

GCSE Chemistry

Worksheet: Size and mass of atoms

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Size and mass of atoms

NAME _____	CLASS _____	DATE _____
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

The radius of an iron atom is 0.126 nm.

$$1 \text{ nm} = 1 \times 10^{-9} \text{ m}$$

0 1 . 1

Calculate the diameter of an iron atom, in nanometres.

.....

.....

.....

Diameter = nm

[1 mark]

0 1 . 2

Give the radius of an iron atom in metres. Give your answer in standard form.

.....

.....

.....

.....

Radius = m

[2 marks]

0 1 . 3

Where in an atom is almost all of its mass found?

.....

.....

.....

.....

[1 mark]

0 2

Atoms and their nuclei are extremely small.

$$1 \text{ nm} = 1 \times 10^{-9} \text{ m}$$

0 2 . 1

Which unit is most suitable for measuring the radius of an atom?

Tick (✓) **one** box.

Kilometres (km)

☐

Metres (m)

☐

Millimetres (mm)

☐

Nanometres (nm)

☐

[1 mark]

0 2 . 2

The radius of an atom is about 0.1 nm.

Give this radius in metres.

.....

.....

.....

Radius = m

[1 mark]

0 2 . 3

How does the radius of the nucleus compare with the radius of the atom?

Tick (✓) **one** box.

It is about the same as the radius of the atom.

☐

It is about $\frac{1}{10}$ of the radius of the atom.

☐

It is about $\frac{1}{100}$ of the radius of the atom.

☐

It is less than $\frac{1}{10\,000}$ of the radius of the atom.

☐

[1 mark]

0 3

Atoms are extremely small.

0 3 . 1

What is the approximate radius of an atom?

Tick (✓) **one** box.

1×10^{-2} m

☐

1×10^{-6} m

☐

1×10^{-10} m

☐

1×10^{-14} m

☐

[1 mark]

0 3 . 2

Where is almost all of the mass of an atom found?

.....

.....

.....

[1 mark]

0 3 . 3

An atom of sodium is represented as $^{23}_{11}\text{Na}$.

Give the number of protons, neutrons and electrons in this atom.

.....

.....

.....

.....

.....

.....

[3 marks]

0 3 . 4

What is meant by the mass number of an atom?

.....

.....

[1 mark]

0 4

Magnesium has three isotopes: ^{24}Mg , ^{25}Mg and ^{26}Mg .

The atomic number of magnesium is 12.

0 4 . 1

What are isotopes?

.....

.....

.....

.....

[2 marks]

0 4 . 2

Give the numbers of protons, neutrons and electrons in an atom of ^{25}Mg .

[2 marks]

0 4 . 3

A magnesium ion, Mg^{2+} , is formed from an atom of ^{26}Mg .

Give the number of electrons and the number of neutrons in this ion.

[2 marks]

0 4 . 4

Suggest why the three isotopes of magnesium have the same chemical reactions.

[1 mark]

0 5

An atom has a radius of 1×10^{-10} m. The radius of its nucleus is 1×10^{-14} m.

0 5 . 1

How many times larger is the radius of the atom than the radius of its nucleus?

.....
[1 mark]

0 5 . 2

Give the radius of the atom in nanometres.

$1 \text{ nm} = 1 \times 10^{-9} \text{ m}$

.....

.....

.....

Radius = nm

[1 mark]

0 5 . 3

A student makes a scale model of this atom. The nucleus in the model is a bead with a radius of 2 mm.

Calculate the radius of the atom in the model. Give your answer in metres.

.....

.....

.....

.....

Radius = m

[2 marks]

0 5 . 4

Gold leaf is a very thin sheet of gold. A sample of gold leaf is $1.2 \times 10^{-7} \text{ m}$ thick. The diameter of a gold atom is $2.9 \times 10^{-10} \text{ m}$.

Estimate the number of gold atoms in the thickness of the gold leaf.

.....

.....

.....

.....

Number of atoms =

[2 marks]

0 6

The radius of a silver atom is 0.144 nm. The radius of the nucleus of a silver-107 atom is about 5.7×10^{-15} m.

$$1 \text{ nm} = 1 \times 10^{-9} \text{ m}$$

0 6 . 1

Give the radius of the silver atom in metres.

.....

.....

.....

