

AQA GCSE CHEMISTRY (HIGHER) • 8462

CHEMISTRY



EXAM QUESTION PACK

4.1.2 THE PERIODIC TABLE (PACK 3)

SCORE

/193

PERCENTAGE

%

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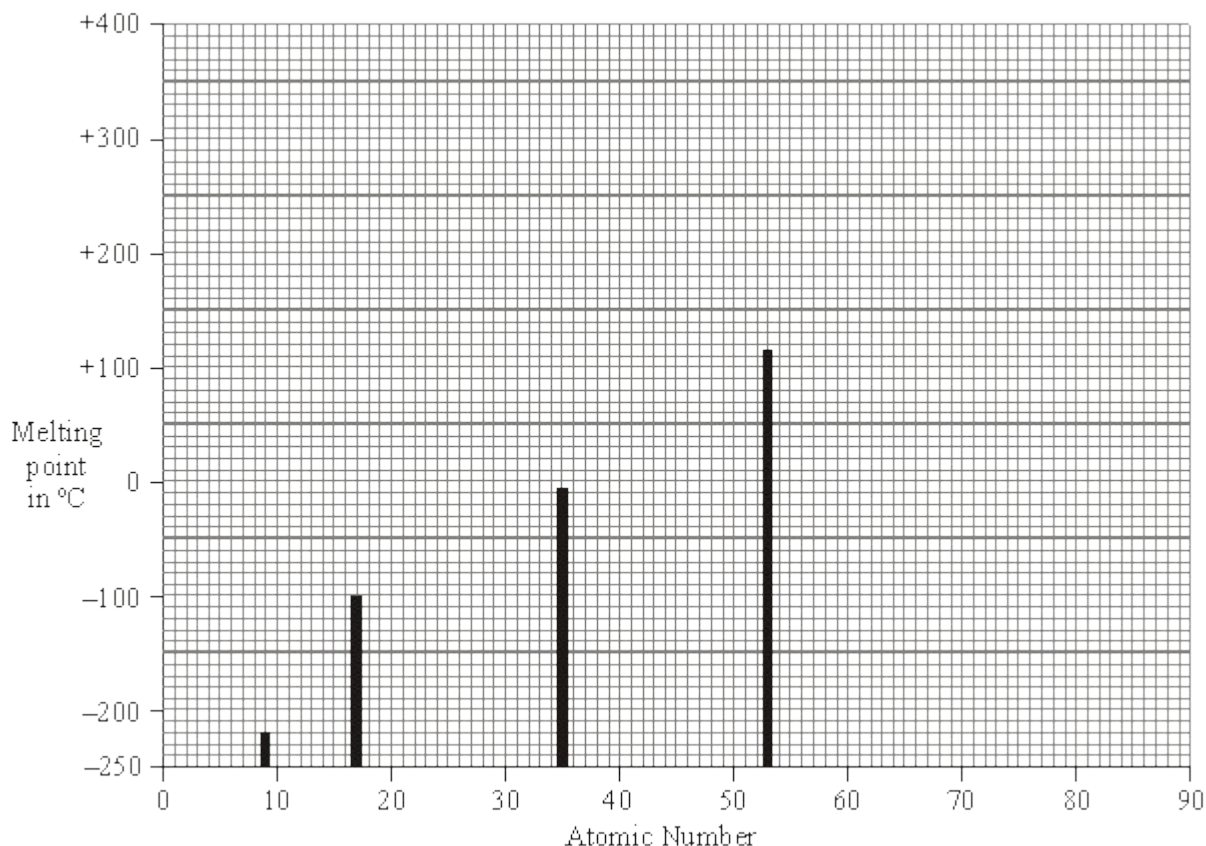
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Q1.

- (a) The bar graph shows the melting points of the elements in Group 7 plotted against their atomic numbers.



- (i) How do the melting points of the Group 7 elements change as the atomic number increases?

(1)

- (ii) The melting point of astatine (atomic number = 85) is not shown on the bar graph. Estimate the melting point of astatine.

_____ °C

(1)

Draw a bar for this value on the bar graph.

(1)

- (b) The water from wells in Japan contains bromide ions.

Bromine is extracted from this water. The bromine is displaced by adding another Group 7 element.

- (i) Place a tick (✓) next to the name of **one** Group 7 element that could be used to displace bromine from this water.

	Group 7	(✓)
Most reactive  Least reactive	Fluorine	
	Chlorine	
	Bromine	
	Iodine	
	Astatine	

(1)

(ii) State why you have chosen this element.

(1)

(iii) One sample of this water contained 2 g of bromine per litre of water.

How many litres of this water would be needed to make 1 kg of bromine?
(1 kg = 1000 g)

_____ litres

(1)

(Total 6 marks)

Q2.

Mendeleev constructed a periodic table in 1869.

In his periodic table:

- most of the elements were put in order of increasing relative atomic mass;
- elements with similar properties were put into groups;
- Mendeleev changed the order of some elements to put them with similar elements;
- spaces were left for elements that Mendeleev thought would be discovered in the future.

One space was in Group 3 between the elements aluminium and indium.

Group 3
Boron

Aluminium
?
Indium
Thallium

Mendeleev called this undiscovered element 'eka-aluminium'. This element is now known as gallium. In 1871, he also predicted some of the properties of gallium.

The table shows the properties of aluminium and indium, along with some of the predictions made by Mendeleev for gallium.

	Appearance	Metal or non-metal	Boiling point in °C	Density in g per cm³	Relative atomic mass
Aluminium	silvery white	metal	2467	2.7	27
Predicted properties of gallium	silvery white	metal	?	?	68
Indium	silvery white	metal	2080	7.31	115

- (i) Suggest **two** reasons why other scientists in 1871 did not accept Mendeleev's periodic table.

Reason 1 _____

Reason 2 _____

(2)

- (ii) Suggest why the discovery of gallium in 1875 convinced other scientists that Mendeleev's table was correct.

(1)

(Total 3 marks)

