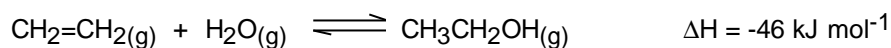


## LONGMAN GCSE CHEMISTRY WORKSHEETS

### 9: The manufacture of ethanol

This sheet looks at the reasons for the various conditions used in the manufacture of ethanol from ethene and steam.



1. Explain the meaning of the symbol  $\rightleftharpoons$ .

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2. State Le Chatelier's Principle.

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3. To get the maximum percentage conversion of the ethene into ethanol a low temperature is needed. Explain why.

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4. The temperature actually used is 300°C (not particularly low). Explain why really low temperatures aren't used in practice.

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5. Conversion of ethene into ethanol is favoured by high pressures. Explain why.

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The actual pressure used is between 60 and 70 atmospheres, which is high but not very high. This isn't just a case of high pressures being expensive to produce. At very high pressures, the ethene can polymerise.

6. Explain what is meant by "polymerisation".

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7. Draw displayed formulae to show the polymerisation of ethene.

8. The catalyst for the reaction is concentrated phosphoric acid (a liquid) supported on solid silica. State the effect of the catalyst on

(i) the rate of formation of the ethanol,

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(ii) the percentage of the ethene converted into ethanol.

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9. According to Le Chatelier's Principle, you would expect to get a better conversion of ethene into ethanol if you used an excess of steam. In fact, the reaction is done with an excess of ethene. This is because an excess of steam can destroy the catalyst. Suggest how that might happen.

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10. When the reaction mixture emerges from the catalyst, only about 5% of the ethene has actually been converted into ethanol. What do you think happens to the remaining 95%?

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