

1 Ethanol is a flammable liquid that can be used as a fuel for cars. One method for producing ethanol is by first producing ethene. Ethene comes from the cracking of long hydrocarbon chains found in crude oil. Ethene is then converted to ethanol.

1 (a) (i) Describe how ethene is converted to ethanol. **[2 marks]**

Hydration [1]

Using steam [1]

And a catalyst [1]

Name of the catalyst not needed.

1 (a) (ii) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Another method for producing ethanol is from the fermentation of sugar from sugar cane plants. The method is described below.

- Sugar cane plants are grown as a crop on farmland.
- Sugar cane plants are crushed and soaked in water to produce a sugar solution.
- The sugar solution is separated from the plant material.
- Yeast is added to the sugar solution and fermented.
- The yeast is separated from the solution of water and ethanol.
- Ethanol is separated from water by fractional distillation.

Evaluate the production of ethanol by fermentation and by using crude oil. In your answer, include environmental, economic and social factors. **[6 marks]**

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content	There is a simple description of advantages and / or disadvantages of environmental or economic or social factors There is a weak or no conclusion.	There a clear description of advantages and /or disadvantages of environmental and economic or social factors.	There is a detailed description of the advantages and / or disadvantages of environmental and economic or social factors

**Disadvantages of ethanol production using crude oil****Environmental**

Crude oil (or it) is non-renewable or it will run out. [1]

It contains 'locked up' carbon or CO<sub>2</sub> or when released it can cause global warming. [1]

Destruction of sea habitats caused by accidents or spillages of crude oil. [1]

**Economic / Social:**

Cracking process requires trained workers. [1]

A lot of energy or fuel is needed so costs are high. [1]

Complex or high tech process so costs are high. [1]

**Advantages of ethanol production using crude oil****Environmental:**

Does not use land when it is in the sea/ocean. [1]

**Economic / Social:**

No loss of food crops because land not needed to make ethene by fermentation of sugar cane. [1]

Extracting or process is fast / continuous / reliable. [1]

This is a typical question where marks are lost because students don't structure the answer well. It is perfectly acceptable - in fact advisable - to use sub-headings based on what the questions ask. It structures your answer better and makes it easy to read - examiners will like that!

**(Total 8 marks)****End**