

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

GCSE ADDITIONAL SCIENCE CHEMISTRY

F

Foundation Tier Unit Chemistry C2

Wednesday 15 June 2016

Afternoon

Time allowed: 1 hour

Materials

For this paper you must have:

- a ruler
- the Chemistry Data Sheet (enclosed).

You may use a calculator.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 6(d) should be answered in continuous prose.

In this question you will be marked on your ability to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

Advice

- In all calculations, show clearly how you work out your answer.

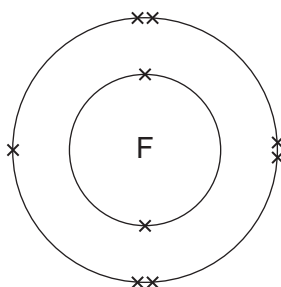


Answer **all** questions in the spaces provided.

1 This question is about fluorine.

1 (a) **Figure 1** shows the arrangement of electrons in a fluorine atom.

Figure 1



1 (a) (i) In which group of the periodic table is fluorine?

[1 mark]

Group _____

1 (a) (ii) Complete **Table 1** to show the particles in an atom and their relative masses.

[2 marks]

Table 1

Name of particle	Relative mass
Proton	
Neutron	1
	Very small

1 (a) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

alkalis

alloys

isotopes

Atoms of fluorine with different numbers of neutrons are called _____ .



1 (b) Sodium reacts with fluorine to produce sodium fluoride.

1 (b) (i) Complete the word equation for this reaction.

[1 mark]

sodium + _____ → _____

1 (b) (ii) Complete the sentence.

[1 mark]

Substances in which atoms of two or more different elements are chemically combined are called _____.

1 (b) (iii) The relative formula mass (M_r) of sodium fluoride is 42.

Use the correct answer from the box to complete the sentence.

[1 mark]

ion

mole

molecule

The relative formula mass (M_r), in grams, of sodium fluoride is one _____ of the substance.

Question 1 continues on the next page

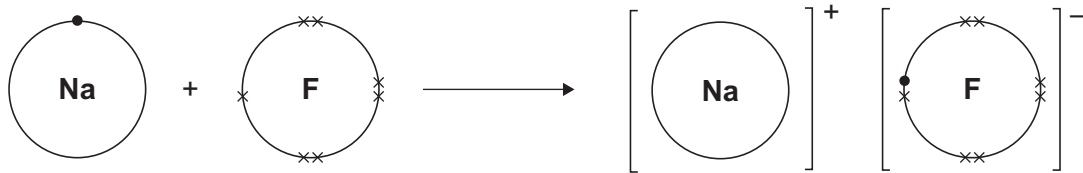
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1 (b) (iv) **Figure 2** shows what happens to the electrons in the outer shells when a sodium atom reacts with a fluorine atom.

The dots (●) and crosses (×) represent electrons.

Figure 2



Use **Figure 2** to help you answer this question.

Describe, as fully as you can, what happens when sodium reacts with fluorine to produce sodium fluoride.

[4 marks]



1 (b) (v) Sodium fluoride is an ionic substance.

What are **two** properties of ionic substances?

[2 marks]

Tick (✓) **two** boxes.

Dissolve in water

Gas at room temperature

High melting point

Low boiling point

13

Turn over for the next question

Turn over ►



2 This question is about substances containing carbon atoms.

2 (a) Diamond is made of carbon atoms.

2 (a) (i) Diamond is used for tips of drills.

Figure 3 shows a drill.

Figure 3



Give **one** reason why diamond is used for tips of drills.

[1 mark]

2 (a) (ii) Diamond nanoparticles can be made.

Use the correct answer from the box to complete the sentence.

[1 mark]

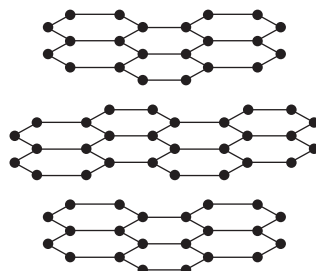
hundred	million	thousand
---------	---------	----------

Nanoparticles contain a few _____ atoms.

