The Haber Process

A12.6.1 conditions and compromise

Name: _____ Date: _____

1. Recall

1.1 Write the Haber equation and the sign of ΔH for the forward reaction.

1.2 State typical T, P and catalyst from the lesson.

1.3 How many gas moles are on each side? Why does increasing pressure raise NH_3 yield?

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2. Temperature compromise

	Lower T	Higher T
NH_3 equilibrium yield		
Rate		
Industrial issue		

2.1 Why is about 450 °C chosen?

3. Pressure compromise

3.1 Why not the highest possible pressure? 3.2 Why is about 200 atm described as a compromise?

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4. Iron

4.1 What does iron change? 4.2 What does it not change at fixed T and P?

5. Options

Judge A 300 °C / 200 atm; B 650 °C / 200 atm; C 450 °C / 200 atm + iron.

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6. Plant X

Choose from 350 / 450 / 600 °C and 100 / 200 / 400 atm, iron available. Give the indicative industrial choice and one reason against each rejected option.

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7. Examination-style

(a) Typical T, P, catalyst [3]. (b) Why not lower T [3]. (c) Why higher P increases yield [2]. (d) Why P is a compromise [3]. (e) Iron [2].

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8. Errors

Correct: choose lowest T for highest yield; choose highest P for highest yield; iron increases equilibrium yield; higher T always improves production.