AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

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.

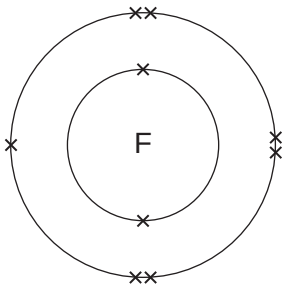
Do not write outside the box

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 _____ .

Do not write outside the box

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.

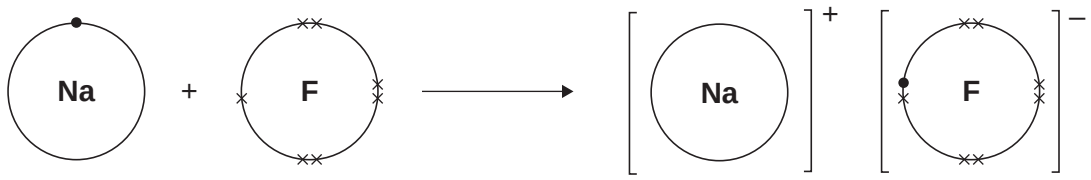
Question 1 continues on the next page

Do not write outside the box

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]

Do not write outside the box

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

Do not write outside the box

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]

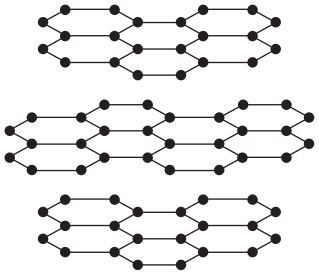
hundred	**million**	**thousand**

Nanoparticles contain a few _____ atoms.

2 (b) Graphite is made of carbon atoms.

Figure 4 shows the structure of graphite.

Figure 4



Do not write outside the box

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

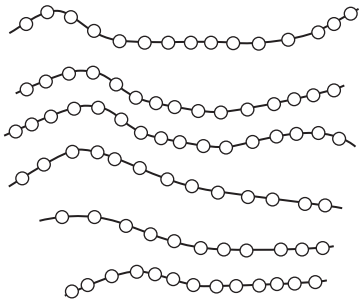
Do not write outside the box

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]

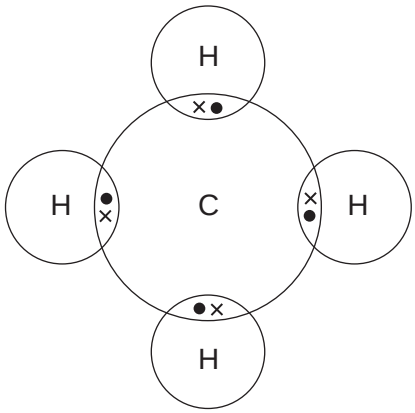
1 _____

2 _____

Do not write outside the box

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 ☐

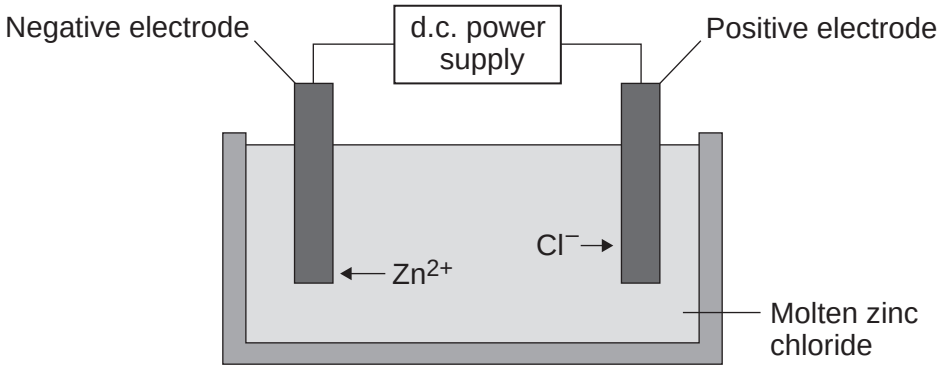
11

Do not write outside the box

3 This question is about zinc.

Figure 7 shows the electrolysis of molten zinc chloride.