2 (b) Graphite is made of carbon atoms.

Figure 4 shows the structure of graphite.

Figure 4



2 (b) (i) What type of bonding does graphite have?

[1 mark]

Tick (✓) **one** box.

Covalent

Ionic

Metallic

2 (b) (ii) How many carbon atoms does each carbon atom bond to in graphite?

[1 mark]

Tick (✓) **one** box.

1

2

3

4

2 (b) (iii) What is a property of graphite?

[1 mark]

Tick (✓) **one** box.

Dissolves in water

Has a low melting point

Soft and slippery

Question 2 continues on the next page

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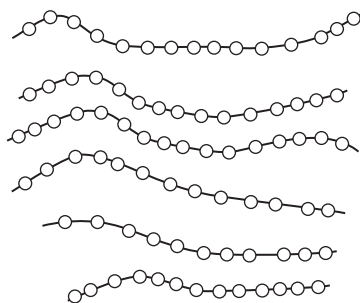


2 (c) Poly(ethene) is made of carbon and hydrogen atoms.

Poly(ethene) is a thermosoftening polymer.

Figure 5 shows the structure of a thermosoftening polymer.

Figure 5



2 (c) (i) Complete the sentence.

[1 mark]

Between the polymer chains in a thermosoftening polymer there are no _____.

2 (c) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

condense

dissolve

melt

Heating would cause a thermosoftening polymer to _____.

2 (c) (iii) Many ethene molecules react together to make poly(ethene).

Different types of poly(ethene) can be made by changing the conditions for the reaction. Suggest **two** conditions that could be changed.

[2 marks]

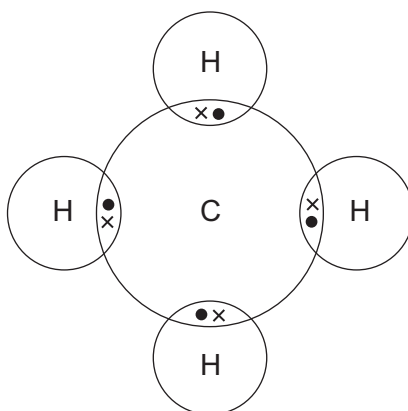
1 _____

2 _____



2 (d) Figure 6 shows how the atoms are bonded in methane.

Figure 6



2 (d) (i) What is the formula for methane?

[1 mark]

Tick (✓) **one** box.

C_4H

CH_4

C_4H_4

2 (d) (ii) Methane has a low boiling point.

What does methane consist of?

[1 mark]

Tick (✓) **one** box.

Charged ions

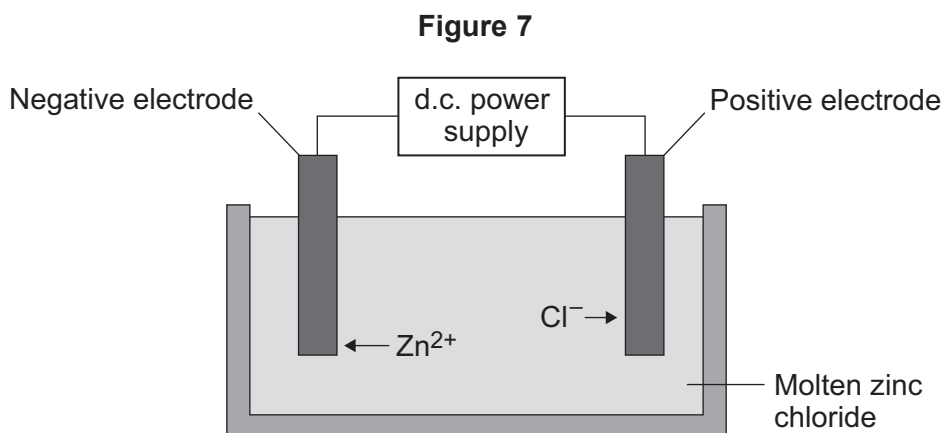
A giant lattice

Small molecules



3 This question is about zinc.

Figure 7 shows the electrolysis of molten zinc chloride.



3 (a) Zinc chloride is an ionic substance.
Complete the sentence.

