GCSE Chemistry

History of the Atom

Question Paper

Time available: 40 minutes
Marks available: 40 marks

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1. This question is about models of the atom.

(a) Atoms were first thought to be tiny spheres that could not be divided.

Which particle was discovered to change this model of the atom?
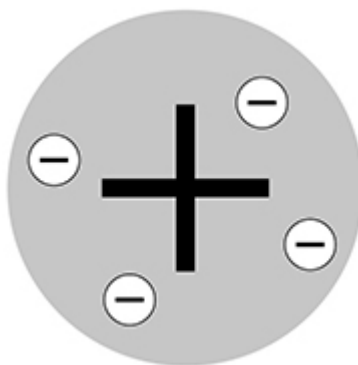
Tick (✓) **one** box.

Electron ☐

Neutron ☐

Proton ☐

(1)

(b) The diagram below shows another model of the atom.

What is the name of this model of the atom?

_____

(1)

(c)   A scientist fired particles at gold atoms.

Some of these particles were scattered.

The results led to a different model of the atom.

Which type of particle was fired at the gold atoms?

Tick (✓) **one** box.

Alpha ☐

Electron ☐

Neutron ☐

Proton ☐

(1)

(d)   Which scientist first suggested that electrons orbit the nucleus at specific distances?

Tick (✓) **one** box.

Bohr ☐

Chadwick ☐

Mendeleev ☐

(1)

(e)   The model of the atom used today has three subatomic particles:

- electrons

- neutrons

- protons.

Complete the sentences.

Atoms of the same element have the same atomic number because they have the

same number of _____.

Atoms of the same element can have different mass numbers because they have

different numbers of _____.

Atoms have no overall charge because they have the same number of

_____ and _____.

(3)

(f)   The radius of a nucleus is approximately 1×10^{-14} m

The radius of an atom is approximately 1×10^{-10} m

A teacher uses a ball of radius 1 cm to represent the nucleus.

What could represent the atom on the same scale?

Tick (✓) **one** box.

A ball of radius 10 cm ☐

A sports arena of radius 100 m ☐

An island of radius 10 km ☐
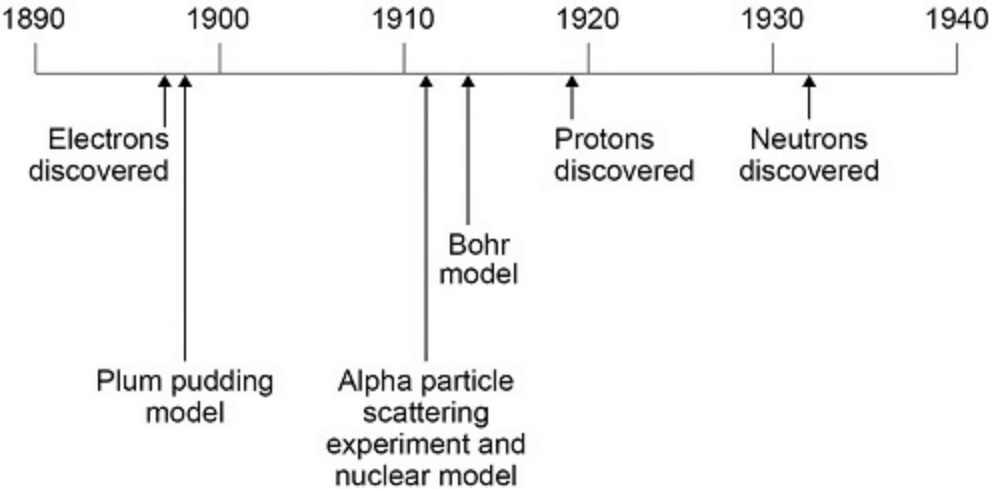
A planet of radius 1000 km ☐

(1)
(Total 8 marks)

2. This question is about the development of scientific theories.

The diagram below shows a timeline of some important steps in the development of the model of the atom.

(a) The plum pudding model did not have a nucleus.

Describe **three** other differences between the nuclear model of the atom and the plum pudding model.

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

(3)

(b) Niels Bohr adapted the nuclear model.

Describe the change that Bohr made to the nuclear model.

