Name:

Date:

C1 - Test 4
ATOMIC STRUCTURE
Intermediate

GCSE

CHEMISTRY

AQA - Triple Science

Mark

Grade

Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

Information

- The marks for the questions are shown in brackets

1. (a) The symbols for seven different elements are shown in **Figure 1**.

Figure 1

																	He
	Be																
Na															S		Ar
	Ca						Fe										

Choose the correct symbol from **Figure 1** to answer each question.

You may use each symbol once, more than once or not at all.

Write the symbol that represents:

(i) a Group 1 element

_____

(1)

(ii) a transition metal

_____

(1)

(iii) an element with electrons in the same number of energy levels as an atom of argon (Ar)

_____

(1)

(iv) an element which forms an oxide that dissolves in water to form an acidic solution

_____

(1)

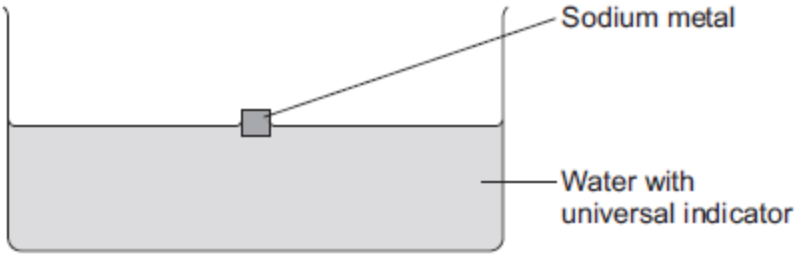
(v) an element that forms a chloride with the formula XCl

_____

(1)

(b) A teacher put a cube of sodium metal into water containing universal indicator, as shown in **Figure 2**.

Figure 2



The equation for the reaction is:

$$2Na(s) + 2H_2O(l) \longrightarrow 2NaOH\ (aq) + H_2(g)$$

sodium + water → sodium hydroxide + hydrogen

(i) The sodium floated on the surface of the water. The universal indicator turned purple.

Give **three other** observations that would be seen during the reaction.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

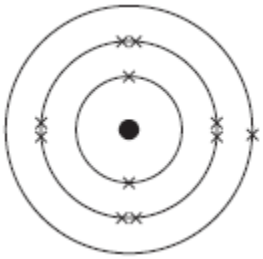
(ii) Name the ion that made the universal indicator turn purple.

_____

(1)

(c) **Figure 3** represents the electronic structure of a sodium atom.

Figure 3



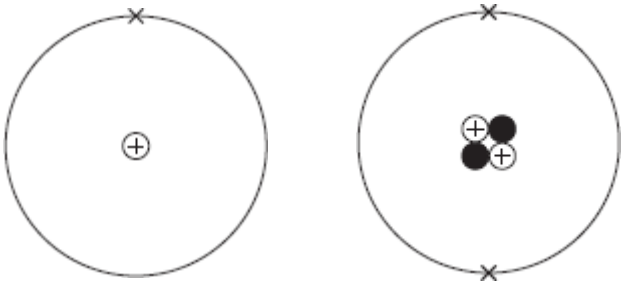
In the space below, draw the electronic structure of a sodium ion. Include the charge on the ion.

(2)

(Total 11 marks)

2. The Sun produces helium atoms from hydrogen atoms by nuclear fusion reactions.

Hydrogen **Helium**



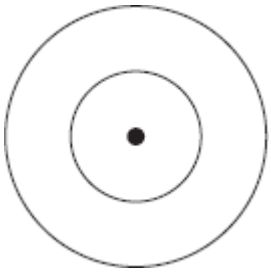
(a) Describe the differences in the atomic structures of a hydrogen atom and a helium atom.

(3)

(b) The Sun consists of 73% hydrogen and 25% helium.
The rest is other elements.
One of the other elements in the Sun is neon.

Use the Chemistry Data Sheet to help you to answer these questions.

(i) Complete the diagram to show the electronic structure of a neon atom.



(1)

(ii) Why is neon in the same group of the periodic table as helium?

_____

_____

_____

(1)

(Total 5 marks)

3. Chlorine and bromine are important Group 7 elements.

(a) Explain why chlorine is added to drinking water.

_____

_____

(1)

(b) Describe what you would **see** when bromine water is added to an unsaturated organic compound.

_____

_____

(1)

(c) Bromine can be extracted from seawater. The dissolved bromide ions are reacted with chlorine. Bromine and chloride ions are formed.

(i) Complete and balance the equation below, which represents the reaction between chlorine and bromide ions.

$Cl_2 + 2Br^- \rightarrow$ _____ + _____

(1)

(ii) Describe what you **see** when chlorine is added to a solution containing bromide ions.

_____

_____

(1)

(d) In terms of electronic structure:

(i) state why bromine and chlorine are both in Group 7

_____

_____

(1)

(ii) explain why bromine is less reactive than chlorine.

