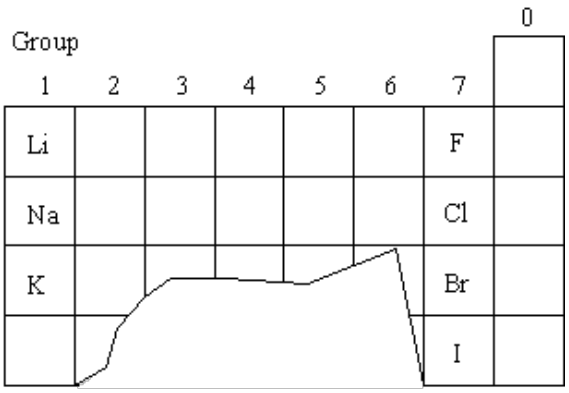
Q1. The diagram shows some of the elements in Groups I and 7 of the Periodic Table.



(a) The elements in Group 1 have similar chemical properties.

Describe **one** chemical reaction which shows that lithium, sodium and potassium react in the same sort of way.
You should say what you would react them with and what substances would be produced.

- What you would react them with

.....

- Substances produced

.....

.....

(3)

(b) All the elements in Group 7 react with hydrogen.

Fluorine reacts in the dark, explosively, at very low temperatures.
Chlorine reacts explosively in sunlight, at room temperature.
Bromine, in light, only reacts if heated to about 200°C.

Suggest the conditions needed for hydrogen and iodine to react.
Give reasons for your answer.

.....

.....

.....

(2)

(c) Hydrogen and chlorine react to produce hydrogen chloride.
Balance the symbol equation for the reaction.

H_2 + Cl_2 → HCl

(1)

(d) Use your understanding of atomic structure to explain the trend in reactivity in the Group 7 elements.

.....

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.....

(2)

(Total 8 marks)

Q2. These are the electronic structures of the atoms of three different elements.

2.8.1	2.8.8	2.8.8.1
element A	element B	element C

(a) Identify elements A and B.

Element A is .....

Element B is .....

(2)

(b) (i) Why is element C more reactive than element A?

.....

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(2)

(ii) Why is element B unreactive?

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.....

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(2)

(Total 6 marks)

Q3. The idea of a periodic table of the elements was started by John Newlands about 140 years ago.

He wrote down the elements he knew about in order, starting with the lightest atoms.

Then he arranged them into seven groups, like this:

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

(a) Write down **three** differences between the groups in Newlands' periodic table and the groups in the modern periodic table (up to the element Ca, which is calcium).

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(3)

(b) Suggest **one** reason why this part of Newlands' table was different from the modern one.

.....

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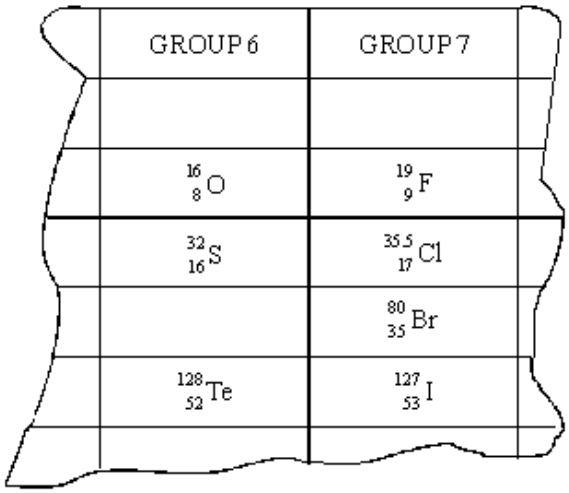
(1)

(c) Dimitri Mendeléev later developed the periodic table of the elements. He arranged the elements according to their properties and their relative atomic masses.

The diagram shows where Mendeléev put tellurium (Te) and iodine (I) in his table because of their properties.

(The diagram uses present day symbols and the atomic numbers of the elements have been added to Mendeléev's table.)



(i) What is wrong with this arrangement of tellurium and iodine in terms of their relative atomic masses?

.....

.....

(1)

(ii) Explain why this is not a problem in the modern periodic table.

.....

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.....

(2)

(Total 7 marks)

Q4. The electronic structures of five elements, V, W, X, Y and Z are shown below.

V	W	X	Y	Z
2.1	2.6	2.8.4	2.5	2.8.6

(a) (i) Write the letters of the **two** elements which belong to the same group in the Periodic Table .....

