AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.1.2.4

Group 0

Past-paper questions

Tier	**Foundation**
Question groups	**6**
Available paper years	**2019–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.1.2.4 Group 0

Question 01

0 3 This question is about the periodic table and argon.

0 3 . 1 What order did scientists use to arrange elements in early periodic tables?

[1 mark]

Tick (✓) **one** box.

- Atomic weight of element ☐
- Number of neutrons in an atom of element ☐
- Size of atoms of element ☐
- Year element was discovered ☐

0 3 . 2 In early periodic tables some elements were placed in the wrong groups.

Mendeleev overcame some of these problems in his periodic table.

Complete the sentence.

[1 mark]

Mendeleev did this by leaving _____ for elements that had not been discovered.

Question 3 continues on the next page

5.1.2.4 Group 0

Question 01 · continued

0 3 . 3 What is the name of the group that contains argon?

[1 mark]

Tick (✓) **one** box.

- Alkali metals ☐
- Halogens ☐
- Noble gases ☐

0 3 . 4 An atom of argon is represented as $^{40}_{18}Ar$

Determine the number of protons and the number of neutrons in one atom of argon.

[2 marks]

Number of protons _____

Number of neutrons _____

0 3 . 5 Different atoms of argon are, $^{39}_{18}Ar$ and $^{38}_{18}Ar$

What is the name given to these different atoms of argon?

[1 mark]

Tick (✓) **one** box.

- Fullerenes ☐
- Ions ☐
- Isotopes ☐
- Molecules ☐

5.1.2.4 Group 0

Question 01 · continued

0 3 . 6 What is the electronic structure of an argon atom, $^{40}_{18}Ar$?

[1 mark]

Tick (✓) **one** box.

2 ☐ 2, 8 ☐ 2, 8, 2 ☐ 2, 8, 8 ☐

0 3 . 7 Why is argon unreactive?

[1 mark]

_____

_____

8

Turn over for the next question

5.1.2.4 Group 0

Question 02

0 4 This question is about the atmospheres of Earth and Mars.

0 4 . 1 Earth's early atmosphere may have been like the atmosphere of Mars today.

Why are scientists **not** certain about the percentage of gases in the Earth's early atmosphere?

[1 mark]

0 4 . 2 What was formed from the water vapour in the Earth's early atmosphere?

[1 mark]

Tick (✓) **one** box.

- Crude oil ☐
- Limestone ☐
- Natural gas ☐
- Oceans ☐

5.1.2.4 Group 0

Question 02 · continued

0 4 . 3 The Earth's atmosphere today consists mainly of nitrogen and oxygen.

Draw **one** line from each gas to what produced the gas.

[2 marks]

Gas	What produced the gas
Nitrogen	Animals
Oxygen	Oceans
	Algae
	Fossils
	Volcanoes

Question 4 continues on the next page

Question 02 · continued

Table 2 shows the percentage of some gases in the atmospheres of Earth and Mars.

Table 2

Gas	Percentage of gas in atmosphere (%)	
	Earth	Mars
Argon	0.9	1.9
Carbon dioxide	0.04	95
Nitrogen	78	2.6
Oxygen	21	0.2

0 4 . 4 Why are animals **not** able to live on Mars?

[1 mark]

Tick (✓) **one** box.

The atmosphere of Mars does not contain enough argon. ☐

The atmosphere of Mars does not contain enough nitrogen. ☐

The atmosphere of Mars does not contain enough oxygen. ☐

0 4 . 5 There is more carbon dioxide on Mars than on Earth.

Which **other** gas is found in larger quantities on Mars than on Earth?

[1 mark]

5.1.2.4 Group 0

Question 02 · continued

0 4 . 6 Calculate how many times more nitrogen than oxygen there is in the atmosphere of Earth.

Use **Table 2**.

Give your answer to 2 significant figures.

[3 marks]

Number of times more nitrogen than oxygen (2 significant figures) = _____

9

Turn over for the next question

5.1.2.4 Group 0

Question 03

June 2022 | 8464/C/1F | Original Q4

0 4 This question is about elements and compounds.

0 4 . 1 Magnesium and oxygen react to produce magnesium oxide.

Balance the equation for the reaction.

[1 mark]

$$_____ Mg + O_2 \rightarrow 2\,MgO$$

0 4 . 2 Suggest **one** safety precaution that should be taken when heating magnesium and oxygen.

