	M1 Na with 2,8 all crosses (1) M2 O with 2,8 outer shell with 6 dots and 2 crosses (1) M3 + AND 2-(1)	3
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Q40

0620/42/M/J/23/Q2(d)(i)-(ii)

Marking Scheme

2(d)(i)	nucleon number / mass number	1												
2(d)(ii)	<table border="1"> <tr> <td></td><td>^{79}Br</td><td>$^{81}\text{Br}^-$</td></tr> <tr> <td>protons</td><td>35</td><td>35</td></tr> <tr> <td>neutrons</td><td>44</td><td>46</td></tr> <tr> <td>electrons</td><td>35</td><td>36</td></tr> </table> Each row ✓		^{79}Br	$^{81}\text{Br}^-$	protons	35	35	neutrons	44	46	electrons	35	36	3
	^{79}Br	$^{81}\text{Br}^-$												
protons	35	35												
neutrons	44	46												
electrons	35	36												

Q41

0620/43/M/J/23/Q2(c)

Marking Scheme

2(c)(i)	27	1
2(c)(ii)	Aluminium / Al	1

Q42

0620/43/M/J/23/Q3(a)(i)

Marking Scheme

3(a)(i)	M1 eight crosses in second shell of Mg M2 7 dots and 1 cross in second shell of F M3 '2+' charge on Mg ion on correct answer line and '-' charge on F ion on correct answer line	3
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Q43 0620/41/O/N/23/Q2(f)(ii) Marking Scheme

2(f)(ii)	M1 eight crosses in second shell of Al (1) M2 7 dots and 1 cross in second shell of F (1) M3 3+ charge on Al ion on correct answer line and – charge on F ion on correct answer line (1)	3
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Q44 0620/42/O/N/23/Q1 Marking Scheme

1(a)	B	1
1(b)	F	1
1(c)	D	1
1(d)	A AND E	1
1(e)	G	1

Q45 0620/43/O/N/23/Q2 Marking Scheme

2(a)(i)	A, B, F	1
2(a)(ii)	D	1
2(a)(iii)	C	1
2(b)	5	1
2(c)	33	1
2(d)	2,8,8	1

Q46 0620/42/F/M/24/Q1(f)

Marking Scheme

1(f)(i)	2,8	1
1(f)(ii)	M1 26 (protons) M2 23 (electrons)	2

Q47 0620/42/M/J/24/Q5(a)(i)-(ii)

Marking Scheme

5(a)(i)	<table border="1"> <tr> <td></td><td>³²S</td><td>³⁴S</td></tr> <tr> <td>protons</td><td>16</td><td>16</td></tr> <tr> <td>neutrons</td><td>16</td><td>18</td></tr> </table>		³² S	³⁴ S	protons	16	16	neutrons	16	18	2
	³² S	³⁴ S									
protons	16	16									
neutrons	16	18									
5(a)(ii)	same electronic configuration / structure	1									

Q48 0620/41/O/N/24/Q2(a)-(d)

Marking Scheme

2(a)	total number of protons and neutrons in the nucleus of an atom	1
2(b)	they are the same	1
2(c)	M1 2,8,4 M2 2,8,8	2
2(d)	M1 12n + 11e M2 10e M3 Ga M4 69 above 31 and to the left of the symbol M5 charge of 3 +	5

Q49 0620/41/O/N/24/Q2(e)(i) Marking Scheme

2(e)(i)	M1 atom(s) of the same element M2 with different number of neutrons	2
---------	--	----------

Q50 0620/41/O/N/24/Q2(e)(iii) Marking Scheme

2(e)(iii)	same number of electrons / same electronic configuration	1
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Q51 0620/42/F/M/25/Q2(b) Marking Scheme

2(b)	M1 8 dots in third shell of each K M2 6 crosses and 2 dots in third shell of S M3 '+' charge on each K ion on correct answer line and '2-' charge on S ion on correct answer line	3
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Q52 0620/41/M/J/25/Q2(c)

Marking Scheme

2(c)	M1 Ar (1) M2 P^{3-} or S^{2-} or Cl^{-} (1)	2
------	--	----------

Q53 0620/42/M/J/25/Q5(c)

Marking Scheme

5(c)	M1 8 dots in second shell of each Na M2 6 crosses and 2 dots in third shell of S M3 '+' charge on each Na ion on correct answer line and '2-' charge on S ion on correct answer line	3
------	--	----------

Q54 0620/42/M/J/25/Q5(d)(i)-(ii)

Marking Scheme

5(d)(i)	isotopes	1
5(d)(ii)	mark by row p = 37 and 37 n = 48 and 50 e = 37 and 36	3

Q55

0620/43/M/J/25/Q2(c)

Marking Scheme

2(c)	M1 Ne M2 Na ⁺ OR Mg ²⁺ OR Al ³⁺	2
------	---	----------

Q56

0620/41/O/N/25/Q1(a)-(c)

Marking Scheme

1(a)	<table border="1"> <thead> <tr> <th>particle</th><th>relative mass</th><th>relative charge</th></tr> </thead> <tbody> <tr> <td>proton</td><td>1</td><td></td></tr> <tr> <td>neutron</td><td>1</td><td>0 / nil</td></tr> <tr> <td>electron</td><td></td><td>- 1</td></tr> <tr> <td></td><td>✓(1)</td><td>✓(1)</td></tr> </tbody> </table>	particle	relative mass	relative charge	proton	1		neutron	1	0 / nil	electron		- 1		✓(1)	✓(1)	2
particle	relative mass	relative charge															
proton	1																
neutron	1	0 / nil															
electron		- 1															
	✓(1)	✓(1)															
1(b)(i)	M1 atoms of the same element that have the same number of protons M2 but different numbers of neutrons	2															
1(b)(ii)	they have the same number of electrons and therefore the same electronic configuration	1															
1(c)	M1 22 M2 16 and 18 M3 50 and 22 and to the left of the symbol M4 Ti M5 2+	5															

Q57

0620/42/O/N/25/Q2(b)

Marking Scheme

2(b)	M1 atoms of the same element that have the same number of protons M2 but different numbers of neutrons	2
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Q58

0620/42/O/N/25/Q2(c)(i)

Marking Scheme

2(c)(i)	p = 26 and 26 n = 28 and 32 e = 24 and 23	3
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