"JUSTIFY" 6 MARK QUESTIONS

C8 Rates of Reaction

Developing a technique to answer a **justify** question
(Justify -Use evidence from the information supplied to support an answer)

- Step 1 – **read** the information supplied
- Step 2 – **plan** your answer
- Plan your answer by writing logically ordered bullet points for each step in the method

Developing a technique to answer a **justify** question (Justify -Use evidence from the information supplied to support an answer)

- Step 1 – **read** the information supplied
- Ethanol can also be made by reacting ethene with steam in the presence of a catalyst.
- $C_2H_{4(g)} + H_2O_{(l)} \rightarrow C_2H_5OH_{(g)}$
- **Figure 1** shows how the percentage yield of ethanol changes as the pressure is changed at three different temperatures.
- **Figure 2** shows how the rate of reaction changes as the temperature changes at three different pressures
- In one process for the reaction of ethene with steam the conditions are: **300 °C, 65 atmospheres and a catalyst.**
- Use the information in **Figure 1** and **Figure 2**, and your own knowledge, to justify this choice of conditions.

Figure 1

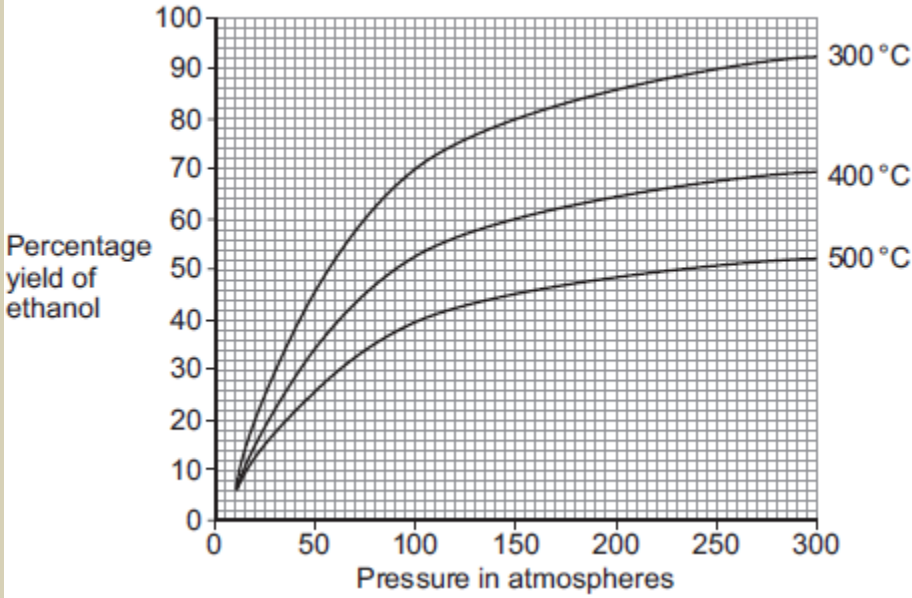
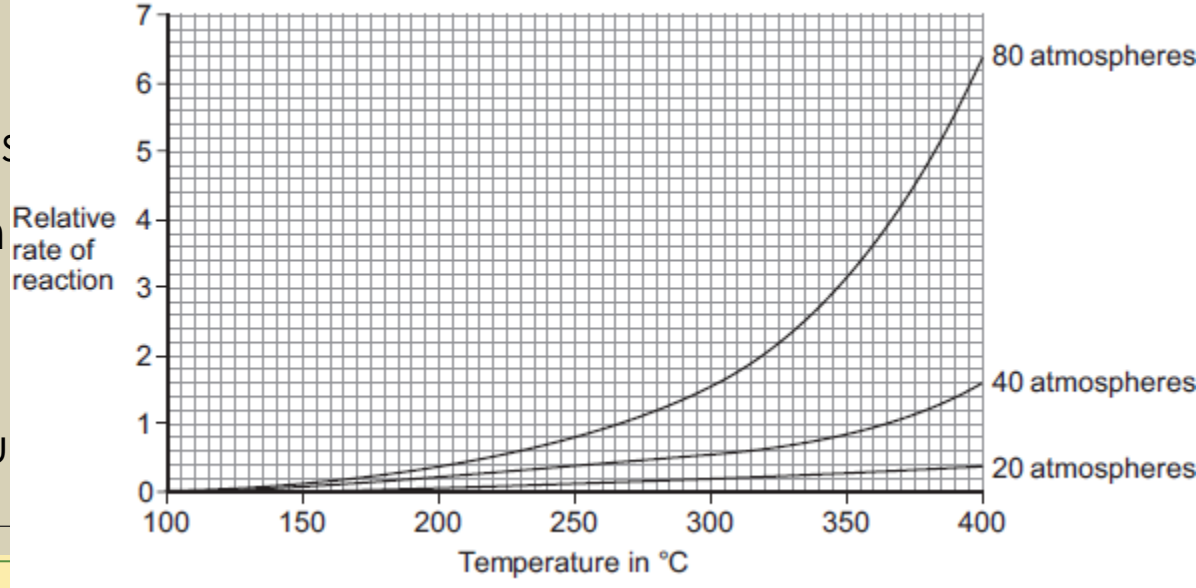


