Q1. An atom of aluminium has the symbol $^{27}_{13}Al$

(a) Give the number of protons, neutrons and electrons in this atom of aluminium.

Number of protons .....

Number of neutrons .....

Number of electrons .....

(3)

(b) Why is aluminium positioned in Group 3 of the periodic table?

.....

.....

(1)

(c) In the periodic table, the transition elements and Group 1 elements are metals.

Some of the properties of two transition elements and two Group 1 elements are shown in the table below.

	Transition elements		**Group 1 elements**	
	Chromium	Iron	Sodium	Caesium
Melting point in °C	1857	1535	98	29
Formula of oxides	CrO Cr_2O_3 CrO_2 CrO_3	FeO Fe_2O_3 Fe_3O_4	Na_2O	Cs_2O

Use your own knowledge **and** the data in the table above to compare the chemical and physical properties of transition elements and Group 1 elements.

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(6)
(Total 10 marks)

Q2. This question is about halogens and their compounds.

The table below shows the boiling points and properties of some of the elements in Group 7 of the periodic table.

Element	**Boiling point in °C**	**Colour in aqueous solution**
Fluorine	−188	colourless
Chlorine	−35	pale green
Bromine	X	orange
Iodine	184	brown

(a) Why does iodine have a higher boiling point than chlorine?

Tick **one** box.

Iodine is ionic and chlorine is covalent ☐

Iodine is less reactive than chlorine ☐

The covalent bonds between iodine atoms are stronger ☐

The forces between iodine molecules are stronger ☐

(1)

(b) Predict the boiling point of bromine.

.....

(1)

(c) A redox reaction takes place when aqueous chlorine is added to potassium iodide solution.

The equation for this reaction is:

$$Cl_2(aq) + 2KI(aq) \rightarrow I_2(aq) + 2KCl(aq)$$

Look at table above.

What is the colour of the final solution in this reaction?

Tick **one** box.

Brown ☐

Orange ☐

Pale green ☐

Colourless ☐

(1)

(d) What is the ionic equation for the reaction of chlorine with potassium iodide?

Tick **one** box.

$Cl_2 + 2K \rightarrow 2KCl$ ☐

$2I^- + Cl_2 \rightarrow I_2 + 2Cl^-$ ☐

$I^- + Cl \rightarrow I + Cl^-$ ☐

$I^- + K^+ \rightarrow KI$ ☐

(1)

(e) Why does potassium iodide solution conduct electricity?

Tick **one** box.

It contains a metal ☐

It contains electrons which can move ☐

It contains ions which can move ☐

It contains water ☐

(1)

(f) What are the products of electrolysing potassium iodide solution?

Tick **one** box.

Product at cathode	**Product at anode**	
hydrogen	iodine	☐
hydrogen	oxygen	☐
potassium	iodine	☐
potassium	oxygen	☐

(1)
(Total 6 marks)

Q3. This question is about atomic structure and elements.

(a) Complete the sentences.

(i) The atomic number of an atom is the number of .....

(1)

(ii) The mass number of an atom is the number of .....

.....

(1)

(b) Explain why an atom has no overall charge.

Use the relative electrical charges of sub-atomic particles in your explanation.

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(2)

(c) Explain why fluorine and chlorine are in the same group of the periodic table.

Give the electronic structures of fluorine and chlorine in your explanation.

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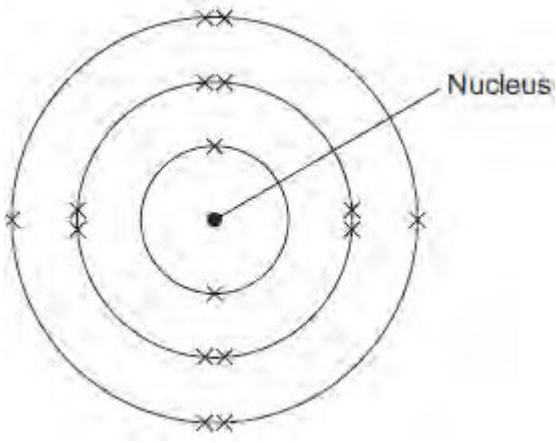
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(2)

(d) The diagram shows the electronic structure of an atom of a non-metal.