_____

_____

_____

_____

_____

_____

_____

(3)

(e) What is the result of adding acidified silver nitrate solution to a solution containing:

(i) chloride ions

_____

(1)

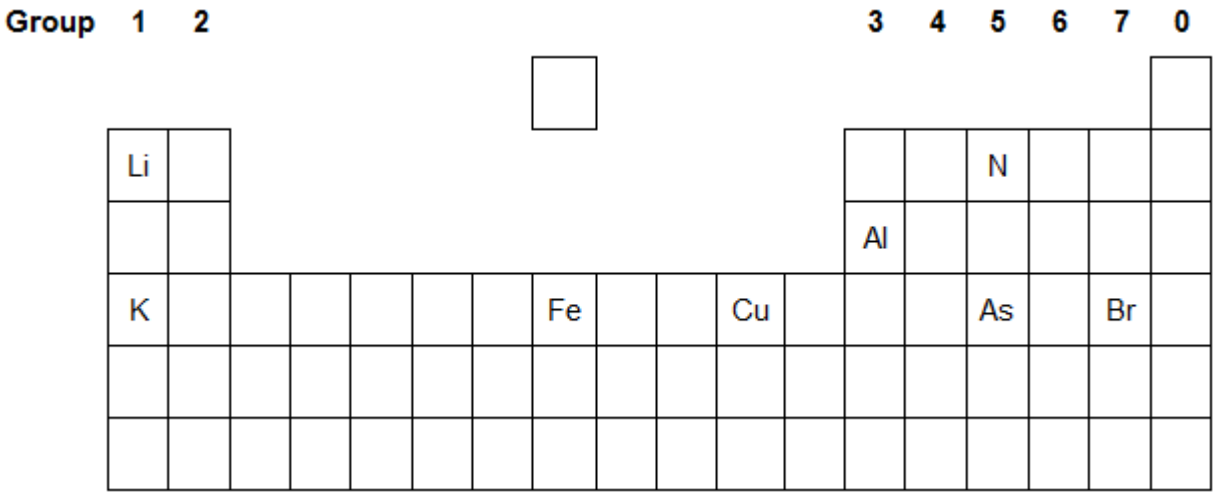
(ii) bromide ions?

_____

(1)

(Total 10 marks)

4. 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)

5.

Sodium is a Group 1 element.

(a) (i) A small piece of sodium is added to some water containing Universal Indicator solution.

Describe what you would **see** happening.

_____

_____

_____

_____

_____

_____

(3)

(ii) Complete **and** balance the equation for the reaction of sodium with water.

___Na + ___H_2O → _____ + H_2

(2)

(b) Francium is the most reactive element in Group 1.

Explain why in terms of electronic structure.

_____

_____

_____

_____

_____

_____

(3)

(c) The transition elements have different properties from the elements in Group 1.

Give **two** of these different properties of transition elements.

1. _____

_____

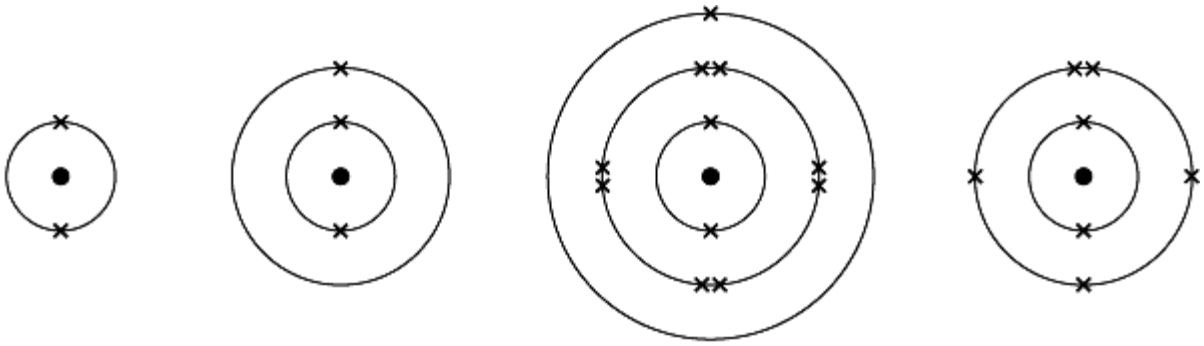
2. _____

_____

(2)

(Total 10 marks)

6. The diagrams show the electronic structure of four different atoms.



Atom A **Atom B** **Atom C** **Atom D**

Use the Chemistry Data Sheet to help you to answer these questions.

(a) Name the two sub-atomic particles in the nucleus of an atom.

_____

(1)

(b) Why is there no overall electrical charge on each atom?

_____

_____

(1)

(c) Why is **Atom A** unreactive?

_____

(1)

(d) Which **two** of these atoms have similar chemical properties?
Give a reason for your answer.

_____

_____

_____

_____

(2)

(Total 5 marks)

7. 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.

(3)

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

(2)

(Total 7 marks)