[1 mark]

When zinc chloride is molten, it will conduct _____.

3 (b) Zinc ions move towards the negative electrode where they gain electrons to produce zinc.

3 (b) (i) Name the product formed at the positive electrode.

[1 mark]

3 (b) (ii) Explain why zinc ions move towards the negative electrode.

[2 marks]



3 (b) (iii) What type of reaction occurs when the zinc ions gain electrons?

[1 mark]

Tick (✓) **one** box.

Neutralisation

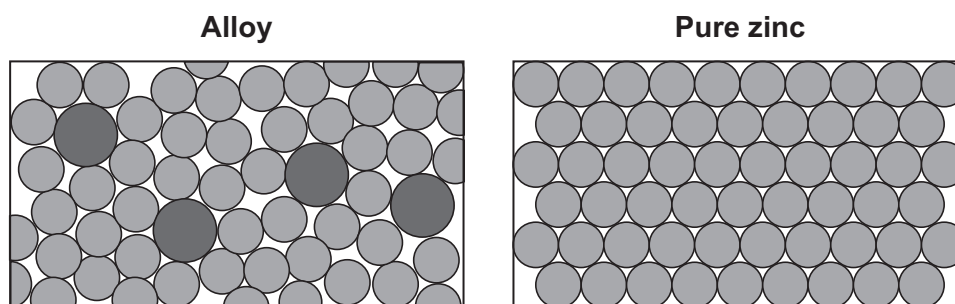
Oxidation

Reduction

3 (c) Zinc is mixed with copper to make an alloy.

3 (c) (i) **Figure 8** shows the particles in the alloy and in pure zinc.

Figure 8



Use **Figure 8** to explain why the alloy is harder than pure zinc.

[2 marks]

3 (c) (ii) Alloys can be bent. Some alloys return to their original shape when heated.

What name is used for these alloys?

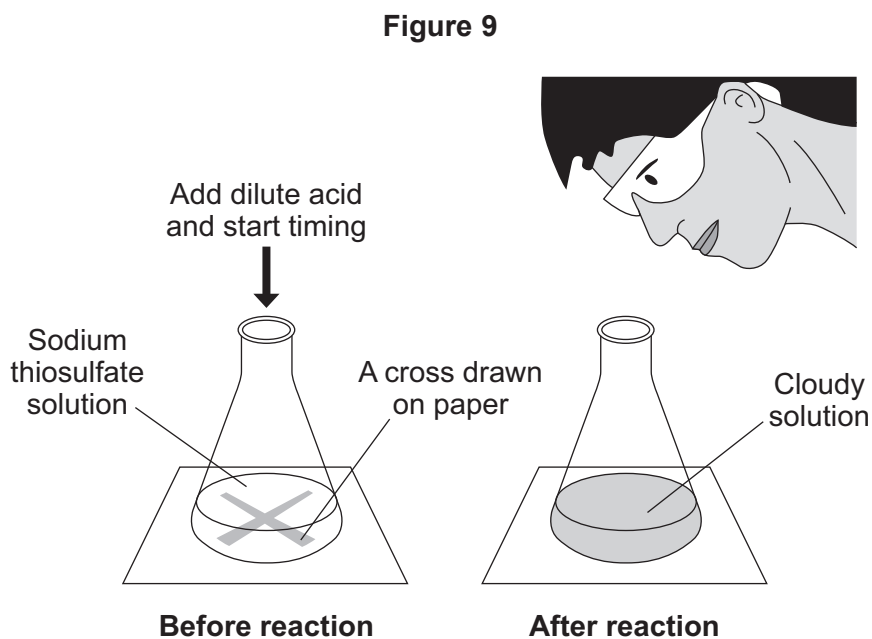
[1 mark]

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4 A student investigated the effect of temperature on the rate of a reaction.

Figure 9 shows an experiment.