[1 mark]

0 4 . 3 Calculate the relative formula mass (M_r) of magnesium fluoride (MgF_2).

Relative atomic masses (A_r): F = 19 Mg = 24

[2 marks]

Relative formula mass (M_r) = _____

0 4 . 4 Argon is a noble gas.

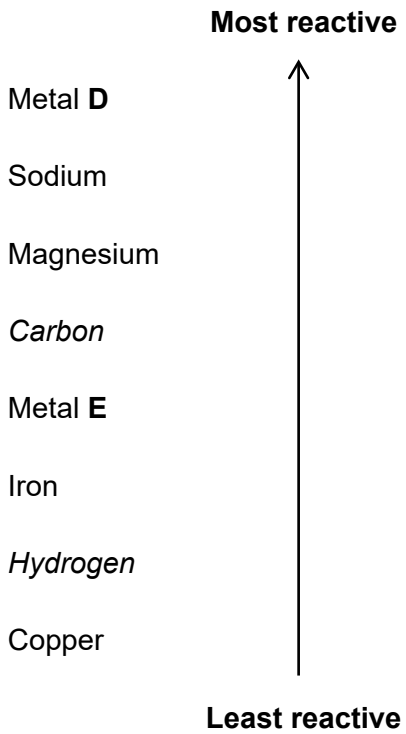
Explain why **no** product is formed when magnesium and argon are heated together.

[2 marks]

5.1.2.4 Group 0

0 4 . 5 **Figure 10** shows a reactivity series.

Figure 10



5.1.2.4 Group 0

Question 03 · continued

Draw **one** line from each metal to the method used to extract that metal.

Use **Figure 10**.

[2 marks]

Metal	Method used to extract that metal
	Extracted by electrolysis of a molten ionic compound.
Metal **D**	Extracted from its oxide by reduction with carbon.
	Extracted from its oxide by reduction with hydrogen.
Metal **E**	
	Removed from the Earth as the metal itself.

Question 4 continues on the next page

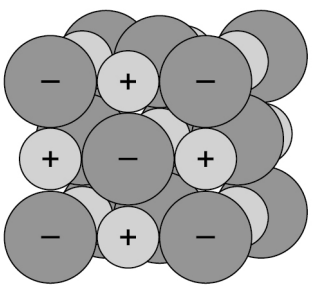
5.1.2.4 Group 0

Question 03 · continued

A substance conducts electricity when it has charged particles that are free to move.

0 4 . 6 **Figure 11** represents the structure of sodium chloride.

Figure 11



Sodium chloride

Explain why sodium chloride conducts electricity when molten but **not** when solid.

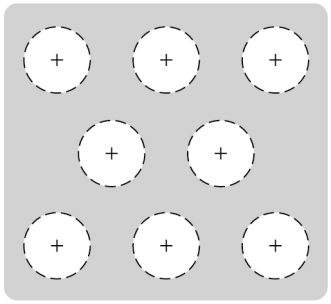
[3 marks]

5.1.2.4 Group 0

Question 03 · continued

0 4 . 7 **Figure 12** represents the structure of sodium metal.

Figure 12



Sodium metal

Explain why sodium metal conducts electricity when solid.

[2 marks]