What is the chemical symbol of this non-metal?

Tick (✓) **one** box.

Ar ☐

O ☐

S ☐

Si ☐

(1)

(e) When elements react, their atoms join with other atoms to form compounds.

Complete the sentences.

(i) Compounds formed when non-metals react with metals consist of

particles called ..... .

(1)

(ii) Compounds formed from only non-metals consist of

particles called ..... .

(1)

(Total 9 marks)

Q4. In 1866 John Newlands produced an early version of the periodic table.

Part of Newlands' periodic table is shown below.

Column	1	2	3	4	5	6	7
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca	Cr	Ti	Mn	Fe

Newlands' periodic table arranged all the known elements into columns in order of their atomic weight.

Newlands was trying to show a pattern by putting the elements into columns.

(a) Iron (Fe) does **not** fit the pattern in column 7.

Give a reason why.

.....

.....

(1)

(b) In 1869 Dmitri Mendeleev produced his version of the periodic table.

Why did Mendeleev leave gaps for undiscovered elements in his periodic table?

.....

.....

(1)

(c) Newlands and Mendeleev placed the elements in order of atomic weight.

Complete the sentence.

The modern periodic table places the elements in order of

..... .

(1)

(d) Lithium, sodium and potassium are all in Group 1 of the modern periodic table.

Explain why.

.....

.....

.....

.....

(2)
(Total 5 marks)

Q5. This question is about the halogens (Group 7).

(a) How do the boiling points of the halogens change down the group from fluorine to iodine?

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(1)

(b) Sodium bromide is produced by reacting sodium with bromine.

Sodium bromide is an ionic compound.

(i) Write down the symbols of the **two** ions in sodium bromide.

.....

(1)

(ii) Chlorine reacts with sodium bromide solution to produce bromine and one other product.

Complete the word equation for the reaction.

chlorine + sodium bromide ⟶ bromine + ...

(1)

(iii) Why does chlorine displace bromine from sodium bromide?

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(1)

(iv) Use the Chemistry Data Sheet to help you to answer this question.

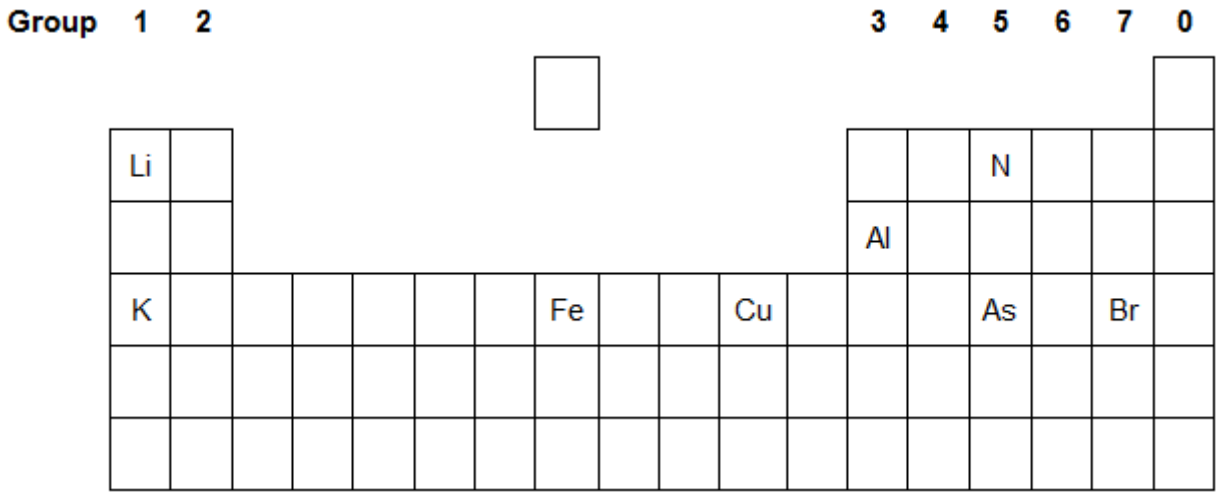
Suggest which halogen could react with sodium chloride solution to produce chlorine.

