

GCSE Combined Science: Trilogy

Worksheet: Development of the periodic table

TIME 25 min	TOTAL 22 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Development of the periodic table

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

Scientists tried to classify the elements long before the modern periodic table was developed.

0 1 . 1

Before protons, neutrons and electrons were discovered, scientists arranged the elements in order of one property.

Name this property.

.....

.....

.....

.....
[1 mark]

0 1 . 2

Some elements were placed in inappropriate groups in early periodic tables. Suggest why.

.....

.....

[1 mark]

0 1 . 3

Mendeleev left gaps in his periodic table.
Why?

[1 mark]

0 1 . 4

Give **one** reason why other scientists came to accept Mendeleev's periodic table.

[1 mark]

0 2

Dmitri Mendeleev published a periodic table in 1869, before protons, neutrons and electrons had been discovered.

0 2 . 1

What did Mendeleev do that earlier scientists had not done?

Tick (✓) **one** box.

He changed the order of some elements based on their atomic weights.

☐

He put the elements in order of atomic number.

☐

He put the elements in the order in which they were discovered.

☐

He ignored the properties of the elements.

☐

[1 mark]

0 2 . 2

Complete the sentence.

Knowledge of made it possible to explain why the order based on atomic weights was not always correct.

[1 mark]

0 3

Mendeleev's periodic table ordered the elements mainly by one property.

0 3 . 1

Which property did Mendeleev mainly use to order the elements in his table?

Tick (✓) **one** box.

Atomic number

☐

Atomic weight (relative atomic mass)

☐

Number of electron shells

☐

Melting point

☐

[1 mark]

0 4

Mendeleev's periodic table was published in 1869. The modern periodic table developed from it.

0 4 . 1

Give **two** differences between Mendeleev's periodic table and the modern periodic table.

.....

.....

.....

.....

[2 marks]

0 4 . 2

Suggest why Mendeleev's table did not include the noble gases.

.....

.....

[1 mark]

0 4 . 3

When the noble gases were discovered, they were placed in a new group without changing the order of the other elements.

Explain why this supported the idea of a periodic table.

.....

.....

[1 mark]

0 5

Mendeleev left a gap in his table for an element he called eka-aluminium, and predicted its properties. When gallium was discovered, its properties matched his predictions closely.

A student says:

‘Mendeleev was just lucky that gallium turned out to have the properties he predicted.’

0 5 . 1

Evaluate the student’s statement.

.....

.....

.....

.....

[2 marks]

0 6

Table 1 shows information about tellurium and iodine.

Table 1

Element	Relative atomic mass	Atomic number
Tellurium, Te	127.6	52
Iodine, I	126.9	53

0 6 . 1

Mendeleev placed tellurium before iodine, even though iodine has a lower atomic weight.

Suggest why.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Explain why tellurium is placed before iodine in the modern periodic table.

.....

.....

[1 mark]

0 6 . 3

Knowledge of isotopes explains why tellurium has a higher relative atomic mass than iodine.
Explain how.

.....

.....

.....

.....

[2 marks]

0 7

Mendeleev also predicted the properties of an undiscovered element he called eka-silicon. Table 2 compares his predictions with the properties of germanium, which was discovered in 1886.

Table 2

Property	Predicted for eka-silicon	Germanium
Relative atomic mass	about 72	72.6
Density in g/cm ³	5.5	5.35

0 7 . 1

Calculate the difference between the predicted density and the density of germanium, as a percentage of the density of germanium.
Give your answer to 2 significant figures.

.....

.....

.....

.....

Percentage difference = %

[2 marks]

0 7 . 2

Explain how the discovery of germanium supported Mendeleev's periodic table.

[2 marks]

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: Development of the periodic table · 22 marks

Question 1 (4 marks)

01.1 [1 mark]

Answer: atomic weight

- atomic weight / relative atomic mass (1)

Notes: Do not accept 'mass' on its own or 'atomic number'.

01.2 [1 mark]

Answer: The strict order of atomic weights was followed.

- (because) the strict order of atomic weights was followed (1)

Notes: Allow 'the tables were incomplete'.

01.3 [1 mark]

Answer: For elements that he thought had not yet been discovered.

- for (undiscovered) elements / elements that had not been discovered (yet) (1)
-

01.4 [1 mark]

Answer: Elements were discovered that fitted the gaps and had the properties he predicted.

- elements were discovered that filled the gaps / had properties that matched his predictions (1)
-
-

Question 2 (2 marks)

02.1 [1 mark]

Correct: He changed the order of some elements based on their atomic weights.

02.2 [1 mark]

Answer: isotopes

- isotopes (1)
-

Question 3 (1 mark)

03.1 [1 mark]

Correct: Atomic weight (relative atomic mass)

Question 4 (4 marks)

04.1 [2 marks]

Answer: The modern table is in order of atomic number (not atomic weight), has no gaps, and includes the noble gases.

- the modern table is in order of atomic number; Mendeleev's was (mainly) in order of atomic weight (1)
- the modern table has no gaps (for undiscovered elements) (1)
- the modern table includes the noble gases / Group 0 (1)
- the modern table contains many more elements (1)

Any 2 of the points above.

04.2 [1 mark]

Answer: They had not been discovered, because they are unreactive and are not found in compounds.

- they had not been discovered (because they are unreactive, so they are not found in compounds) (1)
-

04.3 [1 mark]

Answer: The noble gases have similar properties to each other, so they fitted the pattern as a new group.

- the noble gases have similar properties to each other, so they fitted into the table as a new group (the pattern still worked) (1)
-

Question 5 (2 marks)

05.1 [2 marks]

Answer: It was not luck: Mendeleev based his predictions on the patterns in the properties of the elements in the same group, and other elements he predicted were also discovered with the properties he predicted.

- the predictions were based on patterns / trends in the properties of the elements in the same group, not guesses (1)
- other elements that Mendeleev predicted were also discovered with the properties he predicted, which is very unlikely to happen by chance (1)

Notes: Allow a named example for the second mark (e.g. germanium / eka-silicon, scandium).

Question 6 (5 marks)

06.1 [2 marks]

Answer: Iodine has similar properties to chlorine and bromine, so Mendeleev placed it in the same group as them.

- iodine has (chemical) properties similar to chlorine / bromine (1)
 - so it was placed in the same group as elements with similar properties (1)
-

06.2 [1 mark]

Answer: The modern table is in order of atomic number and tellurium has fewer protons (52) than iodine (53).

- the modern table is in order of atomic number and tellurium has a lower atomic number / fewer protons (52) than iodine (53) (1)
-

06.3 [2 marks]

Answer: Tellurium has more of its atoms as heavier isotopes (with more neutrons), and relative atomic mass is an average that takes account of the abundance of isotopes.

- tellurium has (a greater abundance of) isotopes with more neutrons / heavier isotopes (1)
 - relative atomic mass is an average that takes account of the abundance of the isotopes (1)
-

Question 7 (4 marks)

07.1 [2 marks]

Answer: 2.8%

- $(5.5 - 5.35) \div 5.35 \times 100$ (1)
- 2.8 (%) (1)

Notes: Do not accept 2.7 (dividing by the predicted density).

07.2 [2 marks]

Answer: Germanium's properties closely matched those predicted for eka-silicon, showing that the table could correctly predict undiscovered elements.

- germanium's relative atomic mass and density closely matched the predicted values for eka-silicon (1)
 - this showed that Mendeleev's table could be used to predict the properties of undiscovered elements (so it was based on a real pattern) (1)
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