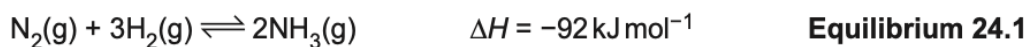


**AS Level Chemistry A**  
**H032/01** Breadth in chemistry

**Question Set 21**

1. This question is about ammonia, NH<sub>3</sub>.

(a) In industry, ammonia is made from nitrogen and hydrogen. This is a reversible reaction, as shown in **equilibrium 24.1** below.



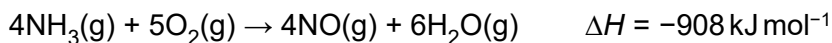
- (i) Explain how le Chatelier's principle can be used to predict the conditions of temperature and pressure for a maximum **equilibrium** yield of ammonia. [4]
- (ii) Using certain conditions, **equilibrium 24.1** has the equilibrium concentrations in the table.

Substance	Equilibrium concentration / mol dm <sup>-3</sup>
N <sub>2</sub> (g)	1.25
H <sub>2</sub> (g)	2.75
NH <sub>3</sub> (g)	0.862

Calculate the numerical value for  $K_c$  for **equilibrium 24.1** under these conditions.

Give your answer to an appropriate number of significant figures and in standard form. [2]

(b) Ammonia is used to make nitric acid. The first stage of the reaction is shown below.



Standard enthalpy changes of formation,  $\Delta_f H^\ominus$ , are given in the table.

Substance	$\Delta_f H^\ominus / \text{kJ mol}^{-1}$
NH <sub>3</sub> (g)	-46
O <sub>2</sub> (g)	0
H <sub>2</sub> O(g)	-242

- (i) State the conditions of temperature and pressure used for standard enthalpy measurements. [1]
- (ii) Calculate the standard enthalpy change of formation, in kJ mol<sup>-1</sup>, for NO(g). [3]

Give your answer to a **whole number**.

**Total Marks for Question Set 21: 10**

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