.....

(1)

(Total 5 marks)

Q6. The positions of eight elements in the modern periodic table are shown below.



Choose the correct chemical symbols to complete each sentence.

(a) The **two** metals that react vigorously with water are ..... and ..... .

(1)

(b) The element used as a catalyst in the Haber process is ..... .

(1)

(c) The **two** elements with five electrons in their outer shell (highest energy level) are ..... and ..... .

(1)

(d) Iron has ions with different charges.

The other metal that has ions with different charges is ..... .

(1)

(Total 4 marks)

Q7. In 1869, Dmitri Mendeleev produced his periodic table of the elements.

Mendeleev placed the alkali metals in the same group.

(a) What evidence did Mendeleev use to decide that the alkali metals should be in the same group?

.....

.....

(1)

(b) Describe how the elements in the modern periodic table are arranged:

(i) in terms of protons

.....

.....

(1)

(ii) in terms of electrons.

.....

.....

(1)

(c) State **two** properties of transition elements that make them more useful than alkali metals for making water pipes.

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(2)

(d) Describe and explain the trend in reactivity of the alkali metals (Group 1).

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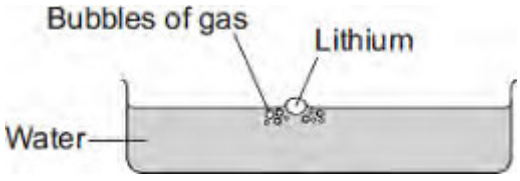
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(4)
(Total 9 marks)

Q8. Lithium is in Group 1 of the periodic table.

Lithium reacts with water to produce a gas and an alkaline solution.



(a) (i) Name the gas produced.

.....

(1)

(ii) Which ion causes the solution to be alkaline?

.....

(1)

(b) Potassium is also in Group 1 of the periodic table.
Potassium reacts with water in a similar way to lithium.

Write down **two** differences you would see between the reactions of potassium and lithium with water.

1 .....

.....

2 .....

.....

(2)
(Total 4 marks)

Q9. John Newlands was a chemist who worked in a sugar factory.

In 1866 he designed a periodic table.
He arranged the elements in order of their relative atomic masses.

He found a repeating pattern for some of the elements.
Newlands wrote, 'the eighth element starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music'.

H	**Li**	**G**	**Bo**	**C**	**N**	**O**
F	**Na**	**Mg**	**Al**	**Si**	**P**	**S**
Cl	**K**	**Ca**	**Cr**	**Ti**	**Mn**	**Fe**
Co, Ni	**Cu**	**Zn**	**Y**	**In**	**As**	**Se**
Br	**Rb**	**Sr**	**Ce, La**	**Zr**	**Di, Mo**	**Ro, Ru**
Pd	**Ag**	**Cd**	**U**	**Sn**	**Sb**	**Te**
I	**Cs**	**Ba, V**	**Ta**	**W**	**Nb**	**Au**
Pt, Ir	**Tl**	**Pb**	**Th**	**Hg**	**Bi**	**Os**

Newlands' periodic table

(a) In Newlands' periodic table, the elements lithium, sodium and potassium are grouped together.

Give **two** properties of these elements which support the idea that they should be grouped together.

1 .....

.....

2 .....

.....

(2)

(b) Newlands' periodic table was not accepted by most chemists in 1866.

Suggest reasons why.
Use the Newlands' periodic table above to help you to answer this question.

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(3)

(c) State **and** explain **one** way in which Mendeleev improved Newlands' periodic table.

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(2)
(Total 7 marks)