

Name:

Date:

C1 - Test 4
ATOMIC STRUCTURE AND THE
PERIODIC TABLE
Intermediate

GCSE

CHEMISTRY

AQA - Combined 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.

Atoms are made up of three main particles.

(a) Complete the table to show the names and charges of the particles in an atom.

Name of particle	Charge
proton	
	0
electron	-1

(2)

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

(b) Why are lithium and sodium in the Group 1 of the periodic table?

(1)

(c) Helium is in Group 0 of the periodic table.

(i) Give **one** property of helium that is the same as other gases in Group 0.

(1)

(ii) Give **one** property of helium that is different from other gases in Group 0.

(1)

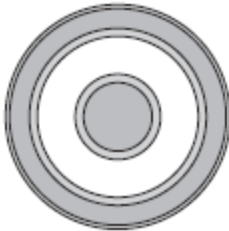
(Total 5 marks)

2.

Scientists in the 16th century used the symbol shown in **Figure 1** for gold.

Figure 1

Gold



The scientists thought platinum was made from gold and silver, so they used the symbol for gold in the symbol for platinum. The symbol for platinum is shown in **Figure 2**.

Figure 2

Platinum



(a) Gold and platinum are elements.

What is meant by the term **element**?

(1)

(b) Why is it incorrect to represent platinum as shown in **Figure 2**?

(1)

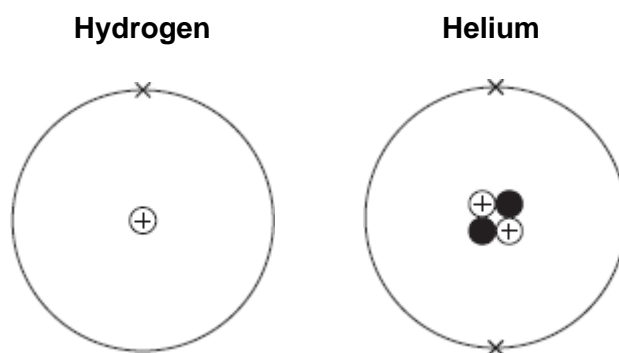
(c) Scientists now use a formula such as Ag_2O to represent a substance.

What does the formula Ag_2O tell you about this substance?

(2)
(Total 4 marks)

3.

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



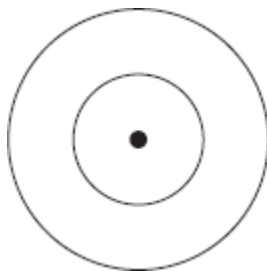
(a) Describe the differences in the atomic structures of a hydrogen atom and a helium atom.

(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)

4.

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

Part of Newlands' periodic table is shown below.

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

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

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

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

Give a reason why.

(1)

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 _____ .

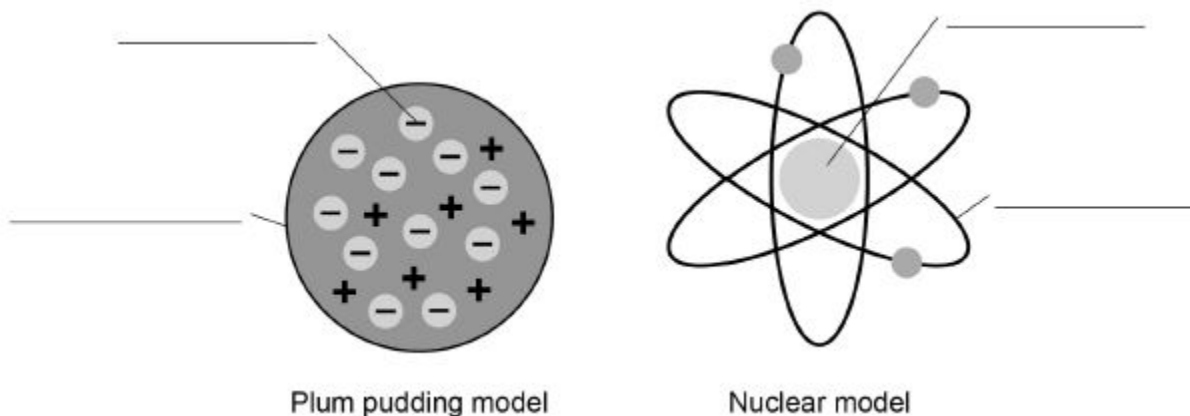
(1)

(Total 4 marks)

6.

