



MAKING ETHANOL

	Fermentation of carbohydrates	Reaction of ethene with steam
Equation	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$	$CH_2=CH_2 + H_2O \rightarrow C_2H_5OH$
Conditions	Temperature = 35°C Pressure = normal atmospheric pressure Catalyst = enzyme in yeast Other = aqueous, anaerobic	Temperature = 300°C Pressure = 70 atm Catalyst = concentrated phosphoric acid
Raw materials	carbohydrate crops (e.g. sugar, maize)	crude oil
Raw material type	renewable	finite (non-renewable)
Type of process	batch (stop-start)	continuous
Reaction rate	slow	fast
Purity of ethanol	impure (must be purified by fractional distillation)	pure

Which method for producing ethanol:

	fermentation	hydration of ethene
a) is fastest?		✓
b) uses renewable raw materials?	✓	
c) takes place at lower temperatures and pressures?	✓	
d) gives purer ethanol?		✓
e) is a continuous process?		✓
f) has lower labour costs?		✓