13

5.1.2.4 Group 0

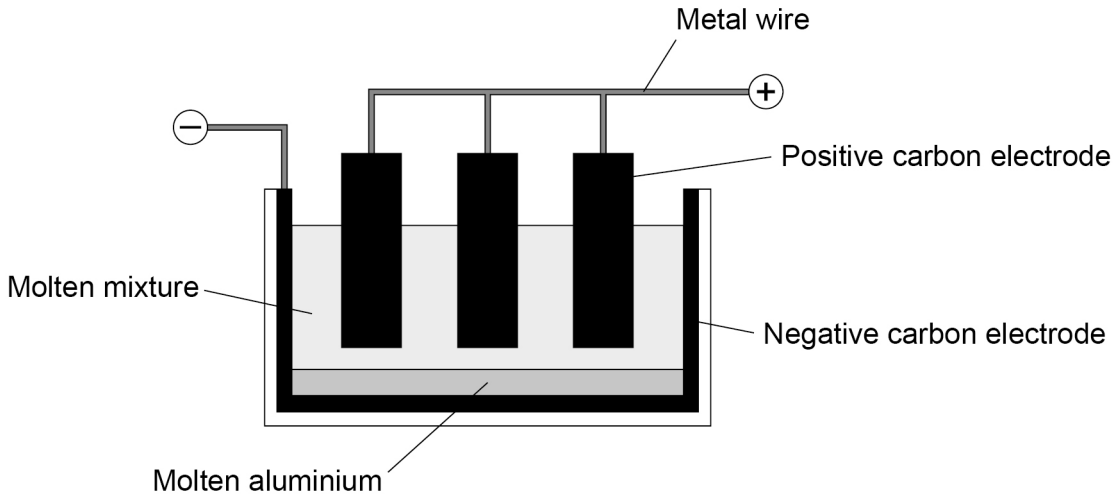
Question 04

0 5 This question is about extraction of metals.

Aluminium is extracted from a molten mixture of aluminium oxide and cryolite using electrolysis.

Figure 12 shows the electrolysis cell.

Figure 12



0 5 . 1 Complete the sentence.

[1 mark]

The extraction of aluminium is expensive because the process uses large amounts of _____ .

0 5 . 2 Oxygen is produced at the positive carbon electrodes.

The oxygen reacts with the carbon electrodes.

Which gas is produced when oxygen reacts with the positive carbon electrodes?

[1 mark]

_____

5.1.2.4 Group 0

Question 04 · continued

Titanium is extracted from titanium chloride by reacting titanium chloride with sodium.

The reaction between titanium chloride and sodium is carried out in an inert atmosphere.

0 5 . 3 Suggest why the reaction is carried out in an inert atmosphere.

[1 mark]

0 5 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

argon	**chlorine**	**hydrogen**

The gas used for the inert atmosphere is _____ .

0 5 . 5 Balance the equation for the reaction.

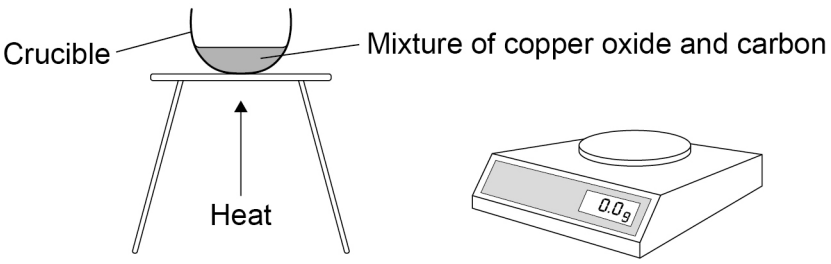
[1 mark]

$$TiCl_4 + 4\,Na \rightarrow Ti + ____\ NaCl$$

Copper is extracted from copper oxide by reacting copper oxide with carbon.

Figure 13 shows the apparatus.

Figure 13



The equation for the reaction is:

$$2\,CuO(s) + C(s) \rightarrow 2\,Cu(s) + CO_2(g)$$

In an experiment 15.9 g of copper oxide and 1.2 g of carbon reacted.

12.7 g of copper was produced in the reaction.

0 5 . 6 Calculate the mass of carbon dioxide produced in this experiment.

[1 mark]

Mass of carbon dioxide = _____ g

0 5 . 7 Explain why the mass of the contents in the crucible changed during the experiment.

[2 marks]

5.1.2.4 Group 0

Question 04 · continued

0 5 . 8 What happens to copper oxide in the reaction?

Give **one** reason for your answer.

Use the equation for the reaction.

[2 marks]

Tick (✓) **one** box.

The copper oxide is dissolved ☐

The copper oxide is oxidised ☐

The copper oxide is reduced ☐

Reason _____

_____

10

Turn over for the next question

5.1.2.4 Group 0

Question 05

0 2 The Earth's atmosphere is always changing.

0 2 . 1 Gases in the Earth's early atmosphere caused changes on the Earth.

Draw **one** line from each change to the gas that caused the change.

[2 marks]

Change	Gas that caused the change
Oceans formed	Ammonia
Sedimentary rocks formed	Carbon dioxide
	Nitrogen
	Oxygen
	Water vapour

5.1.2.4 Group 0

Table 1 shows the percentage of some gases in the atmospheres of Earth and Mars today.

Table 1

Gas	Percentage of gas in atmosphere (%)	
	Earth	Mars
Argon	0.90	1.9
Carbon dioxide	0.04	95
Nitrogen	78	2.6
Oxygen	21	0.20

0 2 . 2 Which gas has the highest percentage in the Earth's atmosphere?