(ii) To which group do they belong? .....

(2)

(b) Write the letters of **two** elements that are gases .....

(1)

(c) Lithium, sodium and potassium are the first three elements in Group 1 of the Periodic Table.

(i) Lithium reacts with cold water to produce lithium hydroxide and hydrogen.

Describe how the reaction between sodium and water is

(A) similar and **(B)** different to that between lithium and water.

(A) Similar .....

.....

.....

(B) Different .....

.....

.....

(3)

(ii) Potassium is much more reactive than lithium.

Explain this in terms of their electronic structures.

.....

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(3)

(Total 9 marks)

Q5. The table shows the properties of four elements from Group VII of the Periodic Table.

Element	Proton Number	Electronic structure	Boiling point (°C)	Melting point (°C)	State at 20°C	Reaction with hydrogen	
						Ease	Product
Fluorine		2.7	–188	–218	gas	Explosive reaction in dull light	hydrogen fluoride
Chlorine	17		–34	–101		Explosive reaction in sunlight	hydrogen chloride
Bromine	35	2.8.18.7	+59	–7		React if heated	hydrogen bromide
Iodine	53	2.8.18.18.7	+185	+114	solid	React if heated strongly	hydrogen iodide

(a) Complete the spaces in the table.

(4)

(b) Comment briefly on the trend in melting points for these four elements.

.....

.....

(1)

(c) Explain, in as much detail as you can:

(i) why the reactions of these elements with hydrogen are similar.

.....

.....

.....

(ii) why their reactivity with hydrogen decreases from fluorine to iodine.

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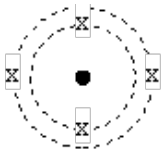
(4)
(Total 9 marks)

Q6. (a) The diagram shows the electronic structure of a particular element.



In a similar way, show the electronic structure of another element from the same group in the periodic table and name the element you select.

Name of element selected .....

(4)

(b) The element lithium gives a moderate reaction with cold water, releasing hydrogen and forming a solution of lithium hydroxide.

Describe how sodium is similar to and how it is different from lithium in its chemical reaction with cold water.

Explain any similarity or difference in terms of their atomic structure.

Similarity. .....

Reason. .....

.....

.....

Difference. .....

Reason. .....

.....

.....

(5)

(Total 9 marks)

Q7. (a) 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

(i) Explain why all the Group 7 elements react in a similar way with hydrogen.

.....

.....

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.....

(2)

(ii) Explain the difference in the rates of the reaction of fluorine with hydrogen, and of iodine with hydrogen.

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.....

(2)

(b) Explain why Group 0 elements are monatomic.

.....

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(2)

(Total 6 marks)

Q8. The table gives some properties of the element silicon.

Melting point	1410 ºC
Relative atomic mass	28
Conductivity	Conducts electricity
Compounds	Forms compounds with covalent bonds
Position in periodic table	Group 4
Reaction with water	Unreactive
Density	Relatively low

(a) Give **two** ways in which silicon is similar to the alkali metals.

1 .....

.....

2 .....

.....

(2)

(b) Give **two** ways in which the properties of silicon are different from those of the alkali metals.

1 .....

.....

2 .....

.....

(2)
(Total 4 marks)

Q9. John Newland produced a periodic table in 1866. The first 21 elements in his table are shown in the diagram.

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

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

(a) In which **two** columns of Newland's periodic table do all the elements have similar properties?

.....

(1)

(b) The modern periodic table is arranged in a different order to Newland's table.

(i) What order is used in the modern periodic table?

.....

(1)

(ii) Argon has a higher relative atomic mass than potassium. Explain why.

.....

.....

(1)

(iii) Describe the changes in the number of electrons in the atoms of elements in the period which begins with potassium and ends with krypton.

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(2)

(Total 5 marks)

Q10. 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.

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.....

(Total 2 marks)

Q11. 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.

.....

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(2)

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

.....

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(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.

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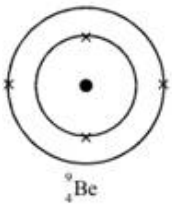
(2)

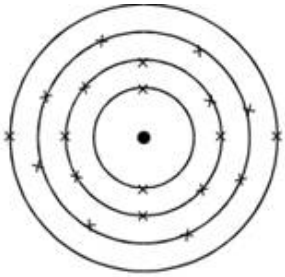
(Total 6 marks)

Q12. Beryllium and calcium are metals in Group 2 of the periodic table.