Figure 2



Developing a technique to answer a **justify** question

(Justify -Use evidence from the information supplied to support an answer)

- Step 2 – **plan** the question
- *There are 6 marks available and 3 conditions for you to consider. A sensible approach would be to comment on each of the 3 conditions with 2 different remarks e.g. how will adding a catalyst help the reaction? What do they do to the reaction speed? How will a catalyst affect the costs involved in this reaction? Ask similar questions for the other conditions.*

Figure 1

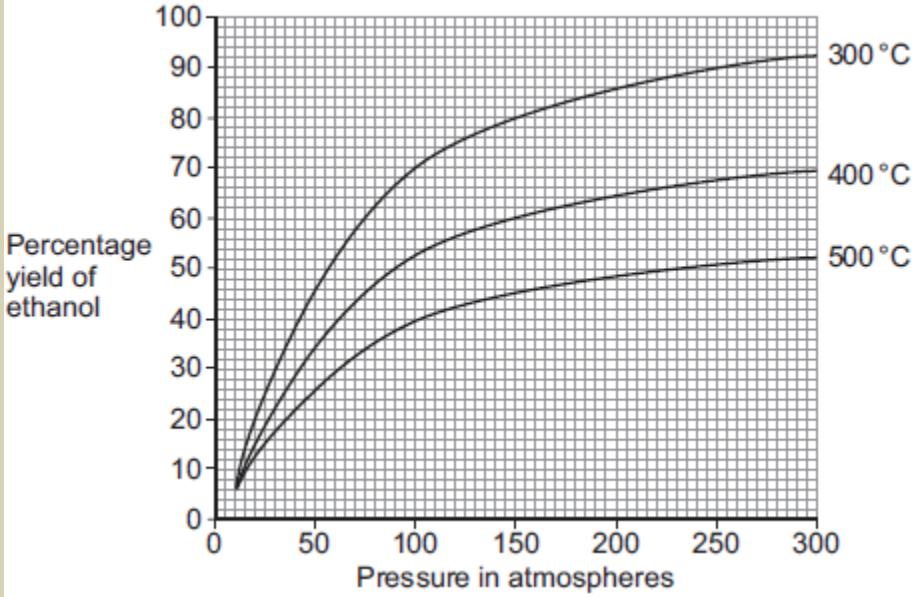
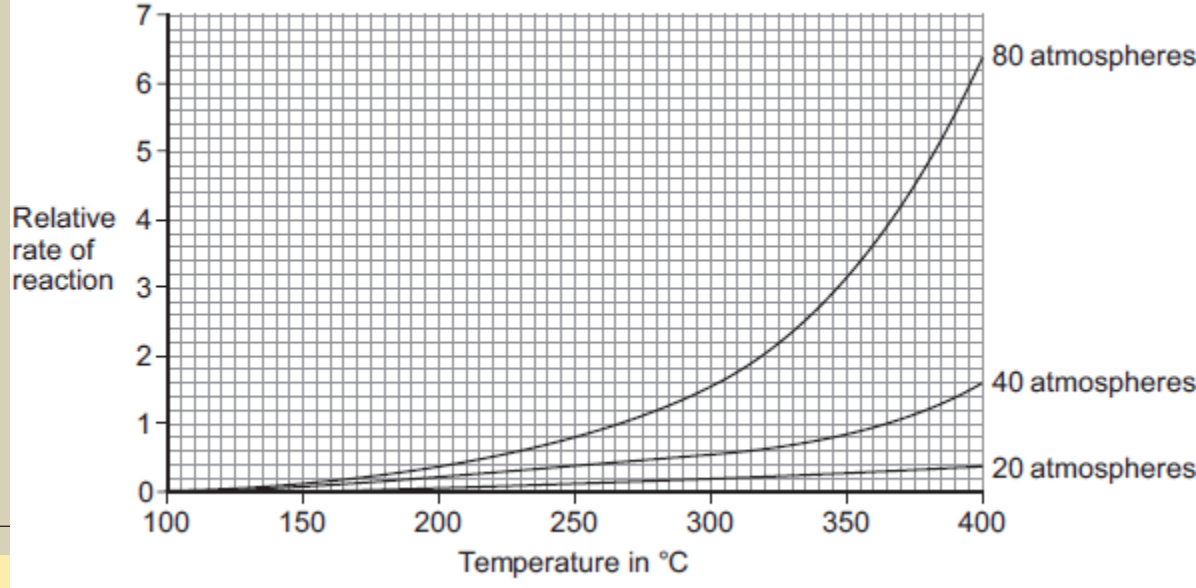


