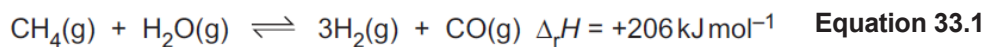


**A Level Chemistry B (Salters)**  
**H433/01** Fundamentals of chemistry

**Question Set 24**

- 1 (a) An important source of hydrogen is from the steam reforming reaction shown in **equation 33.1** below.



The position of equilibrium can be changed by altering the conditions.

Complete the table to show the effects on the yield of hydrogen and the value of the equilibrium constant,  $K_c$ .

	Increasing temperature	Increasing pressure
Effect on yield of hydrogen		
Effect on the value of $K_c$		

[2]

- (b) 2.00 moles of methane and 1.00 mole of steam are allowed to reach equilibrium in a 1.00 dm<sup>3</sup> container. At equilibrium 0.66 mole of steam remains.

Calculate a value for the equilibrium constant and give its units.

$$K_c = \dots\dots\dots \text{ units} \quad [3]$$

- (c) (i) The entropy change for the forward reaction in **equation 33.1**,  $\Delta_{\text{sys}} S = +214.5 \text{ JK}^{-1} \text{ mol}^{-1}$ .

How does the sign of  $\Delta_{\text{sys}} S$  relate to the equation for the reaction? [1]

(ii) The entropy values for some of the gases in **equation 33.1** are shown below.

Gas	Entropy, S/JK <sup>-1</sup> mol <sup>-1</sup>
CH <sub>4</sub>	+186.3
H <sub>2</sub> O	+188.7
CO	+197.7

Use the value of  $\Delta_{\text{sys}}S$  and the entropy values in the table to calculate the entropy of H<sub>2</sub>(g).

entropy of H<sub>2</sub>(g) .....J K<sup>-1</sup> mol<sup>-1</sup> [2]

(d) Calculate whether the forward reaction in **equation 33.1** is feasible at 1000 K. [2]

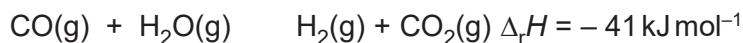
(e) (i) The steam reforming reaction shown in **equation 33.1** makes hydrogen. Much of the hydrogen is used in the manufacture of ammonia.

Calculate the atom economy of the reaction in **equation 33.1** when making hydrogen.

atom economy = .....% [1]

(e) (ii) How is carbon monoxide described when it is formed alongside the required product (hydrogen)? [1]

(f) The carbon monoxide can be used in the exothermic water gas shift reaction.



The water gas shift reaction often takes place in the same industrial plant as steam reforming. Suggest **two** advantages of the water gas shift reaction taking place with steam reforming.

1 .....

2 .....

[2]

**Total Marks for Question Set 24: 14**

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