The diagrams show their electronic structures.



$^{9}_{4}Be$



$^{40}_{20}Ca$

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

.....

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.....

.....

(1)

(b) Calcium is more reactive than beryllium.

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

.....

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.....

(2)

(Total 3 marks)

Q13. 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.

$$Cl_{2(g)} + 2Br^-_{(aq)} \rightarrow Br_{2(g)} + 2Cl^-_{(aq)}$$

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.

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(Total 3 marks)

Q14. (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.
- If 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)

Q15. 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)

Q16. Sodium and potassium are both in Group 1 of the Periodic Table.

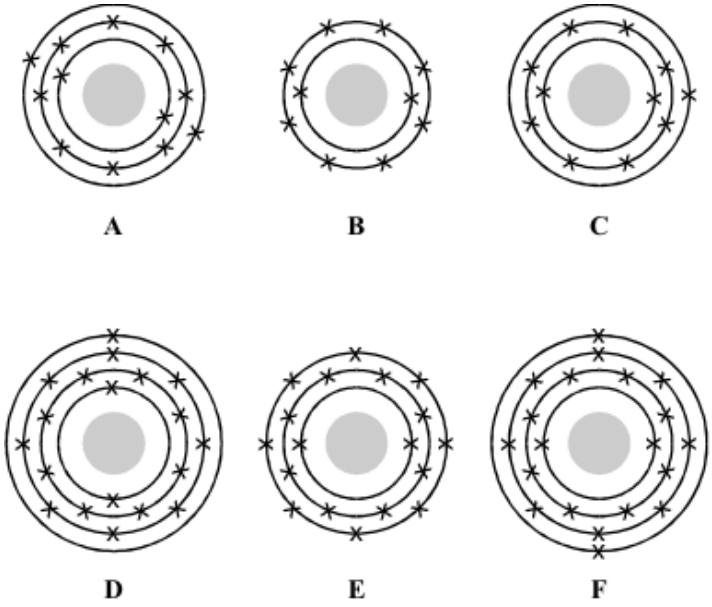
(a) Explain, by reference to their electronic structures, why both elements are placed in Group 1.

.....

.....

(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.



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.

.....

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(4)

(Total 9 marks)

Q17. 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)

Q18. (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.

.....

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.....

(2)
(Total 3 marks)

Q19. Neodymium (Nd) is a member of the group of elements known as the lanthanides. It is a silvery, white metal. It has a number of uses including making special alloys.

In the reactivity series of metals neodymium is above magnesium but below calcium. Predict how neodymium might react with each of the substances in (a) to (c).

If you think a reaction will take place you should suggest **how vigorous** it might be and **name the products** that might be produced.

(a) How might neodymium react with water?

Reaction .....

.....

Products .....

.....

(b) How might neodymium react with air?

Reaction .....

.....

Products .....

.....

(c) How might neodymium react with dilute hydrochloric acid?

Reaction .....

.....

Products .....

.....

(Total 8 marks)

Q20. 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.

.....

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.....

(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.

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(3)

(Total 11 marks)

Q21. 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.

.....

.....

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.....

(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.

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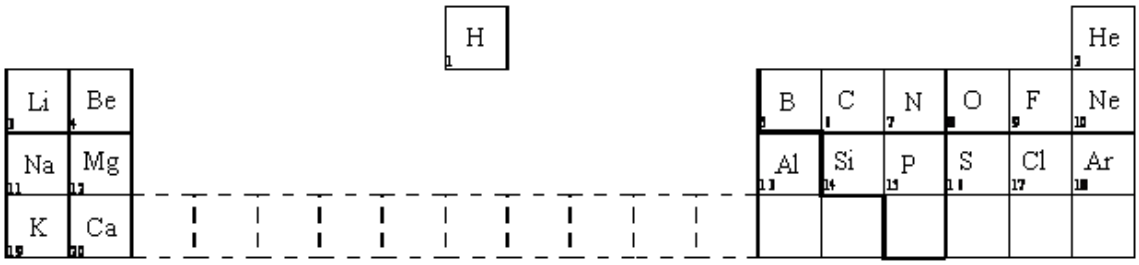
(5)
(Total 14 marks)

Q22. The elements in Mendeleev's periodic table were arranged in order of increasing atomic mass. Part of the modem Periodic Table is shown.