Figure 7



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]

_____

_____

_____

_____

Do not write outside the box

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

[1 mark]

Tick (✓) **one** box.

Neutralisation ☐

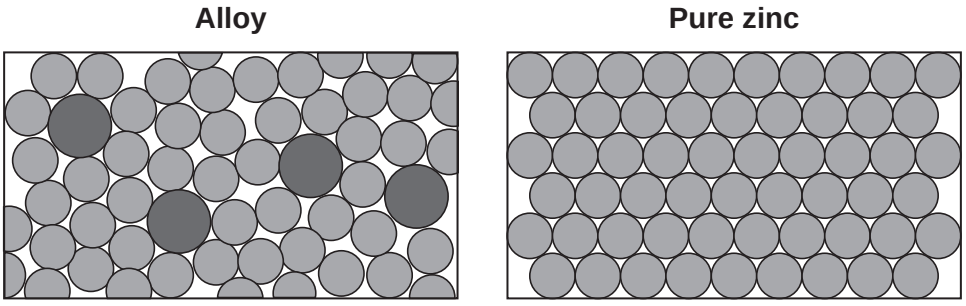
Oxidation ☐

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]

_____

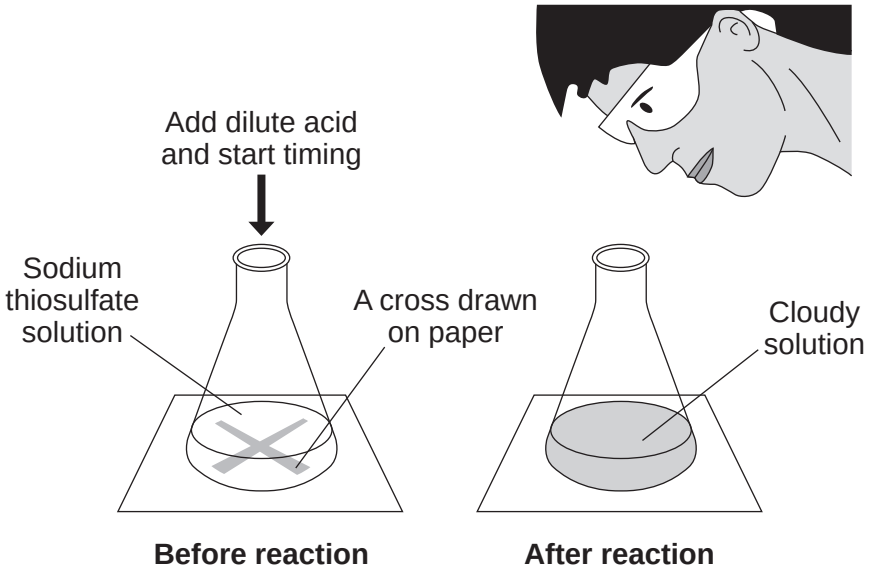
8

Turn over ▶

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

Figure 9 shows an experiment.

Figure 9



The student:

- put 50 cm^3 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 cm^3 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:

$$Na_2S_2O_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + H_2O(l) + SO_2(g) + S(s)$$

sodium thiosulfate	hydrochloric acid		sodium chloride	water	sulfur dioxide		sulfur

