

GCSE Chemistry (9 – 1)

NPK Fertilisers

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/4
2	/9
3	/4
4	/8
Total	/25
%	
Grade	

Information

- The maximum mark for this paper is 25 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. NPK fertilisers are formulations containing compounds of nitrogen (N), phosphorus (P), and potassium (K), which are the three essential elements for plant growth."

Circle the letter of the correct answer for each of the following questions.

- a) A farmer adds calcium hydroxide to a field to neutralise acidic soil. He then immediately adds an ammonium based fertiliser. The two chemicals react, and a strong smell is noticed.

Why does this reaction reduce the effectiveness of the fertiliser?

- A** The nitrogen is lost into the air as ammonia gas.
- B** The nitrogen is locked away as insoluble nitrogen gas.
- C** The reaction neutralises the fertiliser, turning it into water.
- D** The reaction produces heat which kills the bacteria in the soil.

(1 mark)

- b) Which substance contains **two** elements that are found in NPK fertilisers?

- | A | B | C | D |
|-------------------|-------------------|-------------------|------------------|
| Ammonium chloride | Calcium hydroxide | Potassium nitrate | Sodium phosphate |

(1 mark)

- c) Plants require several essential elements to grow healthily.

Which of the following elements is not a primary component of a standard NPK fertiliser?

- | A | B | C | D |
|----------|------------|-----------|-----------|
| Nitrogen | Phosphorus | Magnesium | Potassium |

(1 mark)

- d) A specific crop requires a fertiliser that is high in Potassium but low in Nitrogen.

The table below shows the NPK values for four different fertiliser bags.

Which fertiliser is most suitable for this crop?

Fertiliser	Percentage of N	Percentage of P	Percentage of K
A	20	10	10
B	5	10	25
C	15	15	15
D	30	5	5

(1 mark)

(Total for Question 1 is 4 marks)

2. Ammonium sulfate, $(\text{NH}_4)_2\text{SO}_4$, is a salt used as a fertiliser to improve crop yields.
It is made by reacting ammonia solution with sulfuric acid.

a) State the names of the three elements found in most fertilisers.

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(3 marks)

b) Suggest why farmers use fertilisers on their fields.

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(1 mark)

c) Write a **balanced** symbol equation for the reaction between ammonia and sulfuric acid to produce ammonium sulfate.

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(2 marks)

d) Calculate the percentage by mass (%) of Nitrogen in ammonium sulfate, $(\text{NH}_4)_2\text{SO}_4$.
Relative atomic masses (A_r): H = 1, N = 14, O = 16, S = 32.

Percentage of nitrogen = ...

(3 marks)

(Total for Question 2 is 9 marks)

3. A farmer tests the soil in a field.

The results show:

- Low levels of nitrogen and potassium.
- High levels of phosphorus.

The farmer looks at information about three fertilisers available to buy.

Fertiliser	Formula	Name	Percentage of N, P & K	Cost per Kg
A	KCl	Potassium chloride	K: 52%	£0.24
B	NH ₄ NO ₃	Ammonium nitrate	N: 35%	£0.23
C	(NH ₄) ₂ HPO ₄	Ammonium hydrogen phosphate	N: 21% P: 23%	£0.35

Evaluate which compounds the farmer should use on this field.

In your answer you should:

- State which compounds should be mixed together.
- Explain why compound C should not be used (refer to both the soil needs and the cost).

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(4 marks)

(Total for Question 3 is 4 marks)

4. Potassium chloride and potassium sulfate are used as fertilisers.

a) State the source of these **two** compounds.

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(1 mark)

b) Phosphate rock is obtained from mining.

Explain why phosphate rock cannot be used directly as a fertiliser.

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(2 marks)

c) To make phosphate rock useful, it is treated with acid to produce soluble salts.

Complete the table below by naming the salts produced when phosphate rock reacts with different acids.

Acid added to phosphate rock	Salt(s) produced
Nitric acid	Calcium nitrate an.....
Sulfuric acid	Calcium sulfate and
Phosphoric acid	

(3 marks)

d) Fertilisers like ammonium sulfate can be made in a school laboratory or in a large industrial factory.

Give **two** differences between the laboratory method and the industrial method of production.

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(2 marks)

(Total for Question 4 is 8 marks)