Figure 1 shows two models of the atom.

Figure 1



(a) Write the labels on **Figure 1**

Choose the answers from the box.

atom	electron	nucleus
neutron	orbit	proton

(4)

(b) Explain why the total positive charge in every atom of an element is always the same.

(2)

(c) The results from the alpha particle scattering experiment led to the nuclear model.

Alpha particles were fired at a thin film of gold at a speed of 7% of the speed of light.

Determine the speed of the alpha particles.

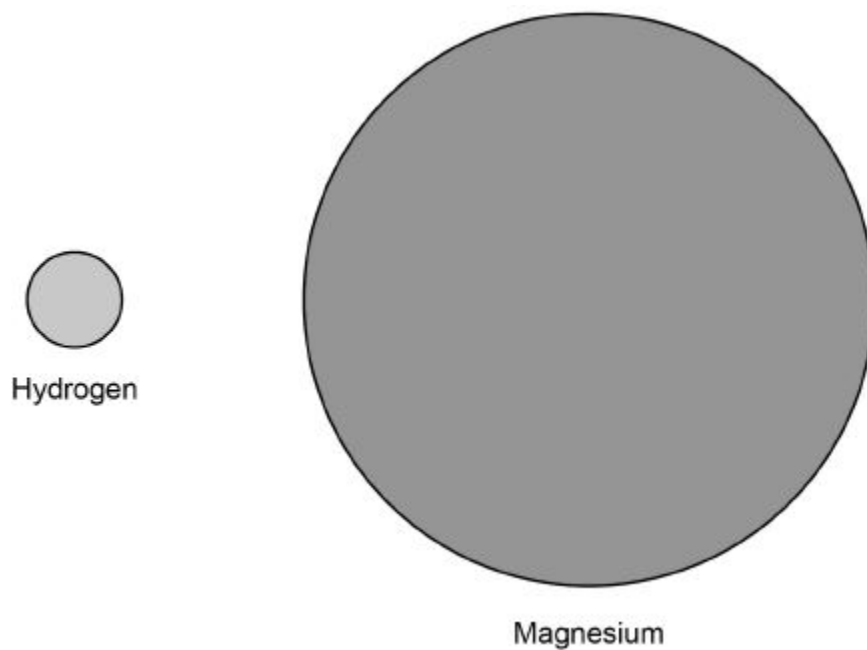
Speed of light = 300 000 000 m/s

Speed = _____ m/s

(2)

(d) **Figure 2** shows two atoms represented as solid spheres.

Figure 2



A hydrogen atom has a radius of 2.5×10^{-11} m

Determine the radius of a magnesium atom.

Use measurements from **Figure 2**

Radius = _____ m

(2)

(Total 10 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.

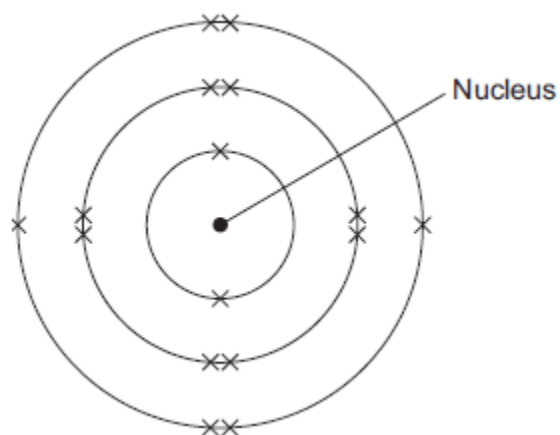
(2)

(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)

8.

This question is about atoms and chemical elements.

Mendeleev's periodic table has groups of elements with similar properties.

Figure 1 shows part of Mendeleev's periodic table.

Figure 1

1	1 H							
2	7 Li	9.4 Be	11 B	12 C	14 N	16 O	19 F	
3	23 Na	24 Mg	27.3 Al	28 Si	31 P	32 S	35.5 Cl	
4	39 K	40 Ca	44	48 Ti	51 V	52 Cr	55 Mn	56 59 59 63 Fe, Co, Ni, Cu

(a) Compare Mendeleev's periodic table with the modern periodic table.

Which group is missing from Mendeleev's periodic table?

Tick **one** box.

Group 1

Group 2

Group 7

Group 0

(1)

(b) In the early periodic tables some elements were placed in the wrong groups.