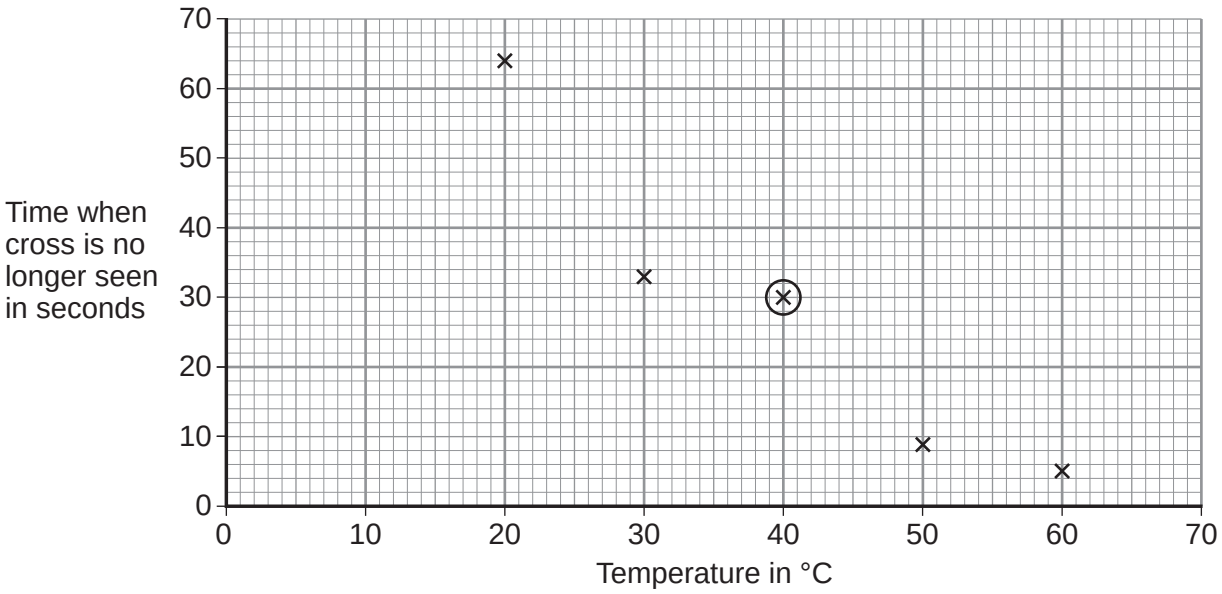
4 (a) Which product is a gas?

[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

Do not write outside the box

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

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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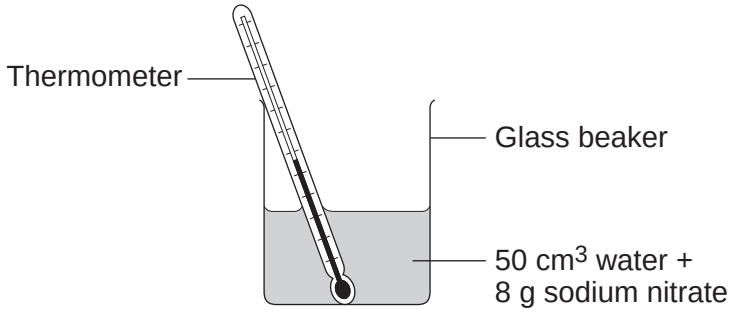
5 This question is about temperature changes.

5 (a) A student investigated the temperature change when 8 g of sodium nitrate dissolves in 50 cm^3 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

Do not write outside the box

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

Do not write outside the box

5 (b) The student investigated the temperature change when different masses of sodium carbonate were added to 50 cm^3 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

Turn over for the next question

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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:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

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 = _____%

Do not write outside the box

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.

$H^+ + OH^- \longrightarrow H_2O$ ☐

$NH_4^+ + OH^- \longrightarrow NH_4OH$ ☐

$H^+ + Cl^- \longrightarrow HCl$ ☐

$H^+ + H_2O \longrightarrow H_3O^+$ ☐

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

[1 mark]

_____

Question 6 continues on the next page

Do not write outside the box

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.