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

The modem 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)

Q23. 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.

.....

.....

.....

.....

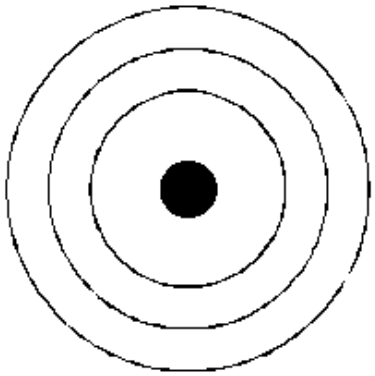
(2)

(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.

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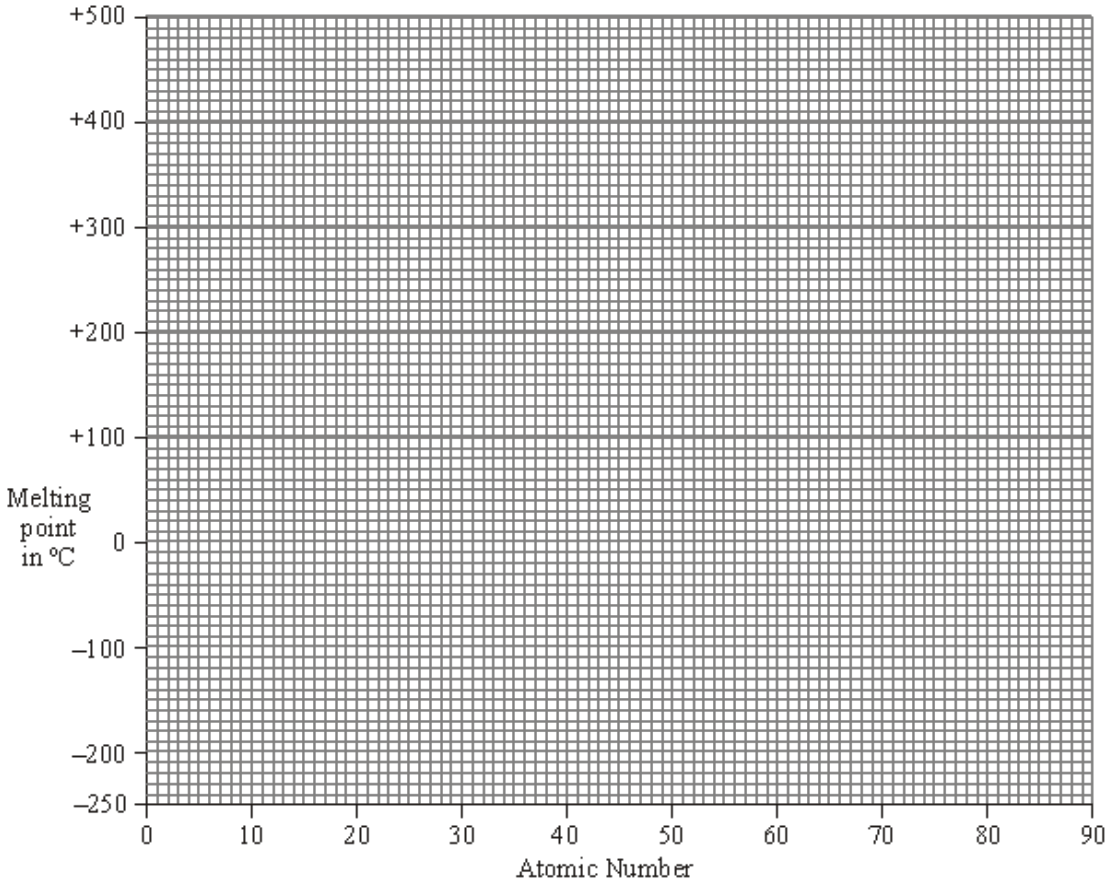
(3)
(Total 10 marks)

Q24. (a) The table gives the melting points of some of the elements of Group 7.

Element	Atomic number	Melting point in ºC
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.

.....

.....

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.....

.....

(3)

(Total 11 marks)

Q25. Caesium is an element in Group 1 of the periodic table.

(a) Which of the electronic structures represented by **A** to **D** is correct for a caesium atom?
The periodic table on the Data Sheet may help you to answer this question.