_____

_____

_____

_____

(2)

(c) Mendeleev published his periodic table in 1869.

Mendeleev arranged the elements in order of atomic weight.

Mendeleev then reversed the order of some pairs of elements.

A student suggested Mendeleev's reason for reversing the order was to arrange the elements in order of atomic number.

Explain why the student's suggestion **cannot** be correct.

Use the diagram above.

_____

_____

_____

_____

(2)

(d) Give the correct reason why Mendeleev reversed the order of some pairs of elements.

_____

_____

(1)
(Total 8 marks)

3. This question is about atomic structure.

(a) Atoms contain subatomic particles.

The table below shows properties of two subatomic particles.

Complete the table.

Name of particle	Relative mass	Relative charge
neutron		
		+1

(2)

An element **X** has two isotopes.

The isotopes have different mass numbers.

(b) Define mass number.

_____

_____

(1)

(c) Why is the mass number different in the two isotopes?

_____

_____

(1)

(d)   The model of the atom changed as new evidence was discovered.

The plum pudding model suggested that the atom was a ball of positive charge with electrons embedded in it.
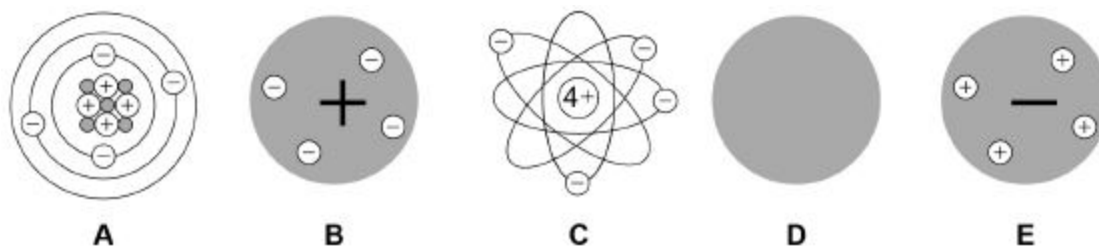
Evidence from the alpha particle scattering experiment led to a change in the model of the atom from the plum pudding model.

Explain how.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

4.   The diagram below represents different models of the atom.

A   B   C   D   E

(a)   Which diagram shows the plum pudding model of the atom?

Tick **one** box.

A ☐   B ☐   C ☐   D ☐   E ☐

(1)

(b) Which diagram shows the model of the atom developed from the alpha particle scattering experiment?

Tick **one** box.

A ☐   B ☐   C ☐   D ☐   E ☐

(1)

(c) Which diagram shows the model of the atom resulting from Bohr's work?

Tick **one** box.

A ☐   B ☐   C ☐   D ☐   E ☐

(1)

(d) Define the mass number of an atom.

_____

_____

(1)

(e) Element **X** has two isotopes. Their mass numbers are 69 and 71

The percentage abundance of each isotope is:

- 60% of ^{69}**X**

- 40% of ^{71}**X**

Estimate the relative atomic mass of element **X**.

Tick **one** box.

< 69.5   ☐

Between 69.5 and 70.0   ☐

Between 70.0 and 70.5   ☐

> 70.5   ☐

(1)

(f)   Chadwick's experimental work on the atom led to a better understanding of isotopes.

Explain how his work led to this understanding.

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

5.   This question is about atoms.

(a)   What does the number 19 represent in $^{19}_{9}F$?

_____

(1)

(b)   How many atoms are present in one mole of fluorine atoms?

Tick (✓) **one** box.

2.03×10^{26} ☐

2.06×10^{23} ☐

6.02×10^{23} ☐

6.02×10^{26} ☐

(1)

(c) The plum pudding model of the atom was replaced by the nuclear model.

The nuclear model was developed after the alpha particle scattering experiment.

Compare the plum pudding model with the nuclear model of the atom.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(d) An element has three isotopes.

The table shows the mass numbers and percentage of each isotope.

	Isotope 1	Isotope 2	Isotope 3
Mass number	24	25	26
Percentage (%)	78.6	10.1	11.3

Calculate the relative atomic mass (A_r) of the element.

Give your answer to 3 significant figures.

_____

_____

_____

_____

Relative atomic mass = _____

(2)
(Total 8 marks)