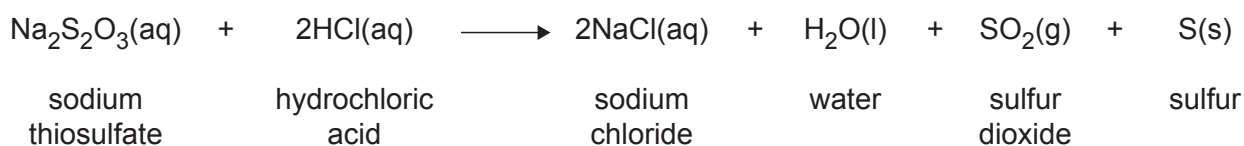


The student:

- put 50 cm³ sodium thiosulfate solution into a conical flask
- heated the sodium thiosulfate solution to the required temperature
- put the flask on a cross drawn on a piece of paper
- added 5 cm³ dilute hydrochloric acid and started a stopclock
- stopped the stopclock when the cross could no longer be seen
- repeated the experiment at different temperatures.



The equation for the reaction is:

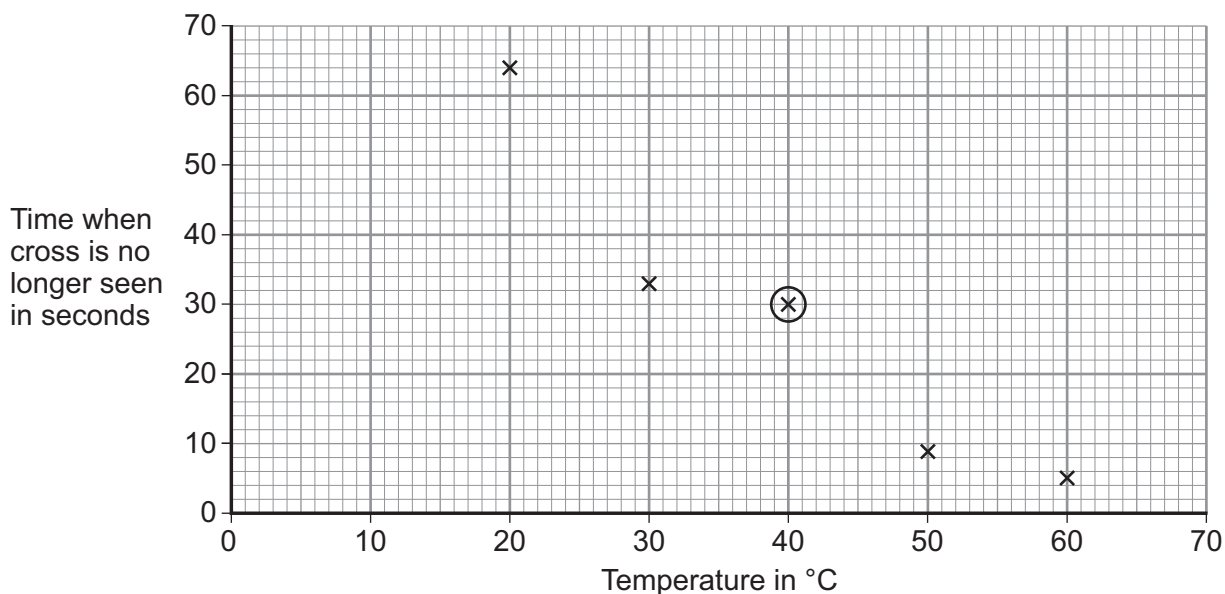


4 (a) Which product is a gas?

[1 mark]

4 (b) **Figure 10** shows the results of this experiment at five different temperatures. The circled result point is anomalous.

Figure 10



4 (b) (i) Draw a line of best fit on **Figure 10** to show how the reaction time varied with reaction temperature.

[1 mark]

4 (b) (ii) Give a possible reason for the anomalous result at 40 °C.

[1 mark]

Question 4 continues on the next page

Turn over ►



4 (b) (iii) The reaction at 20 °C produced 0.32 g of sulfur in 64 seconds.

Calculate the rate of the reaction at 20 °C using the equation:

$$\text{Rate of reaction} = \frac{\text{mass of sulfur}}{\text{time}}$$

[2 marks]

Rate of reaction = _____ grams per second

4 (b) (iv) Give **two** reasons why the rate of the reaction increases as the temperature increases.

