

Name:

Date:

C1 - Test 6
ATOMIC STRUCTURE AND THE
PERIODIC TABLE
Advanced

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

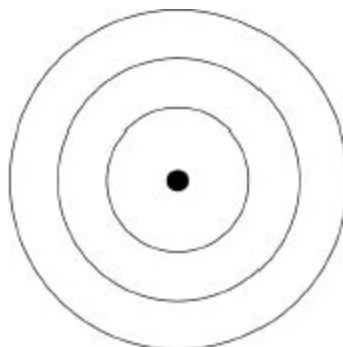
Information

- The marks for the questions are shown in brackets

1. This question is about Group 1 elements.

(a) A sodium atom is represented as ${}_{11}^{23}\text{Na}$

Complete the diagram below to show the electronic structure of a sodium atom.



(1)

A teacher demonstrated the reaction between lithium and water.

The teacher repeated the demonstration using sodium and then potassium with water.

(b) The teacher wore eye protection.

Suggest **two** other safety precautions the teacher should take.

1. _____

2. _____

(2)

- (c) Universal indicator is added to the solution formed in the reaction between potassium and water. The universal indicator becomes purple in colour.

Which ion causes universal indicator to turn purple?

Tick **one** box.

H⁺

K⁺

OH⁻

O²⁻

(1)

- (d) The table below gives the diameter of atoms of Group 1 elements.

Element	Diameter of atom in nm
Lithium	0.304
Sodium	0.372
Potassium	0.454
Rubidium	0.496
Caesium	0.530

Explain how the diameter of the atom affects the reactivity of Group 1 elements.

(4)

(Total 8 marks)

2.

This question is about the halogens.

(a) Write the state symbol for chlorine at room temperature.

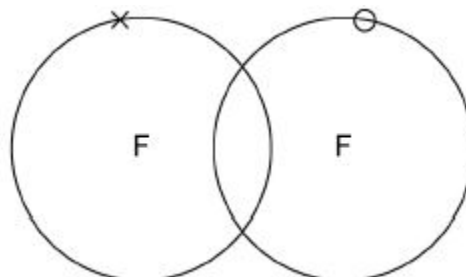
Cl₂ (_____)

(1)

(b) The diagram below represents one molecule of fluorine.

Complete the dot and cross diagram on the diagram above.

You should show only the electrons in the outer shells.



(2)

(c) A fluorine atom can be represented as ${}^{19}_{9}\text{F}$

What is the total number of electrons in a fluorine molecule (F_2)?

Tick **one** box.

9

14

18

38

(1)

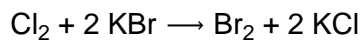
(d) Aluminium reacts with bromine to produce aluminium bromide.

Complete the balanced chemical equation for this reaction.



(2)

(e) When chlorine reacts with potassium bromide, chlorine displaces bromine.



Explain why chlorine is more reactive than bromine.

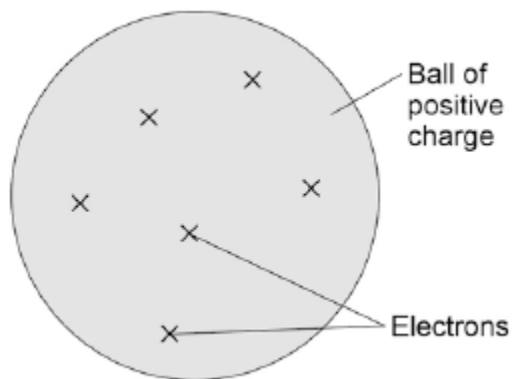
(3)

(Total 9 marks)

3. **Figure 1** shows the plum pudding model of the atom.

This model was used by some scientists after the discovery of electrons in 1897.

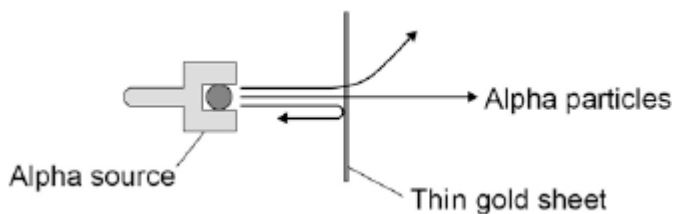
Figure 1
Plum-pudding model



In 1911 the scientists Geiger and Marsden investigated the effect of firing alpha particles at very thin sheets of gold foil.

Their experiment is shown in **Figure 2**. The arrows show the paths taken by alpha particles in the experiment.

