

Name:

Date:

C1 - Test 3
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.

This question is about atoms and isotopes.

(a) Atoms contain protons, neutrons and electrons.

A lithium atom has the symbol ${}^7_3\text{Li}$

Explain, in terms of sub-atomic particles, why the mass number of this lithium atom is 7.

(3)

(b) Amounts of substances can be described in different ways.

Complete the sentences.

One mole of a substance is the relative formula mass in

The relative atomic mass of an element compares the mass of an atom of an element with the mass of an atom of

(2)

(c) Two isotopes of oxygen are ${}^{18}_8\text{O}$ and ${}^{16}_8\text{O}$

Describe the similarities and differences between the isotopes ${}^{18}_8\text{O}$ and ${}^{16}_8\text{O}$

You should refer to the numbers of sub-atomic particles in each isotope.

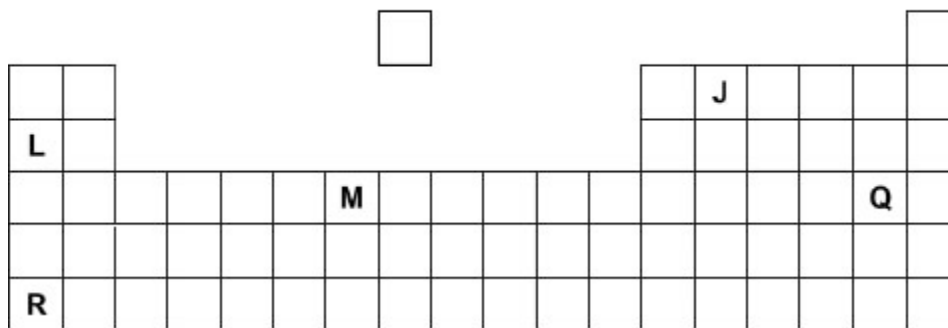
(3)

(Total 8 marks)

2.

Figure 1 shows an outline of the modern periodic table.

Figure 1



J, L, M, Q and R represent elements in the periodic table.

(a) Which element has four electrons in its outer shell?

Tick (✓) **one** box.

J L M Q R

(1)

(b) Which **two** elements in **Figure 1** are in the same period?

_____ and _____

(1)

(c) Which element reacts with potassium to form an ionic compound?

Tick (✓) **one** box.

J L M Q R

(1)

(d) Which element forms ions with different charges?

Tick (✓) **one** box.

J L M Q R

(1)

(e) Which element has three electron shells?

Tick (✓) **one** box.

J

L

M

Q

R

(1)

(f) In the 1860s scientists were trying to organise elements.

Figure 2 shows the table published by John Newlands in 1865.

The elements are arranged in order of their atomic weights.

Figure 2

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

Figure 3 shows the periodic table published by Dmitri Mendeleev in 1869.

Figure 3

H																
Li	Be	B	C	N	O	F										
Na	Mg	Al	Si	P	S	Cl										
K	Cu	Ca	Zn	?	?	Ti	?	V	As	Cr	Se	Mn	Br	Fe	Co	Ni
Rb	Ag	Sr	Cd	Y	In	Zr	Sn	Nb	Sb	Mo	Te	?	I	Ru	Rh	Pd

Mendeleev's table became accepted by other scientists whereas Newlands' table was not.

Evaluate Newlands' and Mendeleev's tables.

You should include:

- a comparison of the tables
- reasons why Mendeleev's table was more acceptable.

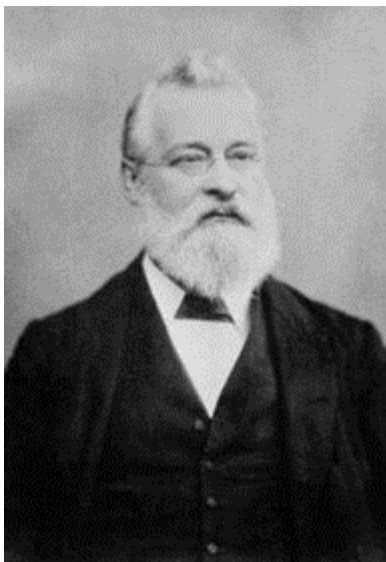
Use **Figure 2** and **Figure 3** and your own knowledge.

(6)
(Total 11 marks)

3.

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

(a) Many chemists have contributed to the development of the periodic table.



John Newlands was one of the first chemists who attempted to classify elements in a systematic way based on atomic weight. In 1866 he suggested that there was a repeating pattern of elements with similar properties every eighth element. Part of Newlands' periodic table is shown below.

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

Many chemists in 1866 did not accept Newland's; periodic table.

By Conget at nl.wikipedia [Public domain], from Wikimedia Commons

(i) Give **one** piece of evidence which supports Newlands' ideas.