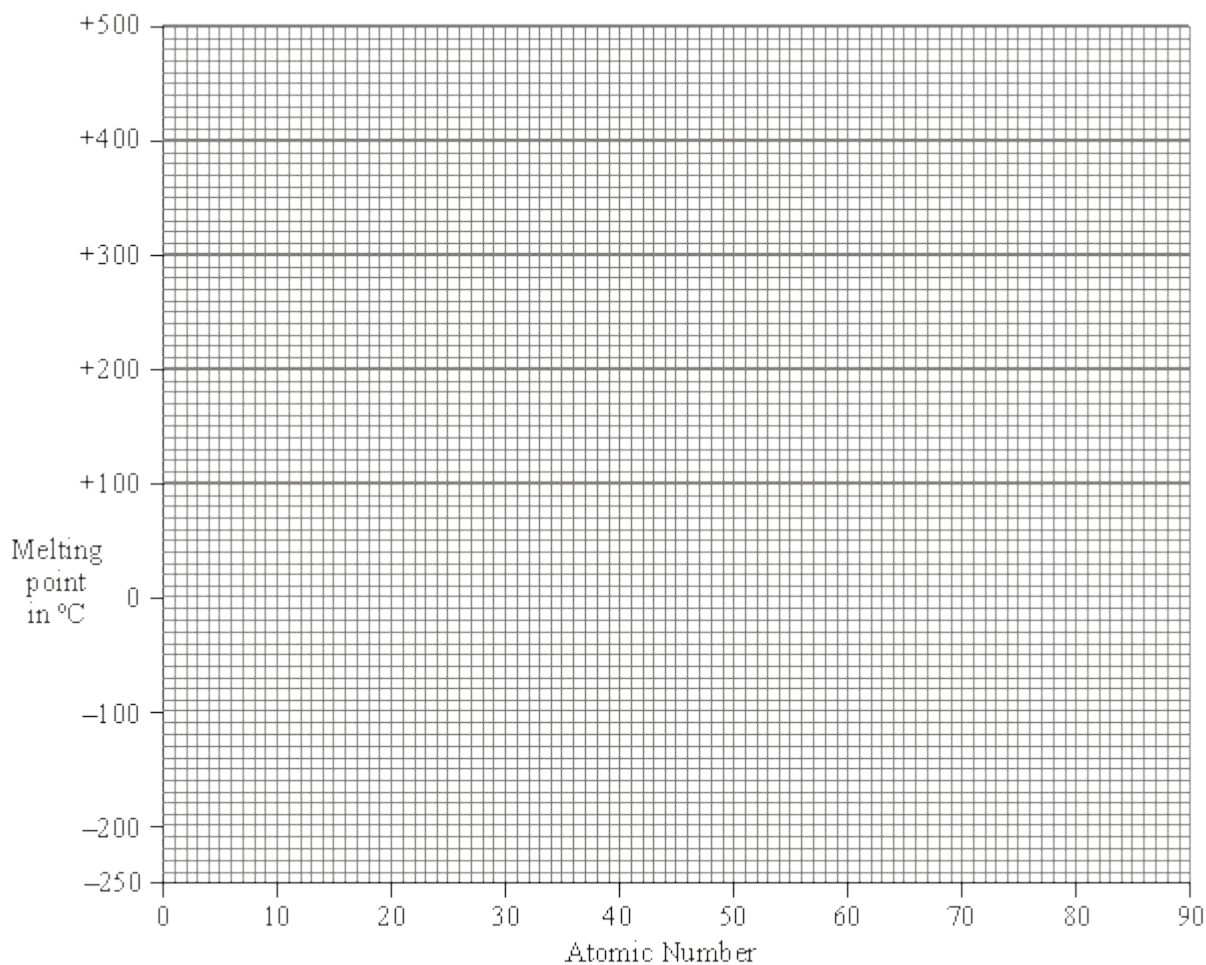
Q3.

- (a) The table gives the melting points of some of the elements of Group 7.

Element	Atomic number	Melting point in °C
----------------	----------------------	----------------------------

Fluorine	9	-220
Chlorine	17	-101
Bromine	35	-7
Iodine	53	114
Astatine	85	?

(i) Plot a graph of the melting point against atomic number.



Draw a line of best fit.

Extend your line to estimate a value for the melting point of astatine.

(2)

(ii) Estimate the melting point of astatine. _____ °C

(1)

(iii) Which of the Group 7 elements are solids at 20 °C?

(1)

(b) (i) Draw a diagram to show the arrangement of electrons in an atom of fluorine.

(1)

- (ii) The elements of Group 7 have similar chemical properties.

Explain, in terms of electrons, why they have similar chemical properties.

(1)

- (c) Xenon is a very unreactive element.

- (i) Explain, in terms of electrons, why xenon is so unreactive.

(2)

- (ii) Fluorine reacts with xenon but iodine does not.

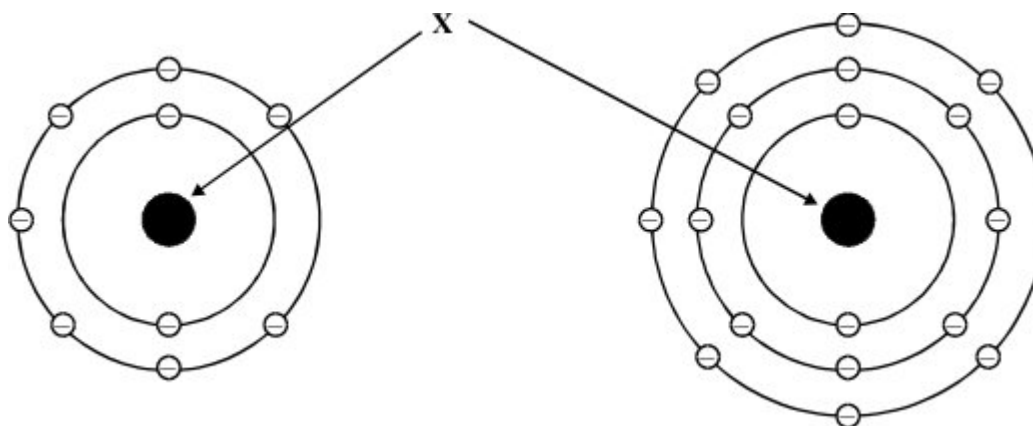
Explain, in terms of atomic structure, why fluorine is more reactive than iodine.

(3)

(Total 11 marks)

Q4.

The diagrams show the electronic arrangement of the atoms of two elements.



- (i) Name the part of the atoms labelled **X**.

_____ (1)

- (ii) Why are these two elements in the same group of the Periodic Table?

 _____ (1)
(Total 2 marks)

Q5.

Fluorine is more reactive than chlorine. Fluorine reacts with most elements in the Periodic Table. However, fluorine does not react with argon.

Atomic numbers: F 9; Cl 17; Ar 18.

- (a) To which group of the Periodic Table do fluorine and chlorine belong?

_____ (1)

- (b) (i) Give **one** use for argon.

_____ (1)

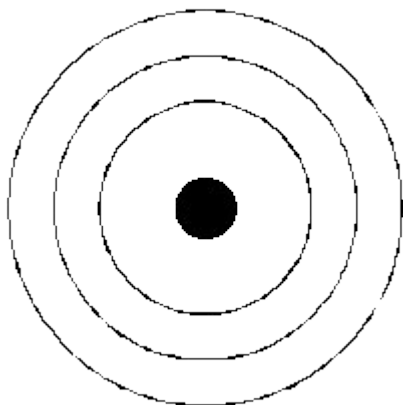
- (ii) Explain why the noble gas argon is unreactive.

 _____ (2)

- (c) (i) Give **one** use for chlorine.

(1)

- (ii) Draw the electron arrangement of a chlorine atom.



(2)

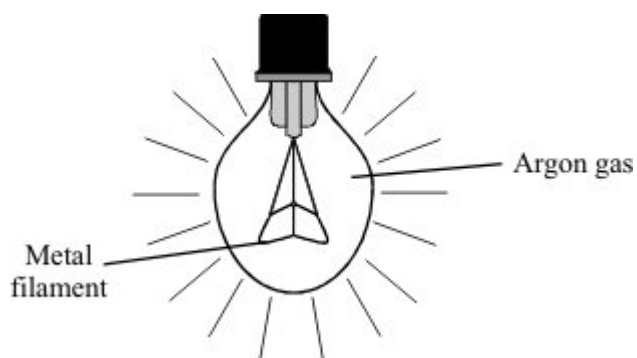
- (iii) Explain why fluorine is more reactive than chlorine.

(3)

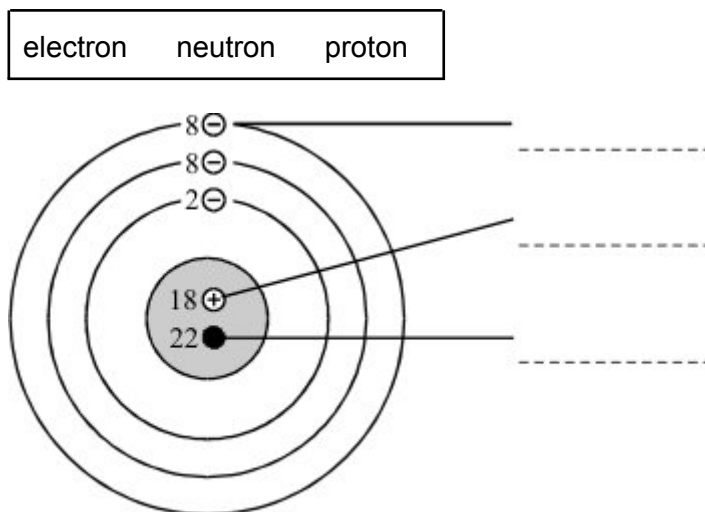
(Total 10 marks)

Q6.

