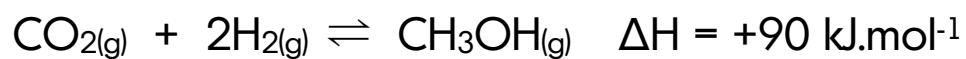






| | |
|----------------------|--|
| INCREASE [X] | |
| DECREASE [Y] | |
| INCREASE TEMPERATURE | |
| DECREASE PRESSURE | |
| ADD A CATALYST | |



| | |
|-------------------------------|--|
| INCREASE [CH ₃ OH] | |
| INCREASE [H ₂] | |
| INCREASE TEMPERATURE | |
| INCREASE PRESSURE | |
| ADD A CATALYST | |



Sulfuric acid is manufactured by the Contact Process.

- (a) In this process, sulfur dioxide reacts with oxygen.
The equation for the equilibrium that is established is



- (a) (i) State and explain the effect of a **decrease** in temperature on the equilibrium yield of SO_3

Effect of a decrease in temperature on yield

Explanation

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(3 marks)

(Extra space)

.....

- (a) (ii) Give **two** features of a reaction at equilibrium.

Feature 1

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Feature 2

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(2 marks)



- (b) Explain why a catalyst has no effect on the position of an equilibrium.

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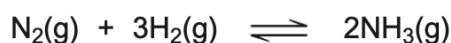
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(2 marks)

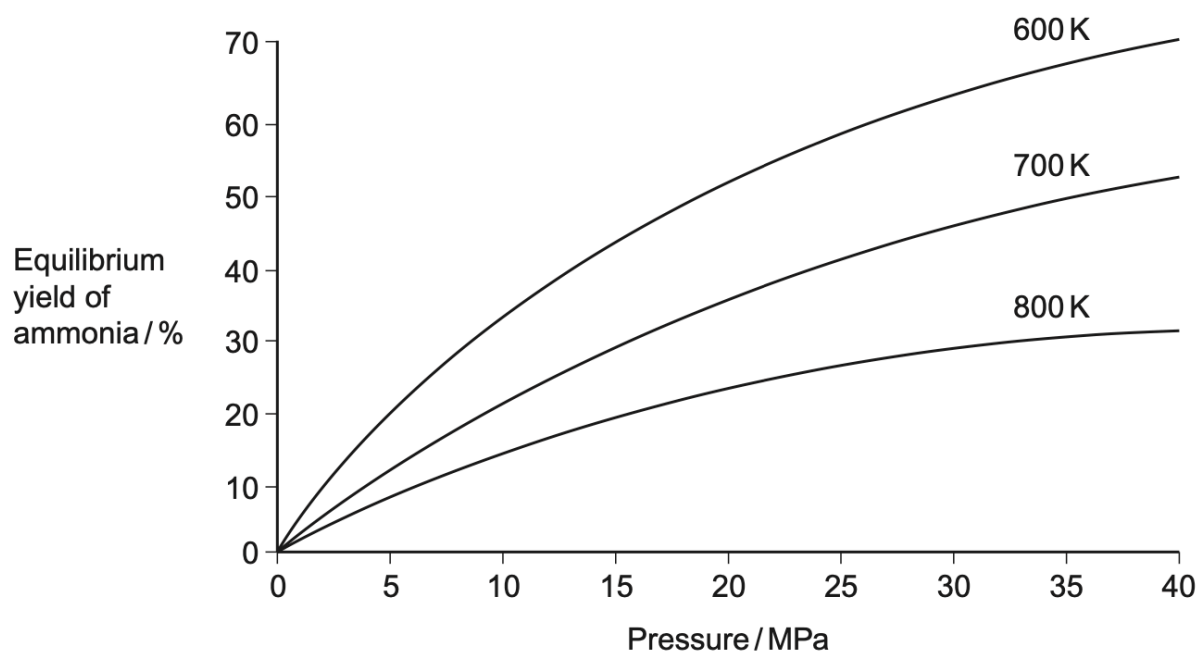
(Extra space)

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Ammonia is manufactured by the Haber process in which the following equilibrium is established.



- (c) The diagram shows how the equilibrium yield of ammonia varies with changes in pressure and temperature.





- (c) (i) Use the diagram to state the effect of an **increase** in pressure at constant temperature on the yield of ammonia. Use Le Chatelier's principle to explain this effect.

Effect on yield

Explanation

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(3 marks)

(Extra space)

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- (c) (ii) Use the diagram to state the effect of an **increase** in temperature at constant pressure on the yield of ammonia. Use Le Chatelier's principle to explain this effect.

Effect on yield

Explanation

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(3 marks)

(Extra space)

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