(1)

(ii) Suggest **two** reasons why many chemists in 1866 did not accept Newlands' ideas.

1. _____

2. _____

(2)

(b) Chlorine, bromine and iodine are Group 7 elements.

A student investigated the reactivity of these elements.

The student added:

- aqueous chlorine to potassium bromide and potassium iodide solutions
- aqueous bromine to potassium chloride and potassium iodide solutions
- aqueous iodine to potassium chloride and potassium bromide solutions.

The student's results are shown below.

Solution	Potassium chloride	Potassium bromide	Potassium iodide
Chlorine		Solution turned orange-brown	Solution turned brown
Bromine	No reaction		Solution turned brown
Iodine	No reaction	No reaction	

(i) Use these results to state **and** explain the trend in reactivity of these Group 7 elements.

(2)

- (ii) Complete the equation below, which represents the reaction between chlorine and potassium bromide.



(1)

- (iii) In terms of electronic structure, state why chlorine, bromine and iodine are in Group 7.

(1)

- (c) Lithium, sodium and potassium are Group 1 elements.

Group 1 elements become **more** reactive down the group.

Explain why in terms of electronic structure.

(3)

(Total 10 marks)

4.

Rock salt is a mixture of sand and salt.

Salt dissolves in water. Sand does **not** dissolve in water.

Some students separated rock salt.

This is the method used.

1. Place the rock salt in a beaker.
2. Add 100 cm³ of cold water.
3. Allow the sand to settle to the bottom of the beaker.
4. Carefully pour the salty water into an evaporating dish.
5. Heat the contents of the evaporating dish with a Bunsen burner until salt crystals start to form.

(a) Suggest **one** improvement to step 2 to make sure all the salt is dissolved in the water.

(1)

(b) The salty water in step 4 still contained very small grains of sand.

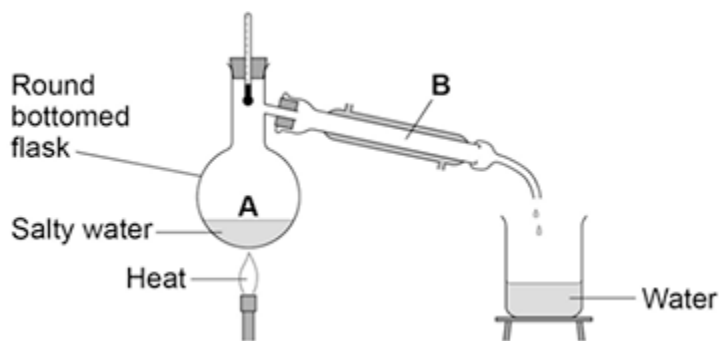
Suggest **one** improvement to step 4 to remove all the sand.

(1)

(c) Suggest **one** safety precaution the students should take in step 5.

(1)

(d) Another student removed water from salty water using the apparatus in the figure below.



Describe how this technique works by referring to the processes at **A** and **B**.

(2)

(e) What is the reading on the thermometer during this process?

_____ °C

(1)

(Total 6 marks)

5.

This question is about elements and the periodic table.

(a) Newlands and Mendeleev both produced early versions of the periodic table.

(i) Complete the sentence.

In their periodic tables, Newlands and Mendeleev arranged the elements in order of _____ .

(1)

(ii) Name the particle that allowed the elements to be arranged in order of their atomic number in the modern periodic table.

(1)

(b) The diagram below shows the position of nine elements in the modern periodic table.

Li																						
Na																						
K																						
Rb																						

(i) Which **one** of the nine elements shown in the diagram above has the lowest boiling point?

(1)

(ii) Copper and potassium have different melting points and boiling points. Give **one other** difference between the properties of copper and potassium.

(1)

(iii) Explain why the reactivity of the elements increases going down Group 1 from lithium to rubidium but decreases going down Group 7 from fluorine to iodine.

(4)

(Total 8 marks)

6.

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?

(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 \longrightarrow bromine + _____

(1)

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

(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)

7.

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.

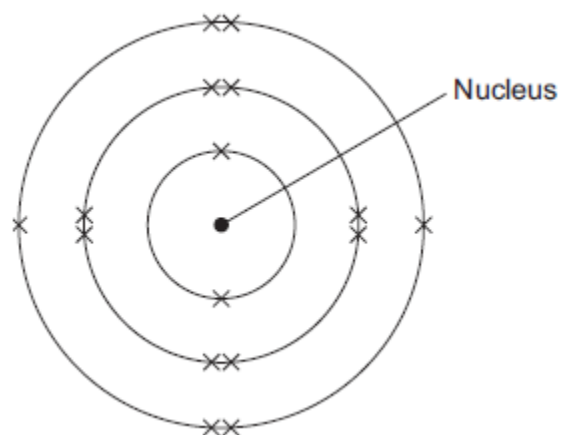
(2)

(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.

(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)