Figure 2



(a) Explain why scientists replaced the plum pudding model of the atom with the nuclear model of the atom as a result of the experiment.

(4)

(b) According to modern measurements:

- the radius of an atom is about $1 \times 10^{-10}\text{m}$
- the radius of an atomic nucleus is about $1 \times 10^{-14}\text{m}$

Show that these values fit with the nuclear model of the atom.

(2)

(c) In 1931 a scientist discovered that there are hydrogen atoms with mass number 2 as well as hydrogen atoms with mass number 1.

A year later, another scientist discovered neutrons.

Explain why the discovery of neutrons could explain the presence of hydrogen atoms with different mass numbers.

(3)

(d) How would the results of the experiment shown in **Figure 2** change if neutrons were used instead of alpha particles to bombard a thin sheet of gold?

(2)

(Total 11 marks)

4.

The elements in Group 1 of the periodic table are metals.

(a) The elements in Group 1 are called the alkali metals.

Why are they called the alkali metals?

(2)

(b) Explain the increase in reactivity of elements further down the group.

(4)

(c) Lithium oxide is an ionic compound.

Draw a dot and cross diagram to show how lithium and oxygen combine to form lithium oxide.

Only show the electrons in the outer shell of each atom.

Give the charges on the ions formed.

(4)

(Total 10 marks)

5. This question is about subatomic particles.

(a) Subatomic particles in an atom are electrons, protons and neutrons.

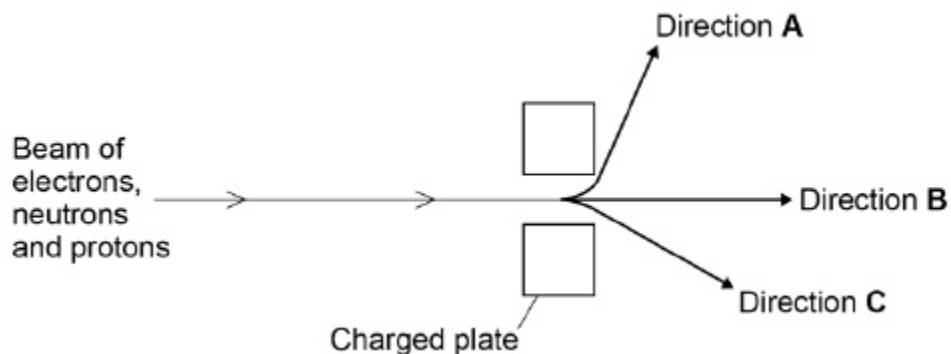
Complete the table to show when each subatomic particle was discovered.

Date of discovery	Subatomic particle
1897	
1920	
1932	

(2)

- (b) A beam of electrons, neutrons and protons travelling at the same speed is passed through two oppositely charged plates.

The diagram shows the directions of three particles after passing through the charged plates.



The charges on the electric plates are **not** shown.

The heavier the particle the less the deflection.

Explain which directions the electrons, neutrons and protons will take.

(4)

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

Avogadro constant = 6.02×10^{23} per mole.

Give your answer to 3 significant figures.

Mass of one atom of sodium = _____ g

(2)

(d) The radius of a sodium atom is 227 picometres (pm)

1 picometre = 1×10^{-12} m

What is the approximate radius of the nucleus of a sodium atom?

Tick **one** box.

2.27×10^{-12} m

2.27×10^{-14} m

2.27×10^{-24} m

4.54×10^{-14} m

(1)

(Total 9 marks)

6.

Elements are made up of atoms.

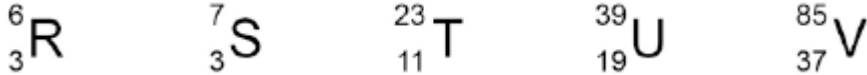
(a) What is the approximate radius of an atom?

Tick **one** box.

- $1 \times 10 \text{ m}$
- $1 \times 10^{-1} \text{ m}$
- $1 \times 10^{-10} \text{ m}$
- $1 \times 10^{-100} \text{ m}$

(1)

(b) The figure below shows the atoms of five elements.



The letters are **not** the symbols of these elements.

Complete the sentence.

All of the elements in the figure above are in Group _____ of the periodic table.

(1)

(c) Which **two** atoms in the figure above are isotopes of the same element?

Explain your answer fully.

(3)

(d) The halogens are in Group 7 of the periodic table.

Explain the trend in reactivity of the halogens.

(6)
(Total 11 marks)