

C2 The Periodic Table Homework task 2

Q1.

This question is about the halogens.

- (a) Which group in the periodic table is known as the halogens?

Tick **one** box.

Group 1

Group 2

Group 7

Group 0

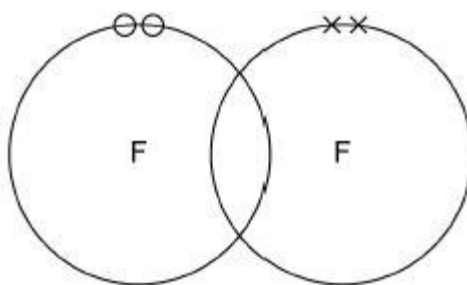
(1)

- (b) A fluorine atom has 7 electrons in the outer shell.

The diagram below shows part of a dot and cross diagram to represent a molecule of fluorine (F_2).

Complete the dot and cross diagram.

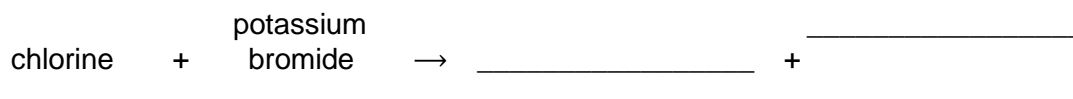
You should show only the electrons in the outer shells.



(2)

- (c) Chlorine reacts with potassium bromide solution.

Complete the word equation.



(2)

- (d) What type of reaction happens when chlorine reacts with potassium bromide solution?

Tick **one** box.

- decomposition
- displacement
- neutralisation
- precipitation

(1)

- (e) Complete the sentence.

Choose the answer from the box.

an atom an electron a neutron a proton

Chlorine is more reactive than bromine.

This is because chlorine gains _____ more easily.

(1)

- (f) How does the size of a chlorine atom compare with the size of a bromine atom?

Complete the sentence.

Choose the answer from the box.

bigger than the same size as smaller than

A chlorine atom is _____ a bromine atom.

(1)

- (g) Give a reason for your answer to part (f)

Reason _____

(1)

- (h) Fluorine reacts with chlorine to produce ClF_3

Balance the chemical equation for the reaction.



(1)

(i) Explain why fluorine is a gas at room temperature.

Use the following words in your answer:

energy

forces

molecules

weak

(3)
(Total 13 marks)

Q2.

This question is about atoms and chemical elements.

Mendeleev's periodic table has groups of elements with similar properties.

Figure 1 shows part of Mendeleev's periodic table.

Figure 1

1	1 H							
2	7 Li	9.4 Be	11 B	12 C	14 N	16 O	19 F	
3	23 Na	24 Mg	27.3 Al	28 Si	31 P	32 S	35.5 Cl	
4	39 K	40 Ca	44	48 Ti	51 V	52 Cr	55 Mn	56 59 59 63 Fe, Co, Ni, Cu

(a) Compare Mendeleev's periodic table with the modern periodic table.

Which group is missing from Mendeleev's periodic table?

Tick **one** box.

Group 1

Group 2

Group 7

Group 0

(1)

(b) In the early periodic tables some elements were placed in the wrong groups.

Mendeleev overcame some of these problems in his periodic table.

Give **two** ways Mendeleev did this.

1. _____

2. _____

(2)

Atoms were thought to be tiny spheres that could not be divided.

(c) Draw **one** line from each scientist to the discovery the scientist made.

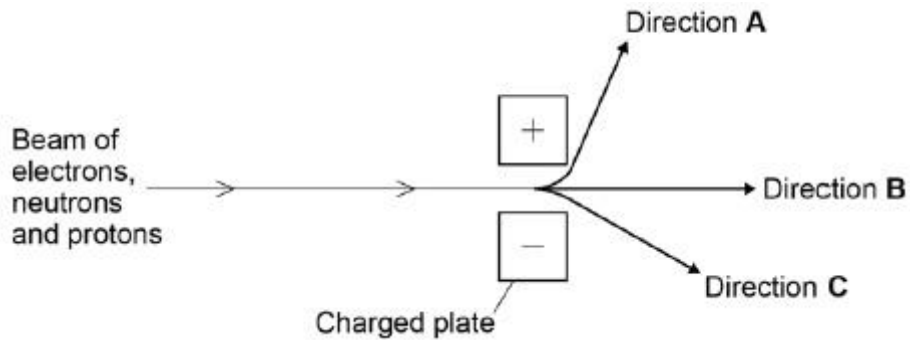
Scientist	Discovery the scientist made
	Discovered electrons
Neils Bohr	Electrons orbit the nucleus
	Existence of neutrons
James Chadwick	Mass of atom concentrated at centre
	Proton found in nucleus

(2)

- (d) A beam of electrons, neutrons and protons can be separated by passing them through an electric field.

