

GCSE Combined Science: Trilogy

Worksheet: Size and mass of atoms

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
-----------------------	--------------------------	------------------------------	-----------------------------------

Topics: Size and mass of atoms

NAME _____ **CLASS** _____ **DATE** _____

- 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

Atoms and their nuclei are extremely small.

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

0 1 . 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 1 . 2

The radius of an atom is about 0.1 nm.

Give this radius in metres.

.....

.....

.....

Radius = m

[1 mark]

0 1 . 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 2

The radius of a lithium atom is 0.152 nm.

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

0 2 . 1

Calculate the diameter of a lithium atom, in nanometres.

.....

.....

.....

Diameter = nm

[1 mark]

0 2 . 2

Give the radius of a lithium atom in metres. Give your answer in standard form.

.....

.....

.....

.....

Radius = m

[2 marks]

0 2 . 3

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

.....

.....

.....

.....

[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

The radius of a magnesium atom is 0.160 nm. The radius of the nucleus of a magnesium-24 atom is about 3.5×10^{-15} m.

1 nm = 1×10^{-9} m

0 4 . 1

Give the radius of the magnesium atom in metres.

.....

.....

.....

Radius = m

[1 mark]

0 4 . 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 4 . 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]

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

Table 1 shows the approximate radius of some particles.

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

Table 1

Particle	Approximate radius in m
Atom	1×10^{-10}
Small molecule	3×10^{-10}
Virus	5×10^{-8}
Grain of sand	2.5×10^{-4}

0 6 . 1

Use Table 1 to calculate how many times larger the radius of the virus is than the radius of the atom.

.....

.....

.....

.....

.....
[2 marks]

0 6 . 2

Give the radius of the virus in nanometres.

.....

.....

.....

Radius = nm

[1 mark]

0 6 . 3

Calculate how many times larger the radius of the grain of sand is than the radius of the atom.

.....

.....

.....

.....

[1 mark]

0 6 . 4

The smallest object that can be seen with the naked eye has a radius of about 5×10^{-5} m.

Which particle in Table 1 could be seen with the naked eye?

.....

.....

.....

.....

[1 mark]

0 7

The radius of a platinum atom is 0.139 nm. The radius of the nucleus of a platinum-195 atom is about 7.0×10^{-15} m.

1 nm = 1×10^{-9} m

0 7 . 1

Give the radius of the platinum atom in metres.

.....

.....

.....

Radius = m

[1 mark]

0 7 . 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 7 . 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 Combined Science: Trilogy · Worksheet: Size and mass of atoms · 32 marks

Question 1 (3 marks)

01.1 [1 mark]

Correct: Nanometres (nm)

01.2 [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.

01.3 [1 mark]

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

Question 2 (4 marks)

02.1 [1 mark]

Answer: 0.304 nm

- $2 \times 0.152 = 0.304$ (nm) (1)
-

02.2 [2 marks]

Answer: 1.52×10^{-10} m

- 0.152×10^{-9} (m) (1)
- 1.52×10^{-10} (m) (1)

Notes: A correct value that is not in standard form (for example 0.152×10^{-9} m) scores 1 mark only.

02.3 [1 mark]

Answer: in the nucleus

- (in the) nucleus (1)
-

Question 3 (6 marks)

03.1 [1 mark]

Correct: $1 \times 10^{-10} \text{ m}$

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 (4 marks)

04.1 [1 mark]

Answer: $1.60 \times 10^{-10} \text{ m}$

- $1.60 \times 10^{-10} \text{ (m) (1)}$

Notes: Allow $0.160 \times 10^{-9} \text{ m}$.

04.2 [2 marks]

Answer: 46 000

- $1.60 \times 10^{-10} \div 3.5 \times 10^{-15} (= 45\,714) (1)$
- $46\,000 / 4.6 \times 10^4 (1)$

Notes: An answer of 45 714 (not given to 2 significant figures) scores 1 mark.

04.3 [1 mark]

Answer: Yes: the atom's radius is about 46 000 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 46 000 times) (1)

Notes: Allow ECF from the value calculated.

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 (5 marks)

06.1 [2 marks]

Answer: 500

- $5 \times 10^{-8} \div 1 \times 10^{-10}$ (1)
 - 500 (1)
-

06.2 [1 mark]

Answer: 50 nm

- 50 (nm) (1)
-

06.3 [1 mark]

Answer: 2.5×10^6

- $2.5 \times 10^6 / 2\,500\,000$ (1)
-

06.4 [1 mark]

Answer: the grain of sand

- (the grain of) sand (1)
-

Question 7 (4 marks)

07.1 [1 mark]

Answer: $1.39 \times 10^{-10} \text{ m}$

- $1.39 \times 10^{-10} \text{ (m) (1)}$

Notes: Allow $0.139 \times 10^{-9} \text{ m}$.

07.2 [2 marks]

Answer: 20 000

- $1.39 \times 10^{-10} \div 7.0 \times 10^{-15} (= 19\,857) (1)$
- $20\,000 / 2.0 \times 10^4 (1)$

Notes: An answer of 19 857 (not given to 2 significant figures) scores 1 mark.

07.3 [1 mark]

Answer: Yes: the atom's radius is about 20 000 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 20 000 times) (1)

Notes: Allow ECF from the value calculated.