[2 marks]

Tick (✓) **two** boxes.

The particles move faster.

The particles collide less often.

All the particles have the same energy.

The particles collide with more energy.

The number of particles increases.

4 (b) (v) Use the correct answer from the box to complete the sentence.

[1 mark]

activation

collision

exothermic

The minimum amount of energy particles must have to react is called
the _____ energy.

8



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ANSWER IN THE SPACES PROVIDED**

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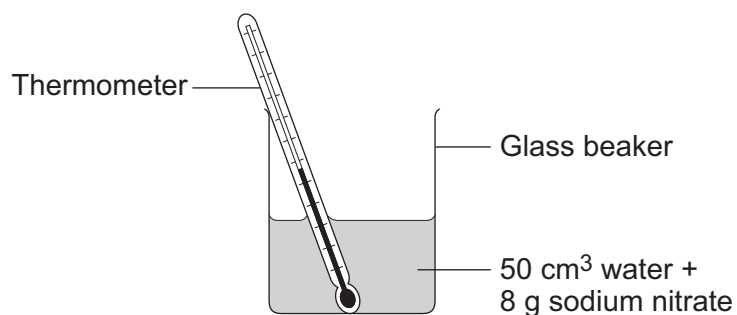


5 This question is about temperature changes.

5 (a) A student investigated the temperature change when 8 g of sodium nitrate dissolves in 50 cm³ of water.

Figure 11 shows the apparatus the student used.

Figure 11



The student did the experiment five times.

Table 2 shows the results.

Table 2

Experiment	Decrease in temperature of water in °C
1	5.9
2	5.7
3	7.2
4	5.6
5	5.8



- 5 (a) (i)** Calculate the mean decrease in temperature.
Do not use the anomalous result in your calculation.

[2 marks]

Mean decrease in temperature = _____ °C

- 5 (a) (ii)** Suggest **one** change in the apparatus in **Figure 11** which would improve the accuracy of the results.
Give a reason for your answer.

[2 marks]

Question 5 continues on the next page

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- 5 (b)** The student investigated the temperature change when different masses of sodium carbonate were added to 50 cm³ of water at 20 °C.

Table 3 shows the results.

Table 3

Mass of sodium carbonate in g	Final temperature of solution in °C
2.0	21.5
4.0	23.0
6.0	24.5
8.0	26.0
10.0	26.6
12.0	26.6
14.0	26.6

Describe the relationship between the mass of sodium carbonate added and the final temperature of the solution.

Use values from **Table 3** in your answer.

[3 marks]

7



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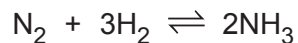
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6 This question is about ammonia and fertilisers.

6 (a) Ammonia is produced by a reversible reaction.

The equation for the reaction is:



Complete the sentence.

[1 mark]

The forward reaction is exothermic, so the reverse reaction is _____ .

6 (b) Calculate the percentage by mass of nitrogen in ammonia (NH_3).

Relative atomic masses (A_r): H = 1; N = 14

You **must** show how you work out your answer.

[3 marks]

Percentage by mass of nitrogen = _____ %



6 (c) A neutral solution can be produced when ammonia reacts with an acid.

6 (c) (i) Give the pH of a neutral solution.

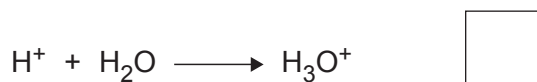
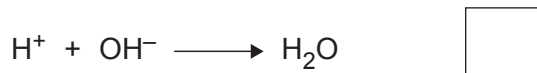
[1 mark]

pH _____

6 (c) (ii) Which of these ionic equations shows a neutralisation reaction?

[1 mark]

Tick (✓) **one** box.



6 (c) (iii) Name the salt produced when ammonia reacts with hydrochloric acid.

