Ethanol

1. In each part choose only **one** answer.

Ethanol is produced by two different processes.

Process 1	Process 2
Fermentation of a sugar solution by yeast in a reaction vessel This is a batch process because the reaction vessel has to be emptied and refilled every few days. Makes 15% alcohol	Reaction of ethane (from crude oil) with steam This process runs continuously for several years as ethanol is constantly made. Makes 100% ethanol

A Ethene for **Process 2** is obtained from hydrocarbons in crude oil by . . .

1 thermal decomposition.

2 hydration.

3 fractional distillation.

4 polymerisation.

B One advantage of **Process 1** over **Process 2** is that . . .

1 the ethanol is colourless.

2 the raw materials are renewable.

3 there are no additives in the ethanol.

4 yeast is a living organism.

C One advantage of **Process 2** over **Process 1** is that . . .

1 crude oil is readily available.

2 lower temperatures are required for the reaction.

3 no expensive catalysts are required.

4 the ethanol is purer.

D It is more economic to produce a large quantity of ethanol in a given time by **Process 2** because . . .

1 crude oil is more easily transported than sugar.

2 it is a batch process.

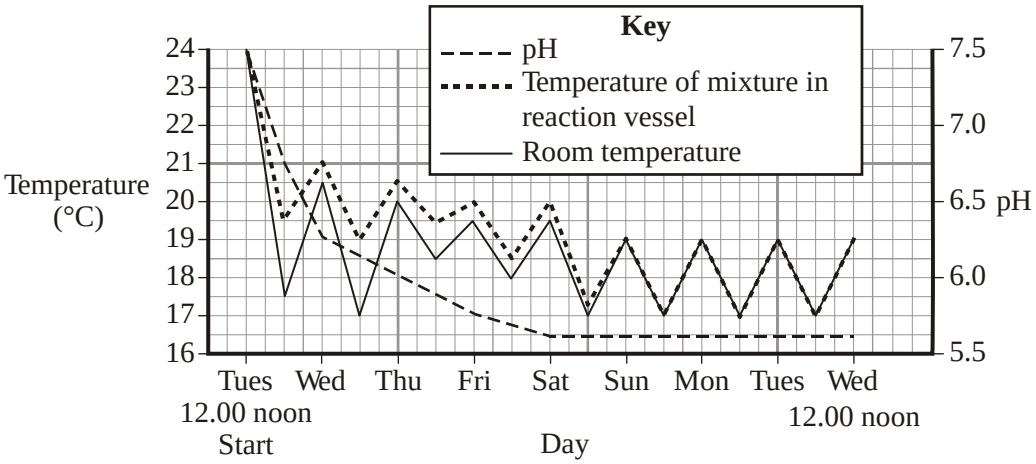
3 the reaction is faster and is run as a continuous process.

4 the reaction vessel is larger.

2. In each part choose only **one** answer.

Ethanol can be made by the action of yeast on a solution of sugar. This is called fermentation. The sugar is converted to ethanol and carbon dioxide. Carbon dioxide is a slightly acid gas. During fermentation, some of the energy is transferred as thermal energy.

A sugar solution and yeast were put into a reaction vessel.
The temperature of the mixture, the pH of the mixture and the room temperature were recorded over an eight-day period. The results are shown on the graph.



A There is a larger difference between the temperature of the mixture and the room temperature during the first few days than there is later.

The probable reason is that . . .

1 fermentation is quicker at the start.

2 the room temperature is steadily decreasing.

3 the pH value of the mixture is decreasing.

4 the room temperature fluctuates.

B From the information on the graph, . . .

1 fermentation is completed after 4 days.

2 fermentation is completed after 5 days.

3 fermentation is completed after 6 days.

4 fermentation continues after 8 days.

C A general conclusion from the graph is that . . .

1 the yeast cannot survive for more than 8 days.

2 the acidity of the mixture increases in the first 4 days.

3 the acidity of the mixture is greater at the start than when fermentation is completed.

4 the temperature of the mixture does not fall below 18.0 °C.

D One advantage of producing ethanol by fermentation rather than from ethene is that . . .

1 less carbon dioxide is produced in fermentation.

2 there are no waste products.

3 the raw materials are renewable.

4 the ethanol does not need further processing.