Figure 2



Developing a technique to answer a **justify** question
(Justify -Use evidence from the information supplied to support an answer)

- Step 3 – **answer** the question
- Proof read your answer
- Check that your points flow logically e.g. have you discussed each condition separately

Top tips for planning:

There are 6 marks available and 3 conditions for you to consider. A sensible approach would be to comment on each of the 3 conditions with 2 different remarks e.g. how will adding a catalyst help the reaction? What do they do to the reaction speed? How will a catalyst affect the costs involved in this reaction? Ask similar questions for the other conditions.

Example answer:

- THE HIGHEST YIELD IS ACHIEVED AT THE LOWER TEMPERATURE OF 300 DEGREES CELSIUS, ALTHOUGH THIS WILL ALSO GIVE THE SLOWEST REACTION TIME. YIELD AND RATE OF REACTION INCREASE AS THE PRESSURE INCREASES, HOWEVER THIS WOULD COST MORE TO ACHIEVE AND COULD INCLUDE SAFETY RISKS. 65 ATMOSPHERES IS A COMPROMISE BECAUSE OF THIS. USING A CATALYST WILL INCREASE THE RATE OF REACTION ENABLING A LOWER TEMPERATURE TO BE USED AND THEREFORE INCREASE THE YIELD AND REDUCE ENERGY COSTS.

Answer Mark Scheme

- **0 marks**
  No relevant content
- **Level 1 (1–2 marks)**
  At least one statement about the effect of a condition on either rate **or** yield.
- **Level 2 (3–4 marks)**
  Correct statements about the effect of at least one condition on rate **and** yield.
- **Level 3 (5–6 marks)**
  Correct statements about the effect of at least one condition on rate and yield **and** at least one correct statement about compromise conditions.

Examples of the points made in the response

Temperature

- a higher temperature gives a lower yield
- a higher temperature gives a faster rate

Pressure

- a higher pressure gives a higher yield
- increase in yield gets less as pressure increases
- a higher pressure gives a faster rate
- increase in rate increases as pressure increases

Catalyst

- using a catalyst speeds up reaction
- catalysts allow a lower temperature to be used and so save energy / reduce energy costs

Compromise

- a higher pressure gives a greater yield but increases costs / (safety) risks
- a high pressure gives a faster rate but increases costs / risks
- a high temperature makes reaction faster but reduces yield
- a catalyst makes reaction faster so a lower temperature can be used which will increase the yield