

The Haber Process

Marks awarded for this answer will be determined by the quality of the written communication as well as the standard of the scientific response

| Poor Understanding (0 marks) | Level 1 Basic Understanding (1-2 marks) Grade 3-4 | Level 2 Clear Understanding (3-4 marks) Grade 5-6 | Level 3 Detailed Understanding (5-6 marks) Grade 7-8 |
|---|--|---|---|
| | <ul style="list-style-type: none"> • Knowledge of basic information • Simple understanding • The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail • The spelling, punctuation and grammar are very weak | <ul style="list-style-type: none"> • Knowledge of accurate information • Clear understanding • The answer has some structure and organisation, use of terms has been attempted but not always accurately, some detail given • There is reasonable accuracy in spelling, punctuation, although there may still be some errors. | <ul style="list-style-type: none"> • Knowledge of accurate information appropriately contextualised • Detailed understanding supported by relevant evidence and examples • Answer is coherent and is in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately • The answer shows almost faultless spelling, punctuation and grammar |

Examples of Chemistry points made in the response

200 atmospheres pressure

- high pressure gives a high yield of ammonia
- too high a pressure causes risk of explosion
- high pressure costly to maintain
- a high pressure will cause the rate to be higher
- 4 moles of gas become 2 (or fewer moles of gas in products)

450 °C

- high temperature increases the rate of reaction
- optimum temperature
- (forward reaction is exothermic so) a high yield of ammonia requires a low temperature
- but too low a temperature causes the rate of reaction to be too slow

iron catalyst

- a catalyst speeds up the reaction
- an iron catalyst allows a lower temperature to be used (saving energy and causing a higher yield)
- iron catalyst increases the rate of reaction equally in both reactions

others

- compromise conditions
- unreacted nitrogen and hydrogen is recycled

6

Total 6 marks