The diagram shows a light bulb.



- (a) (i) An argon atom has the structure shown. Use the words in the box to label the particles in the atom. Each word should only be used **once**.



(2)

(ii) Argon is unreactive. Why?

(1)

(b) Oxygen would **not** be a suitable gas to use in a light bulb. Explain why.

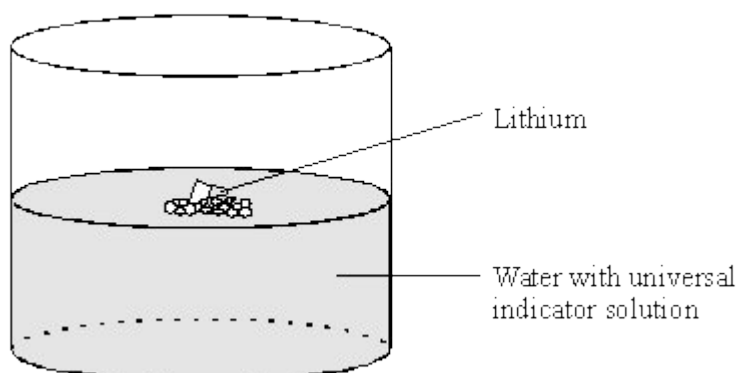
(2)

(Total 5 marks)

Q7.

Lithium is a very reactive metal.

(a) Lithium reacts with cold water.



(i) Which **physical** property of lithium is seen during this reaction?

(1)

(ii) Which **chemical** property of lithium will be shown by the universal indicator?

(1)

(b) Complete the sentence by writing in the missing numbers.

Lithium has an atomic number of 3 and a mass number of 7.

This means that an atom of lithium has _____ protons _____ electrons
and _____ neutrons.

(3)

(Total 5 marks)

Q8.

The elements in Mendeleev's periodic table were arranged in order of increasing atomic mass. Part of the modern Periodic Table is shown.

[illegible]

(a) Complete the sentence by writing in the missing words.

The modern Periodic Table is arranged in order of increasing

(1)

(b) (i) Name a metal in the same group as lithium.

(1)

(ii) Name a non-metal in the same period as magnesium.

(1)

(Total 3 marks)

Q9.

This question is about the Periodic Table.

(a) Dimitri Mendeleev was a Russian scientist who, in 1869, helped to develop the Periodic Table. He made his table with the known elements arranged in order of increasing atomic mass. He started new rows so that elements with similar chemical properties would be in the same column. Mendeleev sometimes had to leave gaps in his table.

- The Periodic Table is now the arrangement of the elements in order of increasing atomic _____. The rows are called _____ and the columns are called _____.

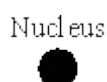
(ii) Suggest why Mendeleev had to leave gaps in his table.

(b) This section of the Periodic Table shows the positions of some elements.

[illegible]

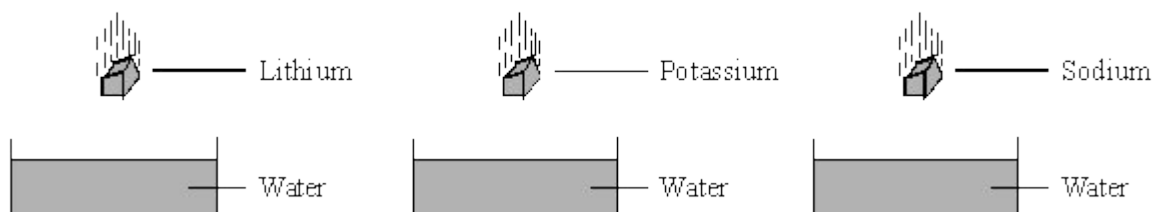
- (i) Give the chemical symbol for **one** of the noble gases.

(ii) Draw the arrangement of electrons around the nucleus for the noble gas that you chose in (i).



(iii) Why do the electron arrangements of lithium, sodium and potassium make them react in a similar way?

(iv) Small pieces of lithium, potassium and sodium are added to water.



What is the order of reactivity for these three metals? Put the most reactive metal first.

(1)

- (v) Complete and balance the chemical equation for the reaction of sodium with water.



(2)

(Total 10 marks)

Q10.

The Periodic Table contains groups of elements that have similar chemical properties.

- (a) The halogens are in Group 7 of the Periodic Table.

- (i) Complete the table. Iodine has been done for you.

Halogen	Colour of vapour
chlorine	
	red-brown
iodine	purple

(2)

- (ii) Why do the halogens have similar chemical properties?

(1)

- (b) The alkali metals are in Group 1 of the Periodic Table. State what is formed when any alkali metal reacts with water.

(2)
(Total 5 marks)

Q11.

Fluorine is a very useful element. It is placed in group 7 of the Periodic Table.

Use your knowledge of the elements in group 7 to help you answer these questions. You may find that information in the Data Sheet may help you with this question.

- (a) Name another element in group 7 of the Periodic Table.

(1)

- (b) Cylinders filled with fluorine molecules are commercially available. What would you expect the formula of a fluorine molecule to be?

(1)

- (c) Fluoride ions are added to drinking water to help prevent tooth decay. What is the charge on fluoride ions in the water?

(1)

- (d) Fluorine reacts with the non-metal sulphur to make sulphur hexafluoride (SF_6).

- (i) What type of bonding would you expect in sulphur hexafluoride?

(1)

- (ii) Explain the reason for your answer to part (i).

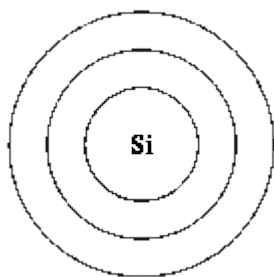
(1)

(Total 5 marks)

Q12.

Silicon is an extremely important element. More than a million tonnes of silicon are produced each year. Silicon is made by reducing silicon oxide (sand) with carbon (coke).

- (a) (i) Complete the diagram below to show the arrangement of electrons in an atom of silicon. The Data Sheet may help you with this question.



(2)

- (ii) Which electrons in the silicon atom take part in chemical reactions with other atoms?

(1)

- (iii) What features of all the atoms of the elements in group 4 of the Periodic Table might give them similar chemical properties?

(1)

- (b) Silicon is difficult to classify as a metal or a non-metal because it has properties which resemble both. Some of the properties of silicon are listed below.

- Silicon is a shiny blue/grey solid.
- Silicon is placed in Group 4 of the Periodic Table.
- Silicon has a relative atomic mass of 28.
- Silicon has a very high melting point (1410°C).
- Silicon has a very high boiling point (2355°C).
- Silicon conducts electricity.
- Silicon oxide will neutralise alkalis.
- Silicon forms compounds in which the silicon atoms are bonded to other atoms by covalent bonds.

- (i) Select **two** properties from the list above in which silicon resembles a metal.

1. _____

2. _____

(2)

- (ii) Select **two** properties from the list above in which silicon resembles a non-metal.

1. _____

2. _____

(2)

(Total 8 marks)

Q13.

Fluorine is the most reactive element in group 7 of the Periodic Table.

Fluorine reacts with all the other elements in the Periodic Table except some of the noble gases. It does not react with helium, neon and argon, but it does react with xenon. Many substances burst into flames when exposed to fluorine.

- (a) (i) The electronic structure of chlorine is 2.8.7. What is the electronic structure of fluorine?

(1)

- (ii) What is the electronic structure of the chloride ion Cl^- ?

(1)

- (iii) Explain why fluorine is more reactive than chlorine.

(4)

- (b) (i) What does the information at the start of this question suggest about the reactivity of the elements in group 0?