Figure 2 shows the directions of the three particles after entering the electric field.

Figure 2



Charged particles are attracted to the oppositely charged plate in the electric field.

Which direction, **A**, **B** or **C**, does each particle follow?

Complete the table.

Particle	Direction
Electron	
Neutron	
Proton	

(2)

- (e) Calculate the mass of one atom of sodium.

Use the equation:

$$\text{mass of one atom of sodium} = \frac{\text{relative atomic mass}}{\text{Avogadro constant}}$$

Avogadro constant = 6.02×10^{23}

Give your answer to 2 significant figures.

Mass = _____ g

(3)

- (f) The radius of a sodium atom is 227 picometres.

1 picometre = 10^{-12} metres (m)

The radius of a nucleus is $\frac{1}{10\,000}$ of that of the atom.

Which calculation shows the radius of a sodium atom's nucleus?

Tick **one** box.

$227 \times 10\,000$ m

$227 \times \frac{1}{10\,000}$ m

$227 \times 10^{-12} \times 10\,000$ m

$227 \times 10^{-12} \times \frac{1}{10\,000}$ m

(1)
(Total 11 marks)

Higher Tier Questions Q3 This question is about the halogens.

- (a) Write the state symbol for chlorine at room temperature.

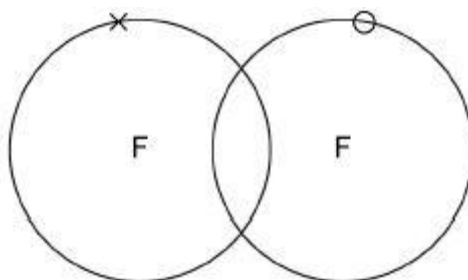
Cl₂ (_____)

(1)

- (b) The diagram below represents one molecule of fluorine.

Complete the dot and cross diagram on the diagram above.

You should show only the electrons in the outer shells.



(2)

- (c) A fluorine atom can be represented as ${}^{19}_{9}\text{F}$

What is the total number of electrons in a fluorine molecule (F₂)?

Tick **one** box.

9

14

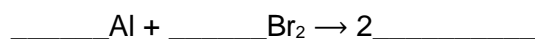
18

38

(1)

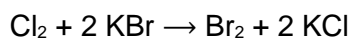
- (d) Aluminium reacts with bromine to produce aluminium bromide.

Complete the balanced chemical equation for this reaction.



(2)

- (e) When chlorine reacts with potassium bromide, chlorine displaces bromine.



Explain why chlorine is more reactive than bromine.

(3)

(Total 9 marks)

Q4.

- (a) Dmitri Mendeleev was one of the first chemists to classify the elements by arranging them in order of their atomic weights. His periodic table was published in 1869.

How did Mendeleev know that there must be undiscovered elements **and** how did he take this into account when he designed his periodic table?

(2)

- (b) By the early 20th century protons and electrons had been discovered.

Describe how knowledge of the numbers of protons and electrons in atoms allow chemists to place elements in their correct order and correct group.

(3)

- (c) The transition elements are a block of elements between Groups 2 and 3 of the periodic table.

- (i) Transition elements have similar properties.

Explain why, in terms of electronic structure.

(2)

- (ii) There are **no** transition elements between the Group 2 element magnesium and the Group 3 element aluminium.

Give a reason why, in terms of electronic structure.

(1)

(Total 8 marks)

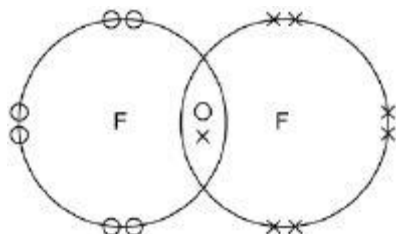
Mark schemes

Q1.