Mendeleev overcame some of these problems in his periodic table.

Give **two** ways Mendeleev did this.

1. _____

2. _____

(2)

Atoms were thought to be tiny spheres that could not be divided.

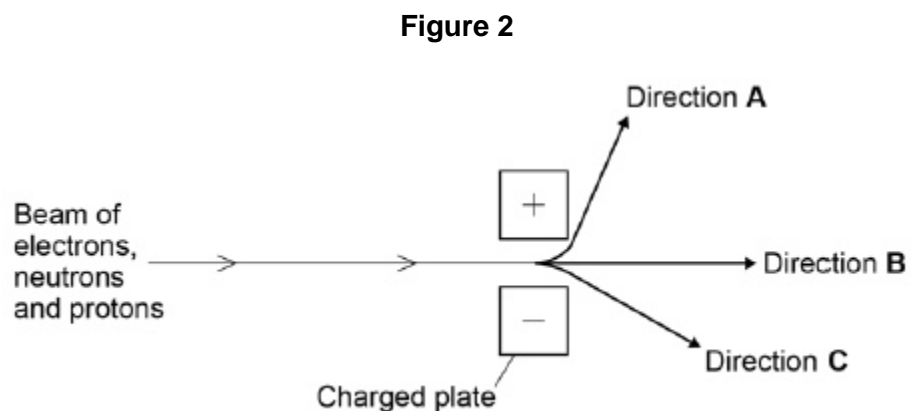
(c) Draw **one** line from each scientist to the discovery the scientist made.

Scientist	Discovery the scientist made
Neils Bohr	Discovered electrons
	Electrons orbit the nucleus
	Existence of neutrons
James Chadwick	Mass of atom concentrated at centre
	Proton found in nucleus

(2)

- (d) A beam of electrons, neutrons and protons can be separated by passing them through an electric field.

Figure 2 shows the directions of the three particles after entering the electric field.



Charged particles are attracted to the oppositely charged plate in the electric field.

Which direction, **A**, **B** or **C**, does each particle follow?

Complete the table.

Particle	Direction
Electron	
Neutron	
Proton	

(2)

(e) Calculate the mass of one atom of sodium.

Use the equation:

$$\text{mass of one atom of sodium} = \frac{\text{relative atomic mass}}{\text{Avogadro constant}}$$

Avogadro constant = 6.02×10^{23}

Give your answer to 2 significant figures.

Mass = _____ g

(3)

(f) The radius of a sodium atom is 227 picometres.

1 picometre = 10^{-12} metres (m)

The radius of a nucleus is $\frac{1}{10\,000}$ of that of the atom.

Which calculation shows the radius of a sodium atom's nucleus?

Tick **one** box.

$227 \times 10\,000$ m

$227 \times \frac{1}{10\,000}$ m

$227 \times 10^{-12} \times 10\,000$ m

$227 \times 10^{-12} \times \frac{1}{10\,000}$ m

(1)

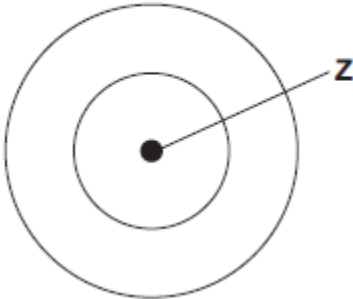
(Total 11 marks)

9.

There are eight elements in the second row (lithium to neon) of the periodic table.

(a) **Figure 1** shows an atom with two energy levels (shells).

Figure 1



(i) Complete **Figure 1** to show the electronic structure of a boron atom.

(1)

(ii) What does the central part labelled **Z** represent in **Figure 1**?

(1)

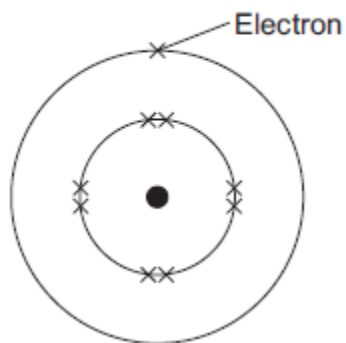
(iii) Name the sub-atomic particles in part **Z** of a boron atom.

Give the relative charges of these sub-atomic particles.

(3)

(b) The electronic structure of a neon atom shown in **Figure 2** is **not** correct.

Figure 2



Explain what is wrong with the electronic structure shown in **Figure 2**.

(3)
(Total 8 marks)