(1)

- (ii) A chemist did an experiment to find out if fluorine reacts with xenon. The two gases were mixed in a glass container. The only product detected was silicon fluoride. Explain what happened.

(2)

- (iii) The experiment was repeated many years later but the gases were mixed in a different type of container. A white solid was obtained which was xenon fluoride.

Predict whether you think (1) krypton and (2) radon will react with fluorine. Explain the reasons for your predictions.

(5)

(Total 14 marks)

Q14.

Use the Periodic Table on the Data Sheet to help you to answer this question.

(a) State **one** similarity and **one** difference in the electronic structure of the elements:

(i) across the Period from sodium to argon;

(2)

(ii) down Group 7 from fluorine to astatine.

(2)

(b) (i) State the trend in reactivity of the Group 1 elements.

(1)

(ii) Explain this trend in terms of atomic structure.

(3)

(c) Hydrogen is an element which is difficult to fit into a suitable position in the Periodic Table. Give reasons why hydrogen could be placed in either Group 1 or Group 7.

(3)

(Total 11 marks)

Q15.

Read the following information about an element X.

The element X melts above 600°C. It conducts electricity at room temperature. It burns in oxygen to form an oxide. When the oxide is mixed with water it turns Universal Indicator blue.

The oxide of X is a white solid at room temperature. It has the formula XO and contains the ion X^{2+} .

The element X reacts with chlorine to form a chloride with a high melting point. The chloride conducts electricity when molten and it is soluble in water.

(a) From the information give **three** pieces of evidence which suggest that X is a metal.

1. _____

2. _____

3. _____

(3)

(b) In which Group of the Periodic Table should X be placed? Give a reason for your answer.

Group _____

Reason _____

(2)

(c) Predict the formula for the chloride of X. _____

(1)

(Total 6 marks)

Q16.

- (a) Why do the elements in Group 1 of the Periodic Table have similar chemical properties?

(1)

- (b) Explain why the reactivity of the elements in Group 1 increases down the group.

(2)

(Total 3 marks)

Q17.

Calcium and magnesium are elements. They are found in the Earth's crust as compounds, often carbonates and sulphates. Magnesium is also found as its chloride.

- (a) Calcium and magnesium are in the same Group in the Periodic Table. State which Group this is.

(1)

- (b) Use the Data Sheet to help you to answer this question.

- (i) Write the chemical formula of magnesium chloride.

(1)

- (ii) Name the type of bonding in magnesium chloride.

(1)

(Total 3 marks)

Q18.

X is an element with the following properties:

- melts at -220°C and boils at -188°C ;
- does not conduct electricity at room temperature;
- forms molecular compounds with non-metals;
- forms ionic salts with metals in which its ion has a 1–charge.

- (a) Would you expect X to be a solid, a liquid or a gas at 20°C?

_____ (1)

- (b) Predict the formula of the product formed when X reacts with aluminium.
(The aluminium ion is Al^{3+} and the X ion is X^- .)
Select your answer from the list below.

AlX

AlX_2

AlX_3

Al_3X

Al_2X_3

Predicted formula _____

(1)

- (c) To which Group of the Periodic Table does the element X belong?

_____ (1)

(Total 3 marks)

Q19.

Sodium and potassium are both in Group 1 of the Periodic Table.

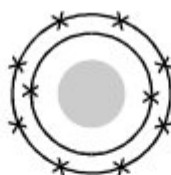
- (a) Explain, by reference to their electronic structures, why both elements are placed in Group 1.

(1)

- (b) Use the Data Sheet to help you to answer this question.
The diagrams below represent the electronic structures of some atoms and ions.



A



B



C



D



E



F

Which one of the structures, **A - F**

(i) represents a sodium **atom**, _____ (1)

(ii) represents a potassium **ion**? _____ (1)

(c) Sodium and potassium both react with cold water.

(i) The word equation represents the reaction of sodium with water.

sodium + water → sodium hydroxide + hydrogen

Complete and balance the symbol equation for this reaction.

_____ + _____ → 2NaOH + _____ (2)

(ii) How does the reactivity of potassium with water differ from that of sodium with water?

Explain this difference in reactivity by reference to the electronic structures of the potassium and sodium atoms.

(4)

(Total 9 marks)

Q20.

One definition of an element is:

“A substance that cannot be broken down into simpler substances by chemical methods”

The table below shows some of the ‘substances’ which Antoine Lavoisier thought were elements. He divided the ‘substances’ into four groups. He published these groups in 1789.

The modern names of some of the ‘substances’ are given in brackets.

ACID-MAKING ELEMENTS	GAS-LIKE ELEMENTS	METALLIC ELEMENTS	EARTHY ELEMENTS
sulphur	light	cobalt mercury	lime (calcium oxide)

phosphorus	caloric (heat)	copper	nickel	magnesia (magnesium oxide)
charcoal (carbon)	oxygen	gold	platina (platinum)	barytes (barium sulphate)
	azote (nitrogen)	iron	silver	argilla (aluminium oxide)
	hydrogen	lead	tin	silex (silicon dioxide)
		magnese	tungsten	
		zinc		

Dmitri Mendeleev devised a Periodic Table of the elements in 1869. A modern version of this table is shown on the Data Sheet.

Give **two** ways in which Mendeleev's table is more useful than Lavoisier's.

1. _____

2. _____

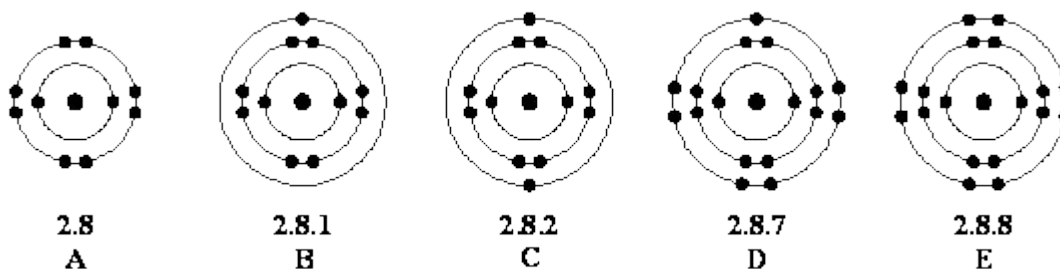
(Total 2 marks)

Q21.

Use the Data Sheet to help you answer this question.

When sodium reacts with water it forms sodium ions.

The diagrams below represent the electron arrangements of some atoms and ions.



Which of the diagrams, **A** to **E**, represents the electron arrangement of each of the following?

- A sodium atom, Na _____
- A sodium ion, Na⁺ _____

(Total 2 marks)

Q22.

Part of the Periodic Table which Mendeleev published in 1869 is shown below.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Period 1	H						
Period 2	Li	Be	B	C	N	O	F
Period 3	Na	Mg	Al	Si	P	S	Cl
Period 4	K Cu	Ca Zn	* *	Ti *	V As	Cr Se	Mn Br
Period 5	Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	* I

Use the Data Sheet to help you to answer this question.

- (a) (i) Give the symbols of **two** elements in Group 1 of Mendeleev's Periodic Table which are **not** found in Group 1 of the modern Periodic Table.

_____ and _____

(1)

- (ii) Name these **two** elements.

_____ and _____

(2)

- (b) Which group of elements in the modern Periodic Table is missing on Mendeleev's table?

(1)

- (c) Mendeleev left several gaps in his Periodic Table. These gaps are shown as asterisks(*) on the table above.
Suggest why Mendeleev left these gaps.

(1)

- (d) Complete the following sentence.

In the **modern** Periodic Table the elements are arranged in the order of their
_____ numbers.