Radius = m

[1 mark]

0 6 . 2

Calculate how many times larger the radius of the atom is than the radius of its nucleus.

Give your answer to 2 significant figures.

.....

.....

.....

.....

.....

[2 marks]

0 6 . 3

Scientists state that the radius of a nucleus is less than $\frac{1}{10\,000}$ of the radius of the atom.

Explain whether your calculated value supports this statement.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: Size and mass of atoms · 30 marks

Question 1 (4 marks)

01.1 [1 mark]

Answer: 0.252 nm

- $2 \times 0.126 = 0.252$ (nm) (1)
-

01.2 [2 marks]

Answer: 1.26×10^{-10} m

- 0.126×10^{-9} (m) (1)
 - 1.26×10^{-10} (m) (1)
-

Notes: A correct value that is not in standard form (for example 0.126×10^{-9} m) scores 1 mark only.

01.3 [1 mark]

Answer: in the nucleus

- (in the) nucleus (1)
-

Question 2 (3 marks)

02.1 [1 mark]

Correct: Nanometres (nm)

02.2 [1 mark]

Answer: 1×10^{-10} m

- 1×10^{-10} (m) (1)
-

Notes: Allow 0.1×10^{-9} m or 0.000 000 000 1 m.

02.3 [1 mark]

Correct: It is less than $\frac{1}{10\,000}$ of the radius of the atom.

Question 3 (6 marks)

03.1 [1 mark]

Correct: 1×10^{-10} m

03.2 [1 mark]

Answer: in the nucleus

- (in the) nucleus (1)
-

03.3 [3 marks]

Answer: 11 protons, 12 neutrons, 11 electrons

- protons: 11 (1)
 - neutrons: 12 (1)
 - electrons: 11 (1)
-

03.4 [1 mark]

Answer: The total number of protons and neutrons in the atom.

- (total) number of protons and neutrons (in the nucleus) (1)

Notes: Do not accept 'the mass of the atom'.

Question 4 (7 marks)

04.1 [2 marks]

Answer: Atoms of the same element (same number of protons) with different numbers of neutrons.

- atoms of the same element / with the same number of protons (1)
 - (with) different numbers of neutrons (1)
-

04.2 [2 marks]

Answer: 12 protons, 13 neutrons, 12 electrons

- 13 neutrons (1)
 - 12 protons and 12 electrons (1)
-

04.3 [2 marks]

Answer: 10 electrons and 14 neutrons

- 10 electrons (1)
 - 14 neutrons (1)
-

04.4 [1 mark]

Answer: They have the same number of electrons / the same electronic structure.

- same number of electrons / same electronic structure / same number of outer electrons (1)

Notes: Allow 'same number of protons and electrons'.

Question 5 (6 marks)

05.1 [1 mark]

Answer: 10 000

- $10\,000 / 1 \times 10^4$ (1)

05.2 [1 mark]

Answer: 0.1 nm

- 0.1 (nm) (1)

05.3 [2 marks]

Answer: 20 m

- $2 \times 10\,000 = 20\,000$ (mm) (1)
- 20 (m) (1)

Notes: An answer of 20 scores 2 marks. Allow ECF from the first part.

05.4 [2 marks]

Answer: 414 (allow 400 to 420)

- $1.2 \times 10^{-7} \div 2.9 \times 10^{-10}$ (1)
- 414 (1)

Notes: Allow any answer from 400 to 420 for the second mark.

Question 6 (4 marks)

06.1 [1 mark]

Answer: $1.44 \times 10^{-10} \text{ m}$

- $1.44 \times 10^{-10} \text{ (m) (1)}$

Notes: Allow $0.144 \times 10^{-9} \text{ m}$.

06.2 [2 marks]

Answer: 25 000

- $1.44 \times 10^{-10} \div 5.7 \times 10^{-15} (= 25\,263) (1)$
- $25\,000 / 2.5 \times 10^4 (1)$

Notes: An answer of 25 263 (not given to 2 significant figures) scores 1 mark.

06.3 [1 mark]

Answer: Yes: the atom's radius is about 25 000 times the nucleus's radius, which is more than 10 000 times.

- yes, because the radius of the atom is more than 10 000 times the radius of the nucleus (about 25 000 times) (1)

Notes: Allow ECF from the value calculated.