[1 mark]

0 2 . 3 Calculate how many times more carbon dioxide there is in the atmosphere of Mars than in the atmosphere of Earth.

Use **Table 1**.

Give your answer in standard form.

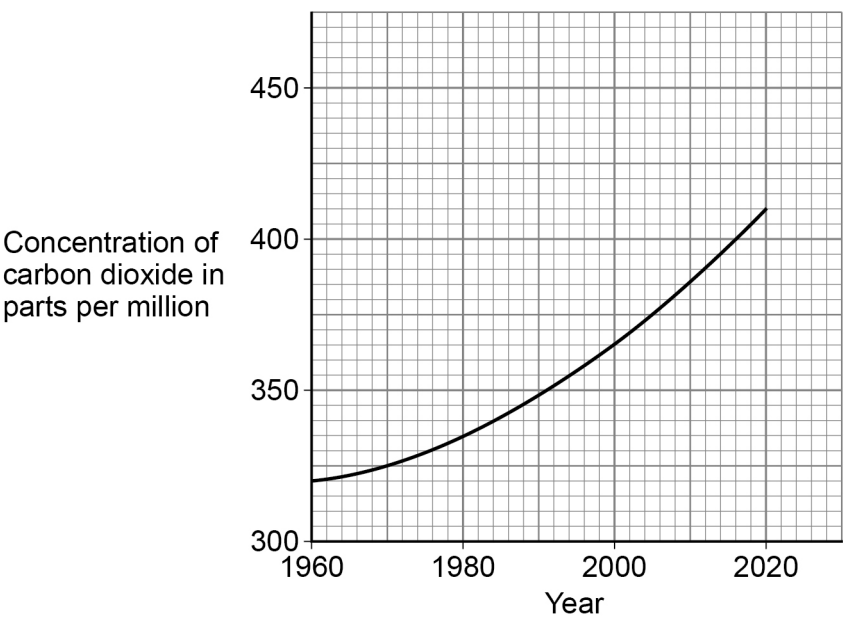
[3 marks]

Number of times more carbon dioxide (in standard form) = _____

Carbon dioxide is a greenhouse gas.

0 2 . 4 **Figure 1** shows the concentration of carbon dioxide in the Earth's atmosphere from 1960 to 2020.

Figure 1



How has the concentration of carbon dioxide in the Earth's atmosphere changed from 1960 to 2020?

[1 mark]

Tick (✓) **one** box.

Decreased ☐

Stayed the same ☐

Increased ☐

5.1.2.4 Group 0

Question 05 · continued

0 2 . 5 Cars emit carbon dioxide.

A car emits 17.2 kg of carbon dioxide on a journey.

There are four people in the car.

Calculate the mass of carbon dioxide emitted per person.

[2 marks]

Mass of carbon dioxide = _____ kg

0 2 . 6 Planting trees helps to reduce climate change, because trees use carbon dioxide from the Earth's atmosphere.

Name the process in trees which uses carbon dioxide.

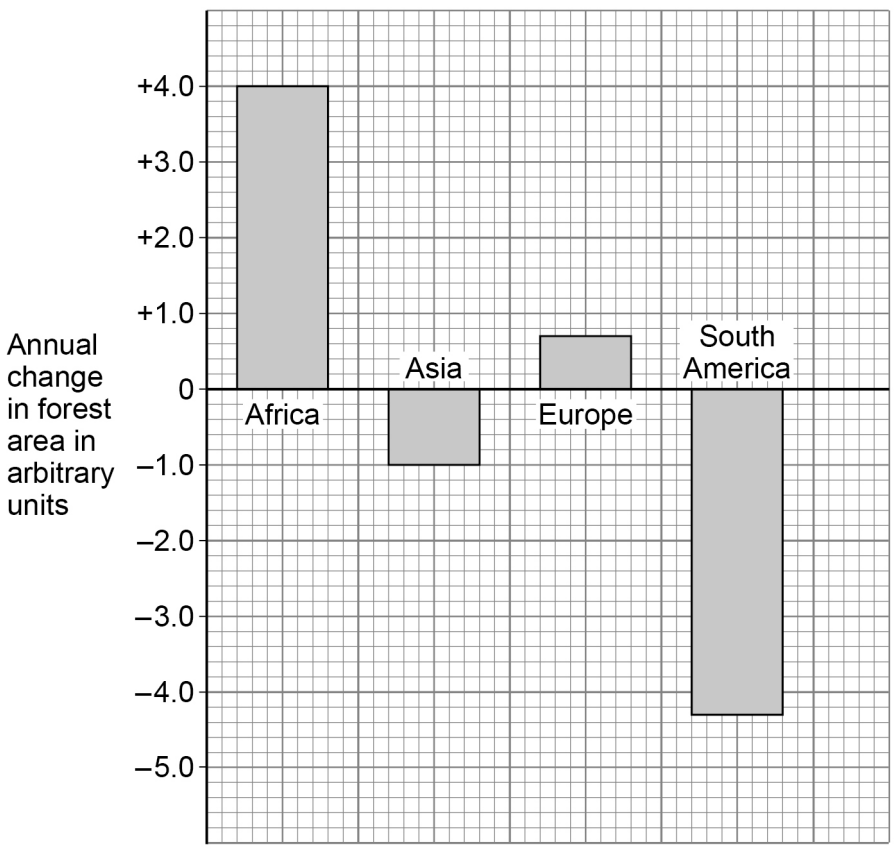
[1 mark]