(1)

- (e) Mendeleev placed lithium, sodium and potassium in Group 1 of his Periodic Table. This was because they have similar properties. Some properties of elements are given in the table. **Four** of them are properties of lithium, sodium and potassium. One of these properties has been ticked for you. Place a tick next to the other three properties.

PROPERTY	
They react with water to give alkaline solutions.	
They are gases.	
They are non-metals.	
They form an ion with a 1+ charge.	
They react with water and give off hydrogen.	✓
They form an ion with a 1– charge.	
They are metals.	
They react with water to give acidic solutions.	

(3)

- (f) What happens when a small piece of sodium reacts with water? You should describe what you would see and state what substances are formed.

(3)

(Total 12 marks)

Q23.

Part of the Periodic Table which Mendeleev published in 1869 is shown below.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Period 1	H						
Period 2	Li	Be	B	C	N	O	F
Period 3	Na	Mg	Al	Si	P	S	Cl
Period 4	K Cu	Ca Zn	* *	Ti *	V As	Cr Se	Mn Br
Period 5	Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	* I

Use the Data Sheet to help you to answer this question.

- (a) Name **two** elements in Group 1 of Mendeleev's Periodic Table which are not found in Group 1 of the modern Periodic Table.

_____ and _____

(2)

- (b) Which group of elements in the modern Periodic Table is missing on Mendeleev's table?

(1)

- (c) Mendeleev left several gaps in his Periodic Table. These gaps are shown as asterisks(*) on the table above.
Suggest why Mendeleev left these gaps.

(1)

- (d) Complete the following sentence.

In the **modern** Periodic Table the elements are arranged in the order of their

_____ numbers.

(1)

(Total 5 marks)

Q24.

- (a) What is the name given to the block of elements in the middle of the Periodic Table which includes vanadium?

(1)

(b) Some of the properties of vanadium are shown in this list.

- It has a high melting point.
- It is a solid at room temperature.
- It is a conductor of electricity.
- It is a good conductor of heat.
- It forms coloured compounds.
- It forms crystalline compounds.
- It forms compounds that are catalysts.

Select **two** properties, from the list above, which are **not** typical of a Group 1 metal.

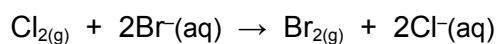
1. _____
2. _____

(2)

(Total 3 marks)

Q25.

In sea water the bromine is present as bromide ions (Br^-). The equation below shows how chlorine can be used to displace bromine from sea water.

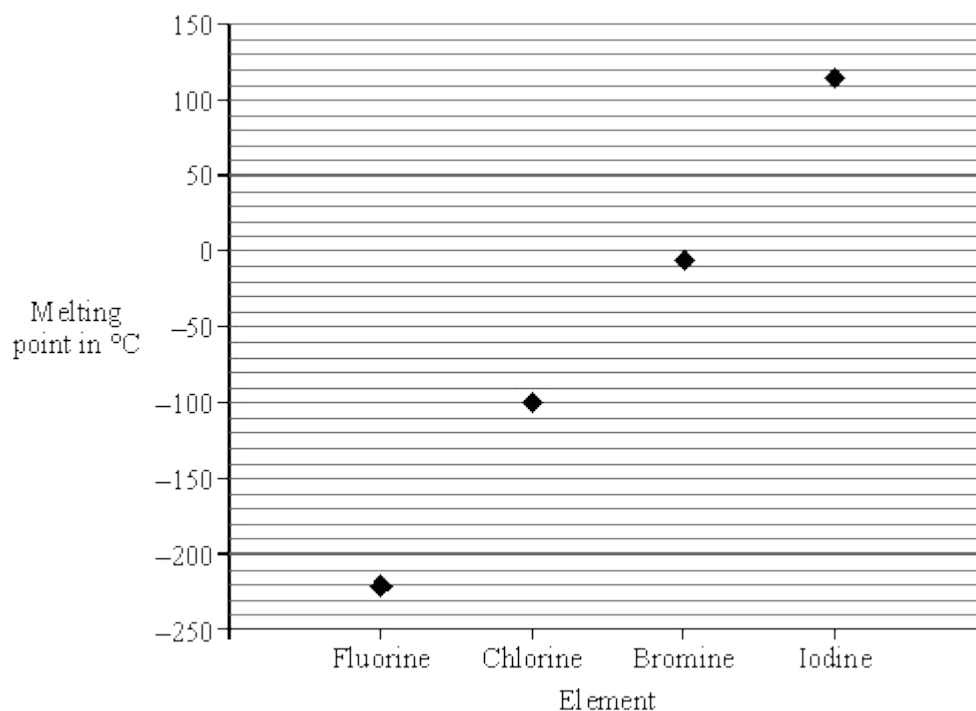


Explain, as fully as you can, why chlorine can displace bromine from sea water.
To obtain full marks your answer should refer to electronic structure.

(Total 3 marks)

Q26.

The graph shows the melting point of four elements in Group 7 of the periodic table.



(a) What is the melting point of fluorine?

_____ (1)

(b) Room temperature is 20°C.

Which element is solid at room temperature?

_____ (1)

(c) Look at the periodic table on the Data Sheet.

Using data from the graph, describe the trend of melting points of the elements in Group 7.

 _____ (2)

(d) The elements in Group 7 are non-metals.

Which **two** of the following are properties of non-metals?

Place a tick (✓) in the box against each correct property.

Brittle (if solid)

☐

- Good conductor of heat ☐
- High boiling point ☐
- Poor conductor of electricity ☐

(2)
(Total 6 marks)

Q27.

The elements in Group 1 are known as the alkali metals.

Which **three** of the following are properties of alkali metals?

Place a tick (✓) in the box against each correct property.

- Hard, tough and strong ☐
- Low density ☐
- Form hydroxides that dissolve in water ☐
- React quickly with water ☐
- Used as catalysts ☐
- Used to make electric cables ☐

(Total 3 marks)

Q28.

Use the periodic table on the Data Sheet to answer these questions.

The table below gives the electronic structures of four elements, **W**, **X**, **Y** and **Z**.

Element	Electronic structure
W	2,5
X	2,7
Y	2,8,8
Z	2,8,8,1

(a) Which element **W**, **X**, **Y** or **Z**:

(i) is a Group 0 gas? _____

- (ii) is nitrogen? _____
- (iii) is a Group 7 gas? _____
- (iv) reacts violently with water? _____

(3)

- (b) Which **two** Groups of the periodic table do **not** contain any non-metals?

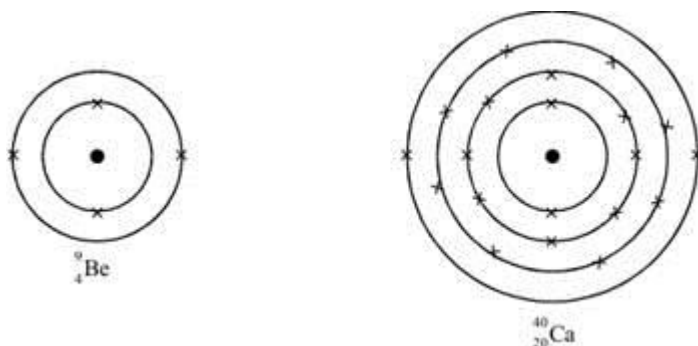
(1)

(Total 4 marks)

Q29.

Beryllium and calcium are metals in Group 2 of the periodic table.

The diagrams show their electronic structures.



- (a) Why do beryllium and calcium have similar chemical properties?

(1)

- (b) Calcium is more reactive than beryllium.

Suggest an explanation for this in terms of the electronic structure of the two elements.

(2)

(Total 3 marks)

Q30.

- (a) Helium is used to fill party balloons.

Which **two** of the following are properties that make helium suitable for filling party balloons?

Place a tick (✓) in the box against each suitable property.

Coloured

☐

Exists as individual atoms

☐

Less dense than air

☐

Poor conductor of heat

☐

Very unreactive

☐

(2)

- (b) The table shows the names of some gases.

