1 (a) A student carried out an experiment to prove that candle wax, a hydrocarbon, produces carbon dioxide and water vapour when it burns.

The equipment used is shown in Figure 11.

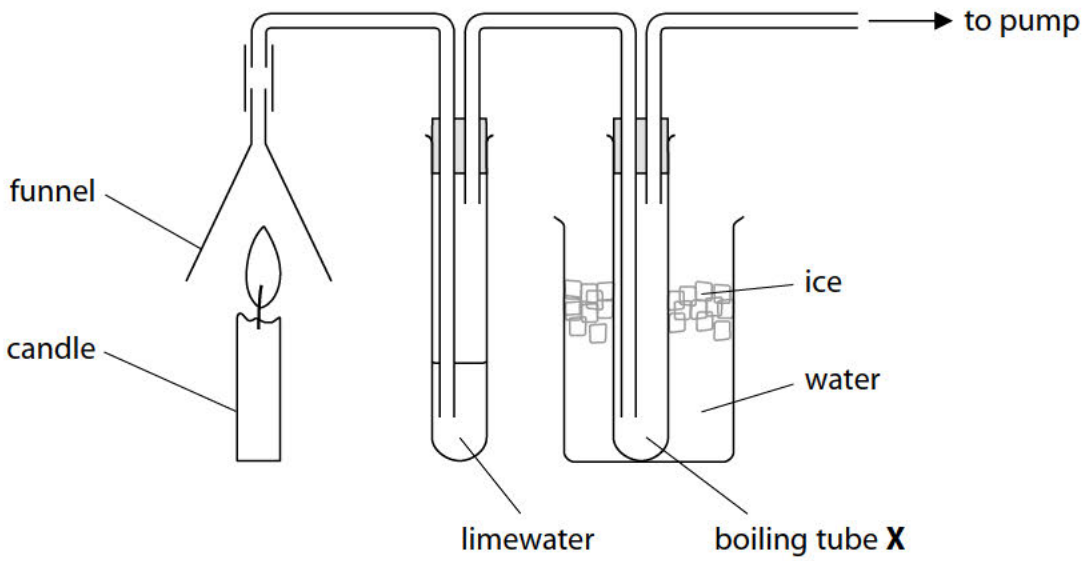


Figure 11

The gas produced from the burning candle is drawn through the apparatus.
The limewater turned milky showing that carbon dioxide had been formed.

A small amount of a colourless liquid condensed in boiling tube **X**.
The student claimed that this proved that burning candle wax produced water.
The teacher said the apparatus had been set up incorrectly and therefore this conclusion about water was not valid.

Explain how the student could modify the equipment to prove that water is produced by burning candle wax.

(2)

.....

.....

.....

.....

*(b) Polymers are addition or condensation polymers.

Polymers can be formed by using the monomers shown in Figure 12.

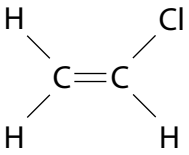
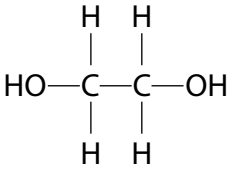
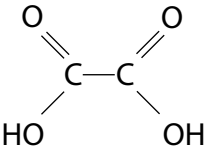
monomer	structure
chloroethene	
ethane-1,2-diol	
ethanedioic acid	

Figure 12

Explain, using appropriate monomers from Figure 12, how different polymers can be formed.

(6)

(c) An alcohol **A**, with molecular formula C_2H_5OH is oxidised to a compound **B** with molecular formula $C_2H_4O_2$.

(i) Compound **B** is not an alcohol and is a member of another homologous series.

State the name of this homologous series.

(1)

.....

(ii) Draw the structure of a molecule of compound **A** and a molecule of compound **B**, showing all covalent bonds.

(2)

Compound **A**

Compound **B**

(Total for Question 1 = 11 marks)

2 Polymers can be made from alkenes.

(a) Which of the following statements about alkenes is correct?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** alkenes turn bromine water orange

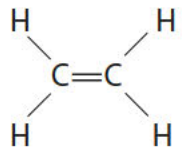
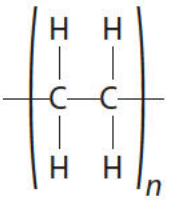
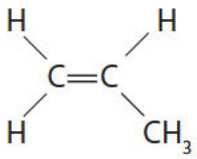
☐ **B** alkenes have a double bond between two hydrogen atoms

☐ **C** alkenes are unsaturated hydrocarbons

☐ **D** alkenes can undergo complete combustion to produce carbon monoxide

(b) The table shows two monomers and the polymers they form.

Complete the table.

monomer structure	name of polymer formed	polymer structure
		
	poly(propene)	

(2)

(c) A number of methods are used to dispose of waste polymers.

