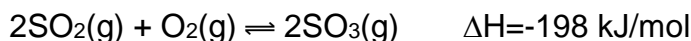


IGCSE EQUILIBRIUM QUESTIONS 2

- 1 The reaction below is one stage in the industrial process for manufacture of sulfuric acid. Sulfur dioxide and oxygen are reacted at a pressure of 200 kPa and a temperature of 450 °C in the presence of a V₂O₅ catalyst:



Explain how each of the following changes affect the amount of SO₃ present at equilibrium:

- (a) increasing the pressure at constant temperature. [2]

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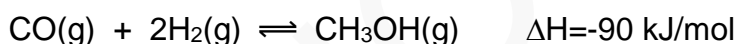
- (b) increasing the temperature at constant pressure. [2]

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- 2 The reaction shown is reversible



Carbon monoxide and hydrogen are placed in a closed container and allowed to come to equilibrium.

Predict and explain the effects of the following changes on the number of moles of methanol present at equilibrium.

- (a) Decreasing the pressure (at constant temperature) [2]

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- (b) Decreasing the temperature (at constant pressure) [2]

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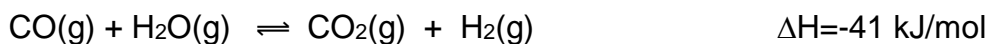
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- 3 Complete the following table by stating whether the position of equilibrium shifts to the left or right under the effect of the given changes. [4]

		Increase Pressure	Increase Temperature
$2\text{NH}_3(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$	endothermic		
$2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$	exothermic		

IGCSE EQUILIBRIUM QUESTIONS 2

5 The water gas shift reaction is an important reaction in several industrial processes.



(a) Explain the effect of increasing the temperature on the yield of hydrogen [2]

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(b) Various catalysts can be used in this process. State and explain the effect of a catalyst on this reaction. [3]

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(c) Although pressure has no effect on the position of equilibrium for this reaction, in some industrial plants a pressure above normal atmospheric pressure is used.

(i) Explain why pressure has no effect on the position of equilibrium in this reaction. [1]

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(ii) Suggest why some companies might use a pressure higher than atmospheric pressure for this reaction. [2]

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6 The reaction shown is reversible: $\text{H}_2\text{(g)} + \text{I}_2\text{(g)} \rightleftharpoons 2\text{HI(g)}$

(a) State the name of HI(g) [1]

(b) Use the bond energies shown in the table to determine the enthalpy change for the forward reaction. [3]

Bond	Bond energy / kJ/mol
H-H	436
I-I	151
H-I	299

(c) Explain how increasing the temperature will affect the amount of HI(g) present at equilibrium. [2]

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