All questions are for separate science students only

Q1.

This question is about materials used to make bicycles.

The figure below shows a bicycle.

The table below shows information about two materials used to make bicycle frames.

	Material	
	Aluminium alloy	**Bamboo**
Raw material	aluminium ore	bamboo plant
Cost of frame in £	250	1500
Strength in arbitrary units	290	193
Mass in kilograms	1.6	2.4
Lifespan in years	6–10	10–15
One method of disposal at end of life	recycled to make new products	burned to produce heat energy

(a) Evaluate the use of aluminium alloy and of bamboo for making bicycle frames.

Use the table above. **(chemistry only)**

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(6)

(b) Explain why aluminium alloy bicycle frames do **not** need protection from corrosion. **(chemistry only)**

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(2)

(c) Bicycle chains are made from an alloy of iron.

Bicycle chains rust without protection.

Paint is **not** used to protect bicycle chains from rusting.

Suggest how bicycle chains can be protected from rusting. **(chemistry only)**

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(1)

(d) Bicycle frames can also be made from a composite of carbon fibres embedded in a polymer resin.

What description is given in this composite to:

- the carbon fibre component
- the polymer resin component? **(chemistry only)**

Carbon fibre _____

Polymer resin _____

(2)

(Total 11 marks)

Q2.

This question is about fertilisers.

Compounds of nitrogen (N), phosphorus (P) and potassium (K) are used as fertilisers to improve agricultural productivity.

The table below shows information about three compounds, **A**, **B** and **C**, that can be used as fertilisers.

	Compound A	**Compound B**	**Compound C**
Name	potassium chloride	ammonium nitrate	diammonium hydrogen phosphate
Formula	KCl	NH_4NO_3	$(NH_4)_2HPO_4$
Percentage (%) of N, P and K by mass	**K**: 52%	**N**: 35%	**N**: 21% **P**: 23%
Cost in £/kg	0.24	0.23	0.35

(a) A scientist analysed the percentages of nitrogen, phosphorus and potassium in a soil.

The percentages of nitrogen and of potassium in the soil were lower than the percentages needed for high agricultural productivity.

There was sufficient phosphorus in the soil for high agricultural productivity.

Evaluate the use of the compounds in the table above to improve the agricultural productivity of this soil. **(chemistry only)**

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(4)

(b) How is potassium chloride (compound **A**) obtained from the Earth? **(chemistry only)**

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(1)

(c) Name **one** other compound that could be used instead of potassium chloride (compound **A**) to give a similar improvement in agricultural productivity. **(chemistry only)**

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(1)

(d) Nitric acid is needed to produce ammonium nitrate (compound **B**).

Name a compound needed to produce nitric acid. **(chemistry only)**

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(1)

(e) Phosphate rock contains phosphorus compounds.

Plants absorb phosphorus from compounds dissolved in rainwater.

Suggest why phosphate rock **cannot** be used directly as a fertiliser. **(chemistry only)**

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(1)

(f) Phosphate rock can be treated with different acids to produce salts useful as fertilisers.

Name the salts which are produced by treating phosphate rock with:

- sulfuric acid
- phosphoric acid. **(chemistry only)**

Sulfuric acid _____

Phosphoric acid _____

(2)

(Total 10 marks)