Question 2 continues on the next page

5.1.2.4 Group 0

0 2 . 7 **Figure 2** shows the annual change in forest area in four different parts of the world.

Figure 2



Give **two** conclusions about the annual change in forest area.

[2 marks]

1 _____

_____

2 _____

_____

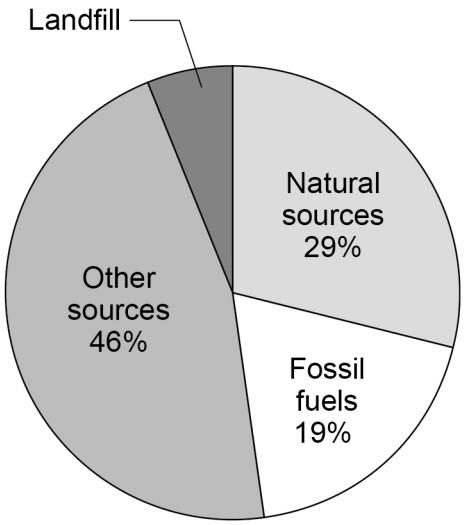
5.1.2.4 Group 0

Question 05 · continued

0 2 . 8 Methane is a greenhouse gas.

Figure 3 shows sources of methane emissions.

Figure 3



Determine the percentage (%) of methane emissions from landfill.

[1 mark]

Percentage = _____ %

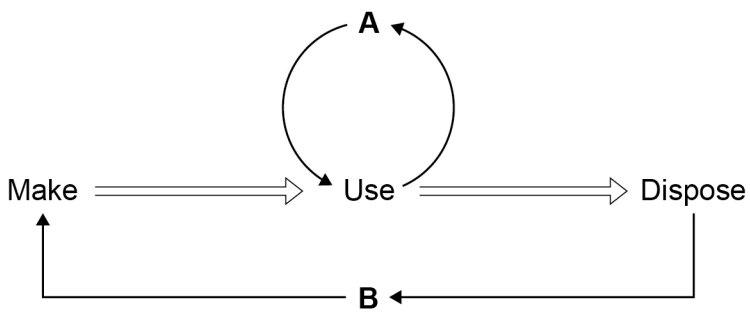
Question 2 continues on the next page

5.1.2.4 Group 0

Question 05 · continued

0 2 . 9 **Figure 4** shows two ways (**A** and **B**) of preventing used items going to landfill.

Figure 4



Name **A** and **B**.

Choose answers from the box.

[2 marks]

recycle	**reduce**	**release**	**reuse**	**reverse**

A _____

B _____

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5.1.2.4 Group 0

Question 06

0 2 Lithium, carbon, nitrogen, fluorine and neon are elements in the same row of the periodic table.

0 2 . 1 What is the chemical symbol of lithium?

Use the periodic table.

[1 mark]

_____

0 2 . 2 Lithium has metallic bonding.

Which electrons are involved in metallic bonding?

[1 mark]

Tick (✓) **one** box.