[1 mark]

Question 6 continues on the next page

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- 6 (d) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

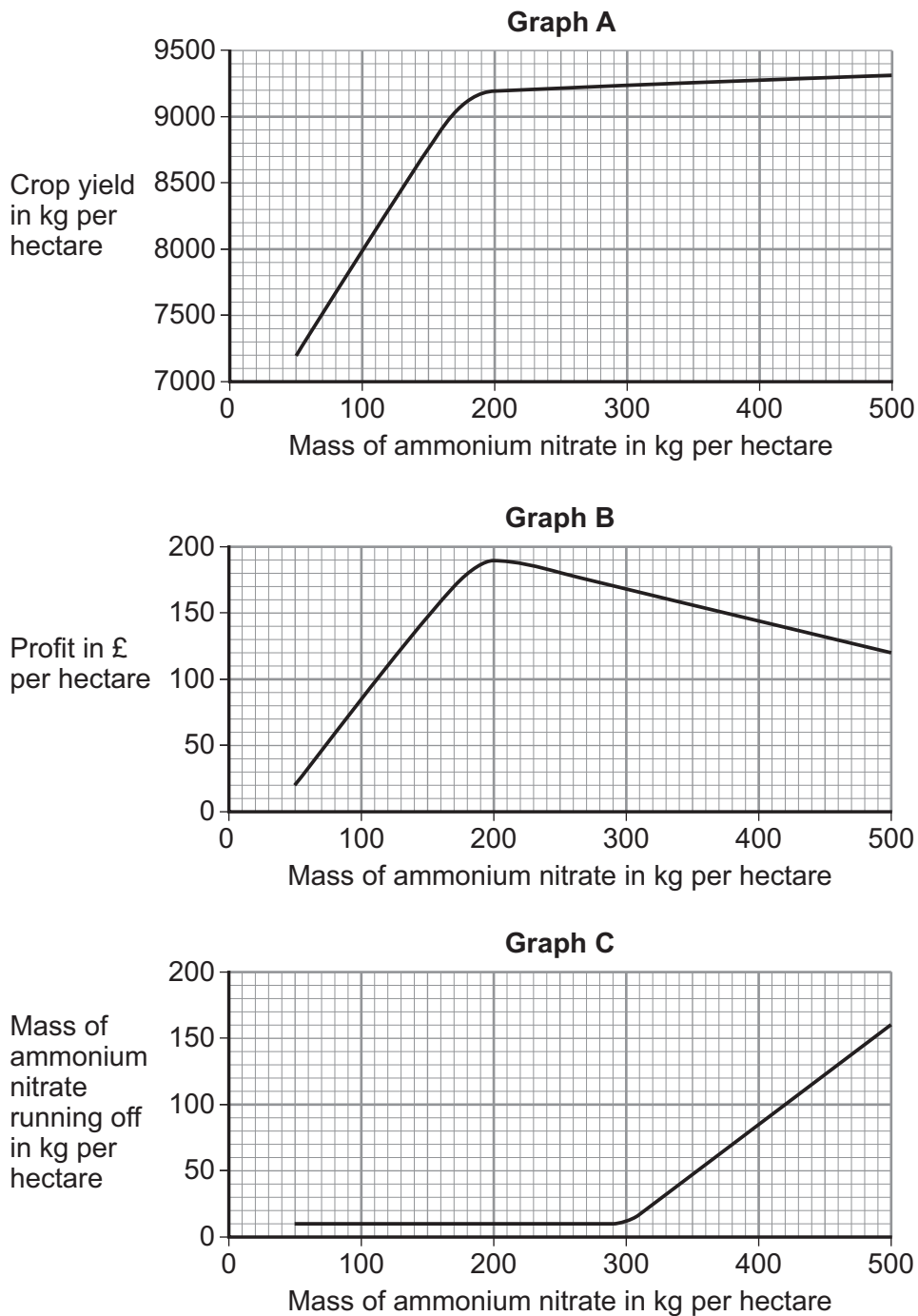
Farmers use ammonium nitrate as a fertiliser for crops.

Rainwater dissolves ammonium nitrate in the soil.

Some of the dissolved ammonium nitrate runs off into rivers and lakes.

Figure 12 shows three graphs **A**, **B** and **C**. The graphs show information about the use of ammonium nitrate as a fertiliser. A hectare is a measurement of an area of land.

Figure 12



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