(a) group 7

1

(b)



*one shared pair anywhere in overlap between two circles **or** on intersection*

6 other electrons on each atom

*allow dots **or** crosses **or** mixture for all marks*

ignore any inner shell electrons

1

1

(c) bromine

1

potassium chloride

1

either order

allow correct chemical formulae

(d) displacement

1

(e) (an) electron

1

(f) smaller than

1

(g) (chlorine has) fewer levels / shells (of electrons)

allow converse for bromine

allow (chlorine has) fewer electrons

allow Cl has 3 levels / shells and Br has 4 levels / shells

ignore atomic number

***or** mass number*

***or** number of protons*

1

mark independent of answer to part (f)

(h) 3

allow multiples

1

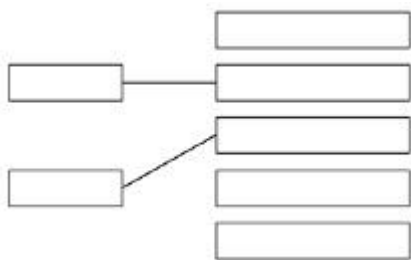
- (i) there are weak forces
do **not** accept weak bonds 1
- between molecules 1
- allow weak intermolecular forces for the first 2 marks*
- which require little energy to overcome / break
allow does not need much energy to boil 1

[13]

Q2.

- (a) group 0 1
- (b) left gaps 1
- in some places changed the order based on atomic weights 1

(c)



1
1

- (d) (electron) **A**
(neutron) **B**
(proton) **C**
3 correct answers scores 2 marks
1/2 correct answers scores 1 mark 2

- (e) $\frac{23}{6.02 \times 10^{23}}$ 1
- $3.820598... \times 10^{-23}$ 1
- 3.8×10^{-23}
an answer of 3.8×10^{-23} scores 3 marks 1

(f) $227 \times 10^{-12} \times \frac{1}{10\,000} \text{ m}$

1

[11]

Q3.

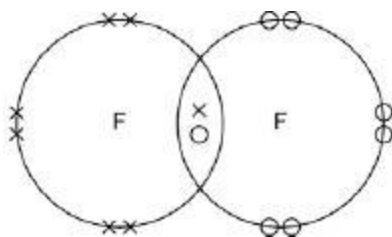
(a) g

do **not** accept upper case (G)

do **not** accept gas

1

(b)



one shared pair anywhere in overlap between two circles **or** on intersection

1

6 other electrons on each atom

1

allow dots **or** crosses **or** mixture for all marks

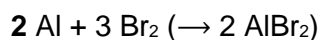
ignore any inner shell electrons

(c) 18

1

(d) AlBr_3

1



1

allow **1** mark for balancing their equation with an incorrect product

(e) chlorine is a smaller atom
or has fewer energy levels
or outer shell closer to nucleus

ignore chlorine has fewer electrons

1

chlorine has less shielding

or

has the greater attraction between the nucleus and the outer shell **or** incoming electron

1

therefore chlorine can gain an electron (into the outer shell) more easily

1

if no other marks awarded allow **1** mark for correct trend in reactivity in Group 7

do **not** accept reference to incorrect particles e.g. chloride atom

max 2 if outer shell / level not mentioned
'it' refers to chlorine
allow converse reasons for bromine being less
reactive

[9]

Q4.

- (a) if placed consecutively, then elements would be in wrong group / have wrong properties

allow some elements didn't fit pattern

1

left gaps

1

- (b) (elements placed in) atomic / proton number order

1

(elements in) same group have same number of outer electrons

1

any **one** from:

- number of protons = number of electrons
- reactions/(chemical) properties depend on the (outer) electrons
- number of shells gives the period

allow number of shells increases down the group

1

- (c) (i) (transition elements usually) have same / similar number of outer / 4th shell electrons

allow 2 electrons in outer shell

1

(because) inner (3rd) shell / energy level is being filled

ignore shells overlap

1

- (ii) 2nd shell / energy level can (only) have maximum of 8 electrons

accept no d-orbitals

or

2nd shell / energy level cannot have 18 electrons

1

[8]