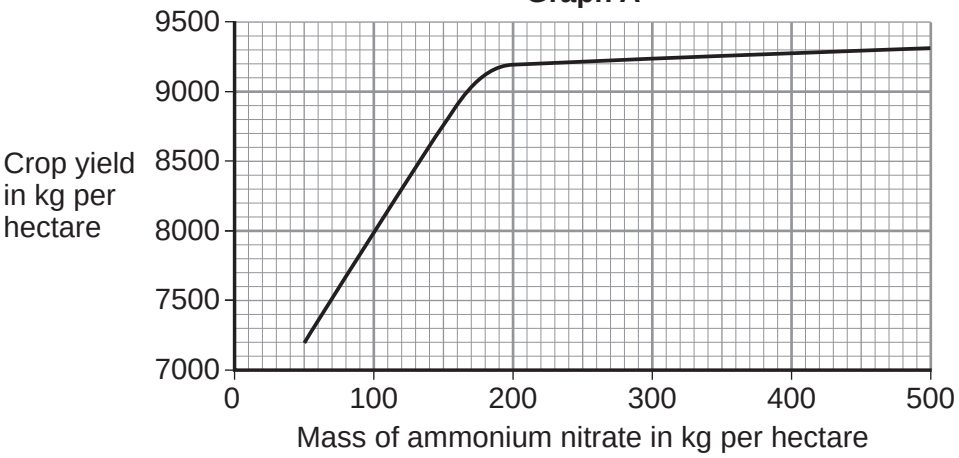
Rainwater dissolves ammonium nitrate in the soil.

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

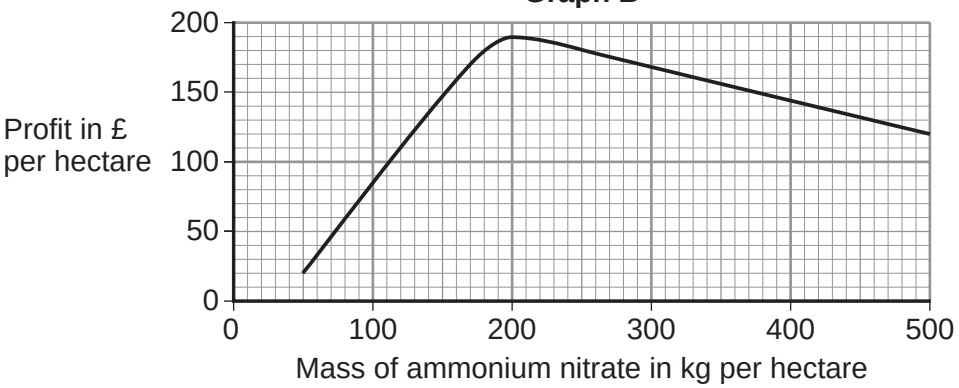
Figure 12 shows three graphs **A**, **B** and **C**. The graphs show information about the use of ammonium nitrate as a fertiliser. A hectare is a measurement of an area of land.

Figure 12

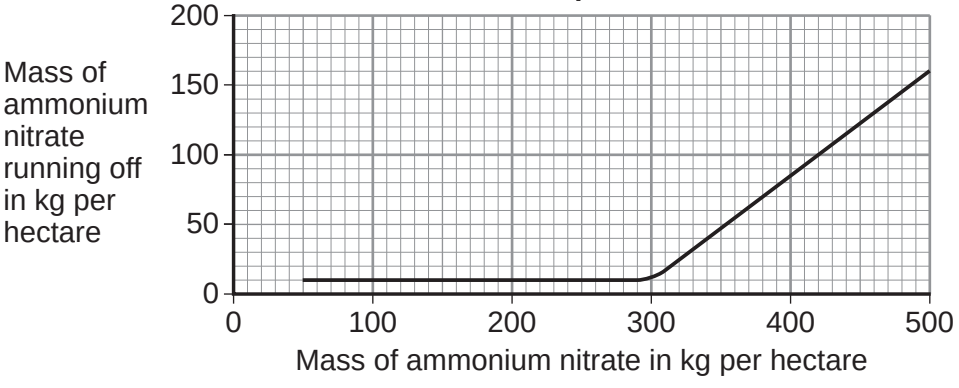
Graph A



Graph B



Graph C



Do not write outside the box

Suggest how much ammonium nitrate farmers should use per hectare.
Give reasons for your answer.
Use information from graphs **A**, **B** and **C**.

[6 marks]

Extra space

13

END OF QUESTIONS

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