Use the correct formulae from the box to complete the table. The first one has been done for you.

CH ₄	CO ₂	H ₂	HCl	NH ₃	O ₂
-----------------	-----------------	----------------	-----	-----------------	----------------

Gas	Formula
Oxygen	O ₂
Carbon dioxide	
Hydrogen chloride	
Ammonia	

(3)

(Total 5 marks)

Q31.

Use the Periodic Table of Elements on the Data Sheet to help you to answer this question.

Francium (Fr) is a very rare element. It is estimated that there is only 25 g of francium in the Earth's crust. Francium is radioactive and has a half-life of only a few minutes.

Mendeleev predicted the existence of francium in the 1870s but the element was not discovered until 1939.

- (a) Explain why Mendeleev was able to predict the existence of francium in the 1870s.

(2)

- (b) Suggest why there is not much experimental evidence for the properties of francium.

(1)

- (c) (i) If you could react francium with water, how would the reaction compare with that of sodium with water?

(1)

- (ii) Explain the reason for your answer.

(2)

(Total 6 marks)

Q32.

Use the periodic table on the Data Sheet to help you to answer these questions.

- (a) Write the symbol for helium.

(1)

- (b) Write the name of an element in Group 4.

(1)

- (c) Write the name of the element which has a relative atomic **mass** of 64.

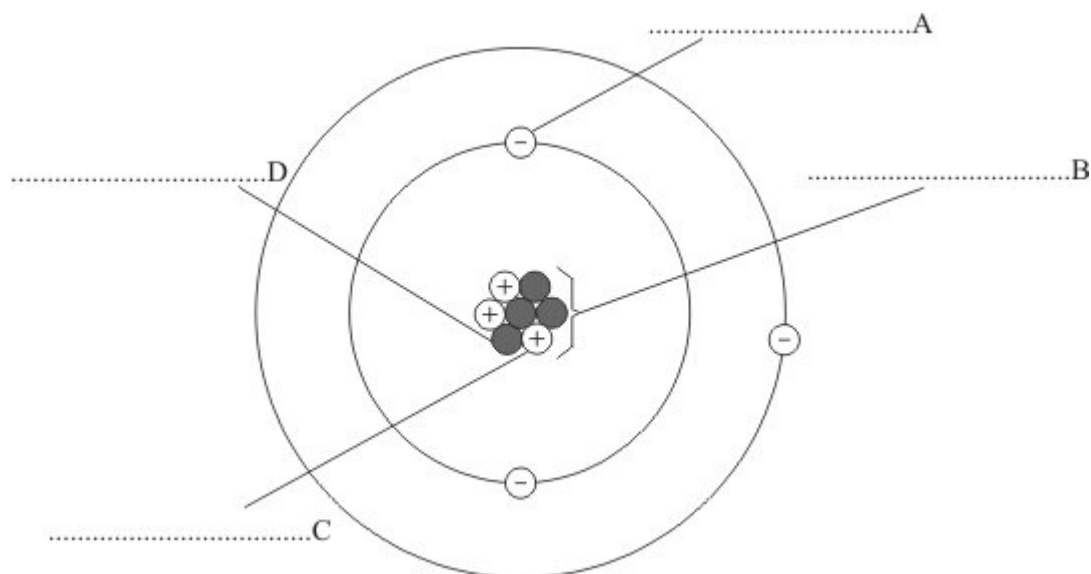
(1)

- (d) Write the name of the element with the next highest atomic number after Te (tellurium) in the periodic table.

_____ (1)
(Total 4 marks)

Q33.

The diagram shows an atom.



- (a) On the diagram, write the names of structures **A**, **B**, **C** and **D**.

(4)

- (b) To which Group of the periodic table does this atom belong?

Give **one** reason for your answer.

(2)

- (c) Name the element which is made up of this type of atom.

(1)
(Total 7 marks)

Q34.

The table shows some properties of four Group 7 elements.

Element	Boiling point in °C	Melting point in °C	State at room	Reaction with hydrogen

			temperature	Description	Product
Fluorine	– 218	– 188	gas	Explosive reaction in dim light	Hydrogen fluoride
Chlorine	– 34	– 101	gas	Explosive reaction in sunlight	Hydrogen chloride
Bromine	+ 59	– 7		Reacts if heated	
Iodine	+ 185	+ 114		Reacts if heated strongly	Hydrogen iodide

(a) What is the state at room temperature of:

(i) bromine; _____

(ii) iodine? _____

(2)

(b) Which **one** of the four elements is most reactive?

(1)

(c) Name the compound formed when hydrogen reacts with bromine.

(1)

(Total 4 marks)

Q35.

The table shows how Group 7 elements react with hydrogen.

Element	Reaction with hydrogen	
	Description	Product
Fluorine	Explosive reaction in dim light	Hydrogen fluoride
Chlorine	Explosive reaction in sunlight	Hydrogen chloride
Bromine	Reacts if heated	Hydrogen bromide
Iodine	Reacts if heated strongly	Hydrogen iodine

Explain the difference in the rates of the reaction of fluorine with hydrogen and of iodine with hydrogen.

(Total 2 marks)

Mark schemes

Q1.

- (a) (i) melting point increases as atomic number increases
accept 'increase' / higher / bigger / larger 1
- (ii) 200 to 350 °C 1
- exactly on $85 \pm \frac{1}{2}$ square
up to their value $\pm \frac{1}{2}$ square 1
- (b) (i) chlorine **or** fluorine
accept if both chlorine and fluorine ticked, otherwise list principle 1
- (ii) chlorine / fluorine are more reactive (than bromine)
accept chlorine / fluorine are higher (up group 7)
accept a more reactive halogen will displace a less reactive halogen 1
- (iii) 500 (litres) 1

[6]

Q2.

- (i) any **two** sensible ideas such as:
- (why) put in order of mass
accept other equally valid orders, eg alphabetical
 - he left gaps **or** table not complete
 - no evidence for undiscovered elements
or they believed all the elements had been discovered
accept predictions could not be backed by evidence
accept why change previous ideas
 - he changed the order of some elements
or there were exceptions to the rule(s)
 - he put metals and non-metals together
accept they didn't like his groupings / groups
 - he did not explain his ideas clearly (owtte)

do **not** accept modern explanations, eg proton number etc

2

- (ii) (the properties of gallium) fitted the predictions (owtte) **or** predictions were correct **or** (properties) would make it fit in the gap **or** (properties) would make it fit in group 3

do **not** accept gallium fitted his theory

accept finding gallium proved there were new elements to be discovered

1

[3]

Q3.

- (a) (i) all points plotted to $\pm \frac{1}{2}$ square

1

sensible line of best fit extended

could be curve

must **not** join dots, ie zig zag

if they draw 2 lines then lose second mark,
but can still gain marks in (a)(ii)

1

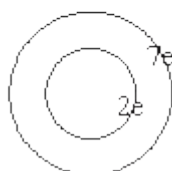
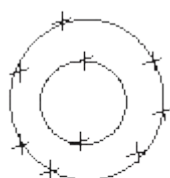
- (ii) as read from their graph $\pm \frac{1}{2}$ square

1

- (iii) iodine **and** astatine/I $\frac{2}{2}$ At/At $\frac{2}{2}$
must give **both** 1

1

- (b) (i)



ignore symbol

ignore nucleus / lack of nucleus

accept dots / crosses etc / e / e⁻

not 2.7 alone

1

- (ii) same number of electrons in **outer** shell **or**
seven electrons in **outer** shell (owtte)

accept missing one electron in outer shell / energy level / orbit
 accept trying to gain one electron
 accept they all form 1^- ions
 do **not** accept orbital / rings

1

- (c) (i) 8 electrons in outer shell **or** full outer shell / energy level

1

does not need to lose / gain / share electrons **or** don't need to form bonds
 accept don't bond ionically or covalently
 they do not react is **not** enough

1

- (ii) fluorine atom is smaller / fewer shells (owtte) **or** outer shell closer to nucleus

accept answers argued in terms of iodine

1

more strongly attracted (to nucleus) **or** less shielding
 accept holds electrons tighter (to the nucleus)

1

gains electron(s) more easily
 accept easier to gain electrons

1

[11]

Q4.