	Electronic structure
A	2, 8, 18, 18, 8, 1
B	2, 8, 18, 18, 9
C	2, 8, 18, 27
D	2, 8, 18, 18, 6, 3

The electronic structure for a caesium atom is represented by letter .....

(1)

(b) When a small piece of lithium is added to cold water it fizzes around on the surface of the water. A small piece of caesium explodes when added to water.

Explain in terms of electronic structure why a caesium atom is more reactive than a lithium atom.

.....

.....

(2)
(Total 3 marks)

Q26. The table shown below was devised by John Newlands in 1864. He arranged the elements in order of their relative atomic masses. He found a repeating pattern, with elements having similar properties in the vertical columns (Groups). He called this pattern the 'Law of Octaves', because elements with similar properties seemed to be repeated every eighth element.

H	Li	Be	B	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

(a) Many scientists were critical of Newlands' Law of Octaves.
Suggest why other scientists were critical of the Law of Octaves.
You should give examples from the table and use your knowledge of the chemistry of the elements.

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(3)

(b) The diagram below shows a version of Mendeleev's Periodic Table of 1871. Mendeleev placed most of the elements in order of relative atomic mass.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
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	Fe Co Ni
Period 5	Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	? I	Ru Rh Pd

This table became accepted by other scientists.

Give **two** ways in which Mendeleev's table improved on Newlands' table.

1 .....

.....

2 .....

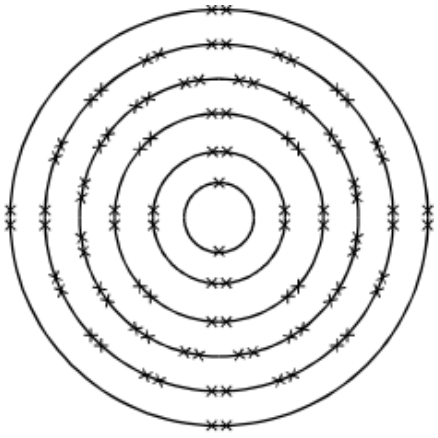
.....

(2)

(Total 5 marks)

Q27. In 1999 scientists at the University of Berkeley claimed to have discovered the element Ununhexium.

The electron arrangement of this element is thought to be as shown in the diagram below.



(a) Which group of the periodic table should this element be placed in?

Group .....

(1)

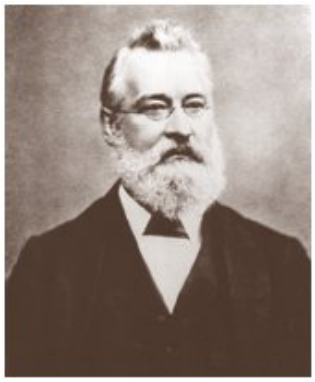
(b) Give a reason for your answer.

.....

.....

(1)
(Total 2 marks)

Q28. Read the information about the development of the periodic table and answer the questions that follow.



John Newlands was one of the first chemists to arrange the known elements in order of increasing atomic mass. In 1866, he put forward the Law of Octaves. He suggested that there was a repeating pattern of elements with similar chemical properties every eighth element, just like the eighth note of an octave of music. A version of his periodic table is shown below.

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	Os	Hg	Tl	Pb	Bi	Th

However, other chemists did not accept Newlands' ideas. It was not until much later that his contribution to the development of the modern periodic table was recognised.

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The modern periodic table on the Data Sheet may help you to answer these questions.

(a) What is the modern symbol for the element 'Bo'? .....

(1)

(b) Describe **one** piece of evidence to support the Law of Octaves.

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(2)

(c) Suggest **two** reasons why other chemists did not accept Newlands' ideas.

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2 .....

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(2)

(d) The alkanes are a series of hydrocarbons with similar chemical properties. They have the general formula C_nH_{2n+2}.

Suggest why the alkanes do not appear in the periodic table.

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(1)

(Total 6 marks)

Q29. The following article appeared recently in the *Manchester Gazette*.

> **Sodium Drum Blaze Scare**
>
> A 20 litre drum containing sodium burst into flames when it reacted violently with rainwater at a Manchester factory. It is believed that the sodium, which is normally stored under oil, had been accidentally left outside with the lid off.
>
> A factory worker put out the blaze before the fire services arrived, and a leading fire fighter said, "It was fortunate that potassium wasn't involved as it would have reacted more violently and exploded. These Group 1 *alkali metals* can be very dangerous".

