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)**

_____

_____

_____

_____

_____

(6)

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

(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)**

(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)

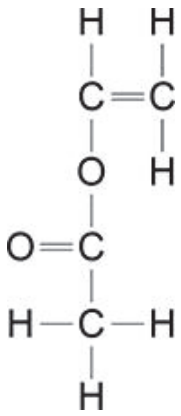
Q2.

This question is about monomers and polymers.

Compound **A** has an alkene functional group and an ester functional group.

Figure 1 represents a molecule of compound **A**.

Figure 1



(a) Draw a circle around the alkene functional group on **Figure 1**.

(1)

(b) Describe what will be seen when compound **A** is shaken with bromine water.

_____

_____

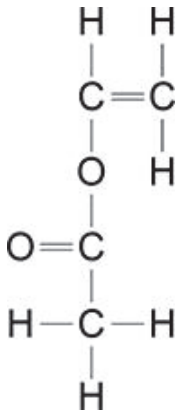
_____

_____

(2)

(c) **Figure 2** is a repeat of **Figure 1**.

Figure 2



Draw a circle around the ester functional group on **Figure 2**. **(chemistry only)**

(1)

(d) Compound **A** has the formula $C_4H_6O_2$

Compound **A** is flammable.

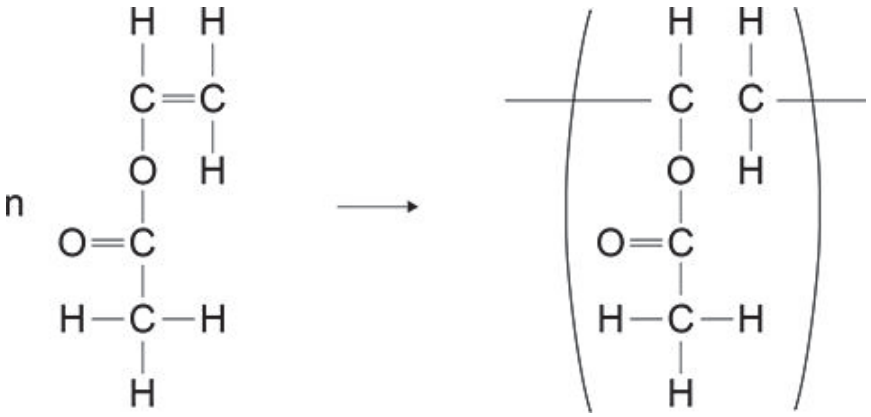
Write a balanced equation for the complete combustion of compound **A**. **(chemistry only)**

_____ + _____ → _____ + _____

(3)

(e) Many molecules of compound **A** join together to form polymer **B**.

Complete the displayed formula equation which represents this reaction. **(chemistry only)**



(2)

(f) What type of polymer is polymer **B**? **(chemistry only)**

Tick (✓) **one** box.

Addition polymer	☐
Condensation polymer	☐
DNA	☐
Protein	☐

(1)

Polymer **B** is a polymer which melts when heated.

(g) What word is used to describe polymers which melt when heated? **(chemistry only)**

_____

(1)

(h) Explain why some polymers do **not** melt when heated. **(chemistry only)**

_____

_____

_____

_____

(2)

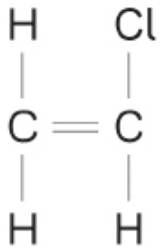
(Total 13 marks)

Q3.

This question is about polymers.

Chloroethene can be used to produce an addition polymer called poly(chloroethene).

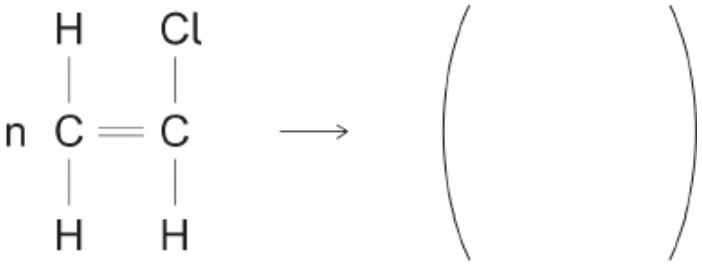
The displayed structural formula of chloroethene is



(a) Draw a circle around the functional group on the displayed structural formula that allows chloroethene to produce an addition polymer. **(chemistry only)**

(1)

(b) Complete the equation for the production of poly(chloroethene) from chloroethene. **(chemistry only)**



(3)

(c) Poly(ethene) can be strengthened with wood particles to make a building material.

The building material consists of a wood particle reinforcement embedded in a poly(ethene) matrix.

What general name is given to materials like this? **(chemistry only)**

_____

(1)

(d) The amino acid beta-alanine has the formula

$$H_2NCH_2CH_2COOH$$

Beta-alanine polymerises to produce a polypeptide and a small molecule.

Name the small molecule produced when beta-alanine polymerises. **(chemistry only) (HT only)**

_____

(1)

(e) An amino acid can be represented as:

The relative formula mass (M_r) of this amino acid is 75

Calculate the relative formula mass of the section of this amino acid molecule represented by

Relative atomic masses (A_r): H = 1 C = 12 N = 14 O = 16

(chemistry only) (HT only)

_____

_____

_____

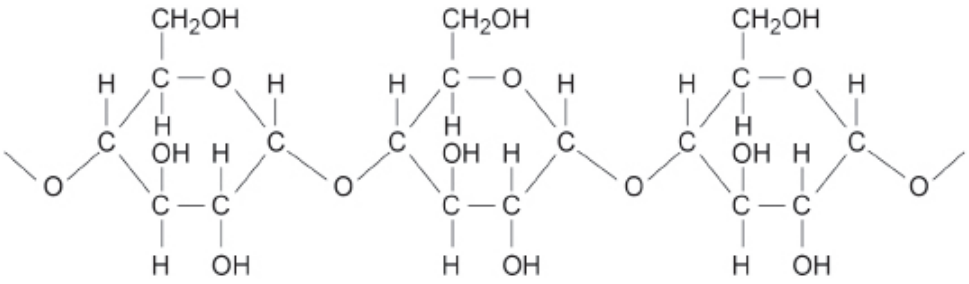
_____

Relative formula mass = _____

(2)

Figure 1 represents part of a naturally occurring polymer molecule produced from glucose.

Figure 1



(f) Draw a circle around the repeating unit in the polymer in **Figure 1**. **(chemistry only)**

(1)

(g) Suggest the identity of this polymer. **(chemistry only)**

_____

(1)

Figure 2 represents the structure of a naturally occurring polymer.

Figure 2

(h) Give the general name for the four different monomers which make up the structure shown in **Figure 2**. **(chemistry only)**

_____

(1)

(i) Name the **shape** of the structure shown in **Figure 2**. **(chemistry only)**

_____

(1)

(Total 12 marks)