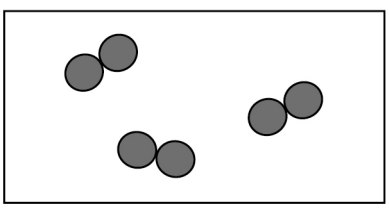
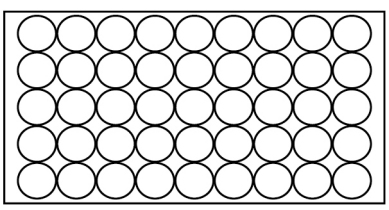
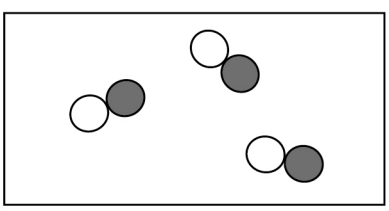
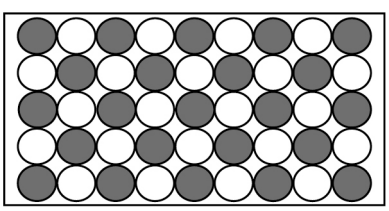
- Delocalised electrons from the inner shell ☐
- Delocalised electrons from the outer shell ☐
- Fixed electrons in the inner shell ☐
- Fixed electrons in the outer shell ☐

Question 2 continues on the next page

0 2 . 3 Lithium reacts with fluorine to produce lithium fluoride.

Draw **one** line from each substance to the particle diagram that represents the substance.

[3 marks]

Substance	Particle diagram
Lithium solid	
Fluorine gas	
Lithium fluoride solid	
	

0 2 . 4 **Table 2** shows the electrical conductivity of three substances.

Table 2

Substance	Electrical conductivity when solid	Electrical conductivity when liquid
C	Poor	Poor
D	Poor	Good
E	Good	Good

Lithium fluoride is an ionic compound.

Which substance is lithium fluoride?

[1 mark]

Tick (✓) **one** box.

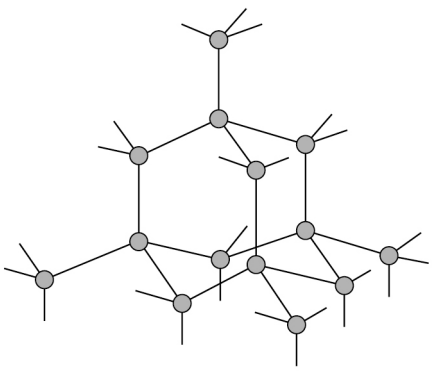
C ☐ **D** ☐ **E** ☐

Question 2 continues on the next page

0 2 . 5 Carbon can exist in different forms.

Figure 4 represents one form of carbon.

Figure 4



What is the name of the form of carbon in **Figure 4**?

[1 mark]

Tick (✓) **one** box.

Buckminsterfullerene ☐

Diamond ☐

Graphite ☐

0 2 . 6 Carbon and fluorine form a compound with the formula CF_4

Calculate the relative formula mass (M_r) of CF_4

Relative atomic masses (A_r): C = 12 F = 19

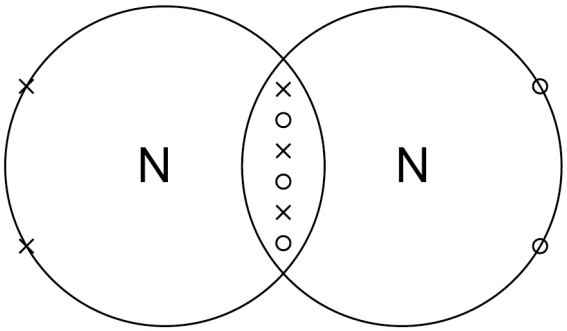
[2 marks]

Relative formula mass (M_r) = _____

5.1.2.4 Group 0

0 2 . 7 **Figure 5** represents a molecule of nitrogen.

Figure 5



What is the total number of shared electrons in the covalent bond shown in **Figure 5**?

[1 mark]

_____

0 2 . 8 Lithium and nitrogen form a compound with the formula Li_3N

Complete the sentence.

Choose the answer from the box.

[1 mark]

nitrate	**nitride**	**nitrogen**

The name of the compound with the formula Li_3N is lithium _____.

Question 2 continues on the next page

5.1.2.4 Group 0

Question 06 · continued

0 2 . 9 Neon does **not** react with other elements to form compounds.

Why is neon unreactive?

[1 mark]

Tick (✓) **one** box.

Neon has a stable arrangement of electrons. ☐

Neon is a gas at room temperature. ☐

Neon is a non-metallic element. ☐

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