(a) Group 1 metals are stored under oil.

Suggest why.

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(1)

(b) Balance the equation which represents the reaction between sodium and water.

$$Na + H_2O \rightarrow NaOH + H_2$$

(1)

(c) Explain why the Group 1 metals are called the *alkali metals*.

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(1)

(d) Explain, in terms of electrons, why potassium reacts more violently than sodium.

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(3)

(Total 6 marks)

Q30. Read the information about the periodic table.

Portrait of Dimitri Mendeleev by Ilya Repin

When the Russian chemist Dimitri Mendeleev put forward his periodic table in 1869, the atomic structure of elements was unknown.

Mendeleev tried to arrange the elements in a meaningful way based on their chemical reactions. First he put the elements in order of their increasing atomic weight.
He then put elements with similar properties in the same column.

However, he left gaps, and sometimes did not follow the order of increasing atomic weight – for example, he placed iodine (atomic weight 127) after tellurium (atomic weight 128).

Within a few years there was sufficient evidence to prove that Mendeleev was correct.

Our modern periodic table has evolved from Mendeleev's table.

The modern periodic table on the Data Sheet may help you to answer these questions.

(a) (i) State why Mendeleev left gaps.

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(1)

(ii) State why some elements were **not** placed in order of increasing atomic weight.

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(1)

(b) (i) The periodic table is now based on atomic structure.

Explain how.

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(3)

(ii) Suggest why it is impossible to have an undiscovered element that would fit between sodium and magnesium.

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(1)

(c) Explain, in terms of electrons, why fluorine is the most reactive element in Group 7.

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(3)
(Total 9 marks)

Q31. Read the information about the periodic table.

> In 1869 Dimitri Mendeleev classified the elements by first putting them in order of their atomic weights.
>
> Then he arranged them in a table, so that elements with similar properties and reactions were in columns known as Groups.
>
> He also left gaps in his table for undiscovered elements.

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

(a) Some elements were **not** placed in order of increasing atomic weights.

In terms of properties, suggest why potassium (atomic weight 39) should be placed after argon (atomic weight 40).

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(1)

(b) Some scientists thought that Mendeleev's table was **not** correct.

Suggest why, by referring to the elements in Group 4.

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(1)

(c) In the 1890s a new group of elements (Group 0) was discovered.

Suggest why they were easily fitted into Mendeleev's table.

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(1)

(Total 3 marks)

Q32. Read the information about the development of the periodic table and answer the questions that follow:

Johann Döbereiner was a chemist who realised there was a link between atomic weight and chemical properties. Although it was difficult to measure atomic weights accurately, by 1829 Döbereiner had arranged many elements with similar chemical reactions in groups of three. He noticed that the middle element had an atomic weight that was approximately the average of the other two. These groupings were known as triads. Three of these triads are shown below:

Li 7	S 32	Cl 35.5
Na 23	Se 79	Br 80
K 39	Te 128	I 127

As new elements were discovered, it became difficult to group them in triads, and it was left to others to build on Döbereiner's work. The result was the first periodic table, suggested by Dimitri Mendeleev in 1869.

Our modern periodic table has evolved from Mendeleev's Table. Lithium, sodium and potassium are still together in Group 1, and chlorine, bromine and iodine are in Group 7.

It was many years before chemists understood the nature of the transition elements.

The modern periodic table on the Data Sheet may help you to answer these questions.

(a) Döbereiner suggested that calcium (Ca), strontium (Sr) and barium (Ba) were also a triad.

Use relative atomic masses to explain why.

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(1)

(b) Suggest why Döbereiner's ideas were replaced by those of Mendeleev.

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(1)

(c) Lithium, sodium and potassium are in Group 1. All these elements react with water.

Describe what you **see** when potassium is added to water.

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(2)

(d) In terms of electronic structure, explain why:

(i) elements in the same group of the periodic table have similar chemical properties

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(1)

(ii) transition elements have similar properties even though they are not in the same group

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(2)

(iii) in Group 1, lithium is **less** reactive than potassium.

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(2)

(Total 9 marks)

Q33. The periodic table was developed over about 200 years.

In 1869, a Russian scientist, Dimitri Mendeleev, arranged the 60 known elements into his periodic table.

Mendeleev put the elements in order of their increasing atomic weights.
Then he put elements with similar chemical properties in the same columns.
He left gaps in his periodic table.

