Worksheet 7.3

Reversible reactions

1 Complete each sentence using the correct ending from the ones given below.

a The main ingredient of any nitrogenous fertiliser is usually made from

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b The raw ingredients of the Haber process are

.....

c The nitrogen comes from the air

.....

d The process also uses a moderately high

.....

e Nitrogen is unreactive so the Haber process needs

.....

f Ammonia

.....

Choose endings from:

- an iron catalyst.
- temperature and pressure.
- and the hydrogen comes from methane.
- is made by the Haber process.
- ammonia.
- nitrogen and hydrogen.

Then put the sentences in an order which describes the Haber process for the production of ammonia.

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2 Complete the following equations, and descriptions, for important reversible reactions.

a N_2 + ... $\rightleftharpoons 2NH_3$ The ..... process for making ammonia

b $2SO_2 + O_2 \rightleftharpoons 2$ ..... The Contact process

c CH_3COOH + ... $\rightleftharpoons CH_3COOC_2H_5$ + ... esterification

3 **a** Write a balanced chemical equation to describe the equilibrium that occurs when nitrogen and hydrogen react to produce ammonia.

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b How many moles of gas are there on the left-hand side of the equilibrium?

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c How many moles of gas are there on the right-hand side of the equilibrium?

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d Does increasing the pressure produce an increase or decrease in the yield of products on the right-hand side of the equation?

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e The usual operating pressure for the commercial production of ammonia is about 200 atm. Why has this been chosen rather than a higher or lower pressure?

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