- (i) nucleus

1

- (ii) they both have seven electrons in the outer shell

accept they both have the same
 number of electrons in the outer
 shell

both need one electron to make full
 outer shell

1

[2]

Q5.

- (a) group seven/7VII

accept halogens

1

- (b) (i) in light **bulbs**/lasers

accept any other specified use as an inert atmosphere e.g.
 (argon)

welding, storing explosives, fluorescent lights

1

- (ii) 2.8.8/has a full/8 in/outer shell 1
- electrons
- accept does not need to share/gain/lose electrons* 1
- (c) (i) any one from:
- disinfectant
- bleaching agent
- sterilising water/kills bacteria
- manufacture of HCl
- water treatment 1
- not: cleaning/in pools*
- purification of water*
- kills germs*
- warfare*
- antiseptic*
- (ii) inner shells 2,8 1
- outer shell 7 1
- (iii) fluorine:
- accept the converse reasons for chlorine*
- gains **one**/an electron easier/is more
- strongly attracted
- not more strongly held* 1
- less shielding of nucleus by inner electron shells 1
- less distance from (attraction of)
- nucleus/less shells 1

[10]

Q6.

- (a) (i) **all correct two marks one or two correct one mark**
- electron
- proton
- neutron

2

- (ii) (argon has) a full outer shell (of electrons)
accept energy level for shell
accept does not lose or gain electrons
*do **not** accept does not form bonds*
***or** react **or** is a noble **or** inert gas*

1

- (b) oxygen would react (with metal)
accept oxygen is reactive
*do **not** accept metal would react (neutral)*

1

- metal would burn
accept metal would be 'destroyed'
***or** metal oxide formed **or** metal is oxidised*
*do **not** accept it would explode **or***
would not last long
accept filament for metal

1

[5]

Q7.

- (a) (i) low density
accept floats (on water)
- (ii) forms an alkaline solution with water
*accept alkali (metal) **or** basic*
*do **not** accept group 1 metal*

1

1

- (b) 3 **or** three (protons)

1

3 **or** three (electrons)

1

4 **or** four (neutrons)

1

[5]

Q8.

- (a) atomic number or proton number
- (b) (i) sodium **or** potassium **must** be name
*accept rubidium **or** caesium **or** francium*
- (ii) silicon **or** phosphorus **or** sulphur **or** chlorine **or** argon **must** be name

1

1

1

[3]

Q9.

- (a) (i) number 1
- periods 1
- groups 1
- (ii) some elements (**or** metals) had not been isolated
*accept some elements (**or** metals) had not been discovered (found)*
*do **not** accept matching properties*
*do **not** accept some elements were not known* 1
- (b) (i) He **or** Ne **or** Ar
*accept Kr **or** Xe **or** Rn*
accept correct names 1
- (ii) arrangement of electrons correct
accept He 2
Ne 2 . 8
Ar 2 . 8 . 8
arrangement of electrons must match
correct answer if given in (i)
*do **not** accept other elements* 1
- (iii) (all) have one electron in the outer shell **or** energy level
*accept (all) have same number of electron(s) in the outer shell **or** energy level*
accept all have to lose one electron
*do **not** accept all in same group* 1
- (iv) K Na Li
accept names
accept correct indication of order of reactivity 1
- (v) H₂
*do **not** accept H* 1
- correctly balanced $\rightarrow 2 + 1$
must have H₂ correct to get balancing mark 1

[10]**Q10.**

- (a) (i) green

- accept 'green-yellow' but **not** 'yellow' alone* 1
- bromine or Br or Br₂
*do **not** accept bromide* 1
- (ii) same number of electrons in outer energy level **or** *accept shell for energy level*
- 7 electrons in outer shell
accept need to gain 1 electron 1
- (b) any **two** from:
- hydrogen **or** H₂
*do **not** accept gas given off **or** fizzes*
 - heat
accept exothermic
*do **not** accept flame*
 - alkaline solution
*accept (metal) hydroxide **or** NaOH **or** OH⁻*
*do **not** accept dissolves **or** forms a solution **or** floating*
accept balanced chemical equation for 2 marks 2

[5]

Q11.

- (a) any (must be named) 1
- (b) F₂ 1
- (c) -/F⁻ 1
- (d) (i) covalent 1
- (ii) made of molecules etc.
 type of bonding when non-metals react. 1

[5]

Q12.

- (a) (i) 14 electrons =
gets 1 mark
- 2.8.4 =
gets 2 marks

		2
(ii)	outer shell electrons	1
(iii)	same number of electrons in outer shell	1
(b)	(1) shiny conducts electricity	
	(2) oxide neutralises alkalis covalent bonds	4

[8]

Q13.

(a)	(i)	2.7	1
	(ii)	2.8.8	1
	(iii)	gains an electron more easily than Cl because the higher the energy level the less easily an electron is gained <i>each for 1 mark</i>	4
(b)	(i)	very unreactive or give reactivity trend	1
	(ii)	fluorine reacted with silicon from glass <i>each for 1 mark</i>	2
	(iii)	Reactivity increases down the group radon likely to react because lower in group than xenon more reactive than xenon Kr may or may not react higher in group than xenon less reactive than xenon <i>any 5 for 1 mark each</i>	5

[14]

Q14.

(a)	(i)	same number of shells/2 full shells/3 shells/same number of energy levels <i>any 1 for 1 mark</i>
		increasing number of electrons/different number of electrons/ number of electrons same as group number

(if electrons not specifically mentioned assume they are referring to electrons)

any 1 for 1 mark

2

- (ii) all have 7 electrons in outer shell/same number in outer shell/
each has one electron missing from outer shell
each can accept one electron

any 1 for 1 mark

number of shells/energy levels increases
increasing number of electrons

any 1 for 1 mark

2

- (b) (i) increases down group/decreases up
for 1 mark

1

- (ii) down group atoms get bigger/larger/have more shells/
more energy levels

for 1 mark

electrons further away from nucleus/more
shielding down group

for 1 mark

outer electron more easily lost/less
firmly held

for 1 mark

3

- (c) H^+ or has positive ions/one electron in outer shell/can lose
one electron/ H^+ ions discharged at negative electrode (max 2)
covalent bonds or compounds/forms diatomic mols. or example/
ability to form H^- ions/non-conductor/
low Mt.Pt or low B.P. (max 2)

(overall max 3)

3

[11]

Q15.

- (a) three from:
high mp/melts above $60^\circ C$
conducts (electricity)
basic oxide /alkaline oxide
chloride has high mp
molten chloride conducts electricity
form positive ions/form ionic compound with non-metals
solid at room temperature

any 3 for 1 mark each

3

- (b) group 2
formula of oxide is XO/ion is X^{2+} /
oxide forms alkaline solution
for 1 mark each

2

- (c) XCl_2 / $X^{2+}(Cl^-)_2(X^{2+})(Cl^-)_2$
Symbol of any group 2 element instead of X
(b) → (c) error carried forward accepted.
e.g. Group 1 → XCl
Group 3 → XCl_3
for 1 mark

1

[6]

Q16.

- (a) same number of electrons in outer shell/highest energy level
or they all form 1+ ions
If number of electrons is given it must be correct
Allow loss of same number of electrons to give full shell
not gain of electrons
for 1 mark
- (b) electrons are lost more readily/more easily
further from nucleus/bigger atom/more shielding/more energy levels/
not just more electrons
not just reduced attraction
for 1 mark each

1

2

[3]

Q17.