The modern periodic table on the Data Sheet may help you to answer these questions.

(a) Mendeleev's periodic table was produced without any knowledge of the atomic structure of elements.

State why Mendeleev left gaps in his periodic table.

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(1)

(b) The modern periodic table was produced with knowledge of the atomic structure of elements.

The modern periodic table is an arrangement of the elements in terms of their atomic structures.

Explain how.

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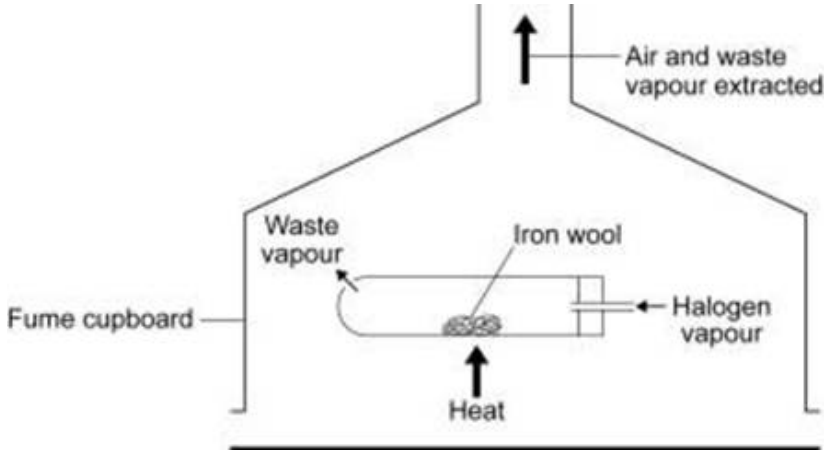
(3)
(Total 4 marks)

Q34. A teacher demonstrated the reactivity of the halogens to some students.
Halogen vapour was passed over heated iron wool in a fume cupboard.



The teacher's observations are shown in the table below.

	Observations	
	During the reaction	**After the reaction**
Bromine	The iron wool glowed	A red–brown solid had been produced
Chlorine	The iron wool glowed	A dark brown solid had been produced
Iodine	The iron wool did not glow	A black solid had been produced

(a) From these observations what conclusion can be made about the order of reactivity of the three halogens?

Explain your conclusion.

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(2)

(b) In terms of electronic structures, explain why iodine is **less reactive** than bromine.

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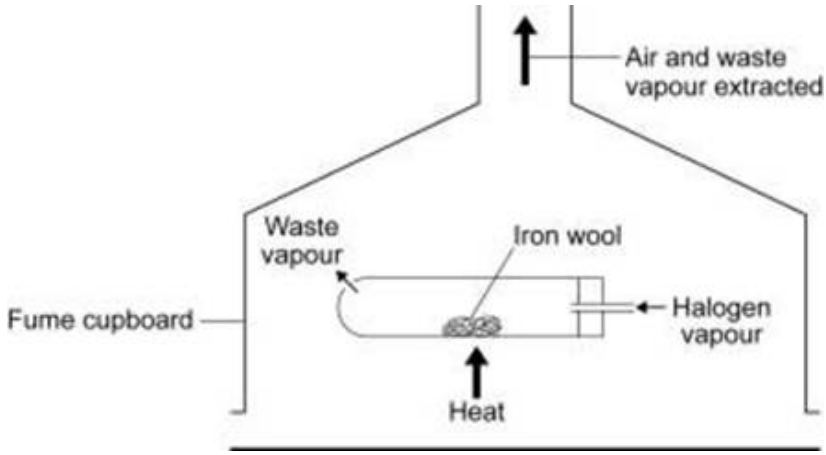
(3)
(Total 5 marks)

Q35. A teacher demonstrated the reactivity of the halogens to some students.
Halogen vapour was passed over heated iron wool in a fume cupboard.



The teacher's observations are shown in the table below.

	Observations	
	During the reaction	**After the reaction**
Bromine	The iron wool glowed	A red–brown solid had been produced
Chlorine	The iron wool glowed	A dark brown solid had been produced
Iodine	The iron wool did not glow	A black solid had been produced

(a) From these observations what conclusion can be made about the order of reactivity of the three halogens?

Explain your conclusion.

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(2)

(b) In terms of electronic structures, explain why iodine is **less reactive** than bromine.

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(3)
(Total 5 marks)