Explain a problem caused by the disposal of polymers.

(2)

*(d) Most of the energy we require comes from burning fossil fuels.
The supply of fossil fuels is limited and therefore other fuels are needed.

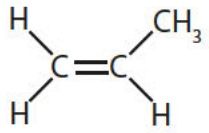
Various fuels are being tested.

Explain the properties required of a good fuel.

(6)

(Total for Question 2 = 11 marks)

3 The structure of a molecule of propene is



(a) Propene is an unsaturated hydrocarbon.

(i) Explain what is meant by **unsaturated hydrocarbon**.

(3)

.....

.....

.....

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Propene can be made by using heat to decompose large alkane molecules into smaller, more useful molecules.

This process is known as

(1)

☒ **A** combustion

☒ **B** cracking

☒ **C** fractional distillation

☒ **D** polymerisation

(iii) Describe what is seen when a sample of propene is shaken with bromine water.

(2)

.....

.....

.....

.....

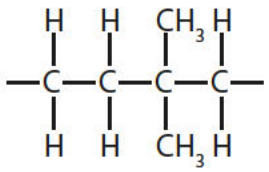
(b) Molecules of propene can be combined to form a molecule of poly(propene).

(i) Which of these shows part of the structure of a molecule of poly(propene)?

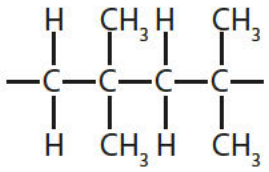
Put a cross (☒) in the box next to your answer.

(1)

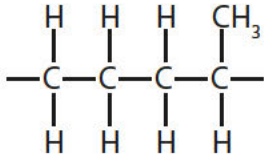
☒ **A**



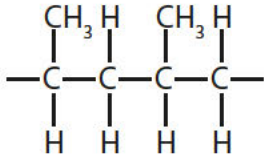
☒ **B**



☒ **C**



☒ **D**



(ii) Ropes used on boats are often made from poly(propene).



State a property of poly(propene) that makes it suitable for use as ropes on boats.

(1)

.....

(iii) e a problem caused by the disposal of poly(propene) ropes in landfill sites.

(1)

.....

.....

.....

(Total for Question 3 = 9 marks)

4 (a) Margarine is made by hydrogenation of a liquid oil.

Complete the sentence by putting a cross (☒) in the box next to your answer.

In hydrogenation of a liquid oil

(1)

- ☐ **A** hydrogen is removed from the liquid oil
- ☐ **B** the liquid oil reacts with steam
- ☐ **C** double bonds are formed
- ☐ **D** the liquid oil is changed into a solid

(b) Soaps are made by boiling oils with concentrated solutions of alkalis.

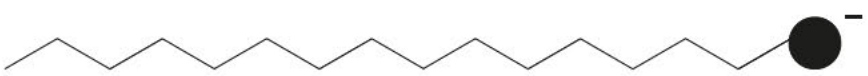
(i) Which of the following would be a suitable alkali to use in the production of soaps?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** sodium chloride
- ☐ **B** sodium hydroxide
- ☐ **C** sodium nitrate
- ☐ **D** sodium sulfate

(ii) The diagram shows a soap anion.



Explain how soap anions remove grease marks from clothes during washing with water.

(2)

.....

.....

.....

.....

.....

(c) Esters are made by reacting alcohols with carboxylic acids.

(i) Give the name of the carboxylic acid that has three carbon atoms in each molecule.

(1)

.....

(ii) When ethanoic acid, CH_3COOH, reacts with ethanol, C_2H_5OH, ethyl ethanoate is one of the products formed.

Write the balanced equation for the reaction.

(2)

.....

(d) Polyesters are used to make plastic bottles.

State another use of polyesters.

(1)

.....

(Total for Question 4 = 8 marks)

5 Propene is an alkene.

The formula of its molecule is C_3H_6.

(a) (i) Draw the structure of a propene molecule, showing all of the bonds.

(2)

(ii) One molecule of decane, $C_{10}H_{22}$, can be cracked to produce one molecule of propene and one molecule of an alkane **X** only.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The formula of a molecule of alkane **X** is

(1)

☐ **A** C_7H_{14}

☐ **B** C_7H_{16}

☐ **C** C_8H_{16}

☐ **D** $C_{13}H_{28}$

(b) Propane is an alkane.

Propane and propene are both gases.

Given a sample of each gas, describe a test to show which gas is propane and which gas is propene.

(3)

.....

.....

.....

.....

.....

.....

*(c) Propene is used to make the polymer poly(propene).

Explain how poly(propene) molecules are formed from propene molecules and relate the properties of poly(propene) to its uses.

(6)

(Total for Question 5 = 12 marks)