- (a) Group 2 / Alkaline Earth Metals
for 1 mark
- (b) (i) $MgCl_2/Mg^{2+}(Cl^-)_2$
(or equation with correct answer)
for 1 mark
- (ii) ionic / electrovalent
for 1 mark

1

1

1

[3]

Q18.

- (a) gas
for 1 mark
- (b) AlX_3

1

for 1 mark

1

- (c) 7 / halogens

for 1 mark

1

[3]

Q19.

- (a) same number of electrons in outer shell / 1 / an electron in outer shell / lose one electron

for 1 mark

1

- (b) (i) C

for 1 mark

1

- (ii) E

for 1 mark

1

- (c) (i) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
symbols must be correct
correct multiples / fractions accepted
Balancing mark is independent

formulae gains 1 mark

balancing gains 1 mark

2

- (ii) Assume 'it' means potassium
potassium more reactive / vigorous / faster reaction / violent (can be awarded in either section)
potassium atom larger than sodium / higher outer energy level /
outer shell further from nucleus / more shells (not just more electrons)
electron in outer shell is less strongly attracted / greater shielding
outer electron more easily lost

for 1 mark each

4

[9]

Q20.

Mendeleev's table
contains only elements
divides metals and non-metals
contains far more elements which were discovered later
groups elements according to chemical properties

puts elements in order of atomic number / atomic mass / table
includes these numbers

can use to work out / linked to electronic structures

left gaps for missing elements which had not been discovered

other sensible answers

any two for 1 mark each

[2]

Q21.

- (i) B or 2, 8, 1

for one mark

1

- (ii) A or 2, 8

for one mark

1

[2]

Q22.

- (a) (i) H, Cu, Ag (rules of upper and lower case to be applied here)

both for one mark

1

- (ii) hydrogen
copper
silver

any two for 1 mark

2

- (b) Group 0 / Noble gases / Group 8 / Group 18 / Inert gases /
Rare gases / Transition elements / Metals

for one mark

1

- (c) sensible suggestions based on their knowledge of the periodic table
left spaces for elements which had not been discovered
left gaps so that elements could be placed in columns with other
elements which had similar properties

for one mark

1

- (d) proton (atomic)

for one mark

1

- (e) they react with water to give alkaline solutions
they form an ion with a 1+ charge
they are metals

for 1 mark each

3

- (f) maximum of 1 mark for description

floats / surface

may melt (*not* gets hot)

moves around

bubbles / steam / fumes / smoke / fizz

dissolves / disappeared / gets smaller

flame

(ignore sounds / heat)
any one for 1 mark

2 marks for correct product

sodium hydroxide or a solution containing sodium and hydroxide ions)
NaOH / caustic soda hydrogen / H₂
(if more than 2 products given subtract one for each incorrect to maximum -2)
three for 1 mark each

3

[12]

Q23.

- (a) Copper
Silver
Hydrogen

two correct symbols gains one mark. (✓x)
any two for 1 mark each

2

- (b) Group 0 / Noble gases / Group 8 / Group 18 / Inert gases / Rare gases
/ Transition elements / metals

for one mark

1

- (c) sensible suggestions based on their knowledge of the Periodic Table
left spaces for elements which had not been discovered
left gaps so that elements could be placed in columns with other
elements which had similar properties

any one for 1 mark

1

- (d) atomic (proton)

for one mark

1

[5]

Q24.

- (a) transition / transitional metals / elements / d-block

for one mark

1

- (b) coloured
catalyst

(accept high melting point)
for 1 mark each

2

[3]

Q25.

chlorine atom smaller than bromine atom / has fewer shells / chlorine is higher in the
group than bromine so it is more reactive

the outer electron / extra electron is more strongly attracted with chlorine than bromine /
bromide (owtte) / more shielding with bromine / less shielding with chlorine

an extra electron is more easily gained by chlorine **or** chlorine can take an electron from
bromide ion (*not* bromine)

for 1 mark each

[3]

Q26.

(a) $-220(^{\circ}\text{C})$

*accept without unit
do **not** credit if no minus sign
no tolerance allowed*

1

(b) iodine

allow I or I₂

1

(c) increase down (the groups)

*N.B. must be **one** comparative or
superlative for either position in group
or melting point to obtain 2 marks
e.g. accept lowest in group has highest
melting point for 2 marks
accept highest in group has lowest
melting point for 2 marks
accept highest mass numbers or proton
numbers or atomic numbers have
highest melting point for 2 marks
allow F has lower **or** lowest melting
point for 1 mark
allow 'Increase from F to 1',
i.e. referring to graph rather than
periodic table for 1 mark
F has a low melting point no marks*

2

(d) brittle

1

poor conductor of electricity

*maximum 1 mark if three boxes ticked
no marks if all four boxes ticked*

1

[6]

Q27.

low density

1

form hydroxides that dissolve in water

1

react quickly with water

*four ticks – max 2 marks
five ticks – max 1 mark
all boxes ticked – 0 marks*

1

[3]

Q28.

- (a) (i) Y **or** 2,8,8 **or** Argon **or** Ar

All correct gains 3 marks

- (ii) W **or** 2,5

3 correct gains 1 mark

- (iii) X **or** 2,7 **or** fluorine **or** F

2 or 1 correct gains 1 mark

- (iv) Z **or** 2,8,8,1 **or** potassium **or** K

N.B. number of ticks on script must equal number of marks

3

- (b) 1 and 2 (both needed)

do not credit if any other group listed

'transition metals' neutral

allow alkali metals and alkali earth metals

1

[4]

Q29.

- (a) same number of outer electrons / have 2 outer electrons

do not accept inner electrons or 2Xs

1

- (b) calcium (idea) outer electrons / shell
further from nucleus

*do **not** credit lower down group*

do not credit larger / more shells

1

more easily lost / attraction from nucleus less

accept screening of inner electrons

1

[3]

Q30.

- (a) less dense than air

no marks if four or five box

1

very unreactive

maximum 1 mark if three boxes ticked

1

(b)	CO ₂	1
	HCl	1
	NH ₃	1
	<i>do not penalise upper / lower case or superscript</i>	

[5]

Q31.

(a)	Mendeleev arranged known elements in order of mass or properties <i>reject explanation in terms of electrons and / or atomic number</i>	1
	gaps in Periodic Table / group 1	1
(b)	does not last long enough to experiment / very little of it <i>allow it has a short half-life</i>	1
(c)	(i) (much) more violent <i>accept more reactive</i>	1
	(ii) since outer electron / or shell further from nucleus <i>do not credit lower down group larger / more shells neutral</i>	1
	therefore more easily lost <i>accept screening by inner electrons</i>	1

[6]

Q32.

(a)	He	1
(b)	carbon / silicon / germanium / tin / lead <i>accept correctly written symbols C / Si / Ge / Sn / Pb</i>	1
(c)	copper <i>accept Cu</i>	1
(d)	iodine <i>accept I or I₂</i>	1

[4]

Q33.

(a) **A** – electron

1

B – nucleus

1

C – proton

1

D – neutron

1

(b) Group 1 / alkali metals

1

has one electron in outer shell

*accept 3 protons / 3 electrons / atomic number 3
therefore lithium (so Group 1 / alkali metals)*

1

(c) lithium

accept Li

1

[7]

Q34.

(a) (i) liquid

allow l

1

(ii) solid

allow s

allow responses written in table

1

(b) fluorine

accept F, reject fluoride

1

(c) hydrogen bromide

reject hydrogen bromine

accept HBr/BrH

allow responses written in table

1

[4]

Q35.

fluorine has fewer shells / less shielding than iodine

1

gains electrons more easily / more pull

1

[2]