

# AQA Chemistry A-level

## Topic 1.6 - Chemical Equilibria, Le Chatelier's principle and $K_c$

Flashcards



Define the term dynamic equilibrium.



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The rate of the forward reaction is equal to the rate of the reverse reaction.

(Hence, the concentrations of reactant and product do not change)



Give an essential condition  
for an equilibrium mixture.



Give an essential condition for an equilibrium mixture.

- Equilibrium occurs in a **closed system** (where reactants and products cannot escape)

**OR**

- Macroscopic properties do not change with time



# State Le Chatelier's principle.

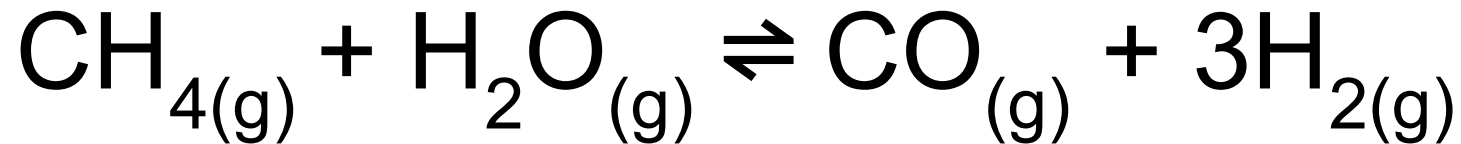


State Le Chatelier's principle.

If a system at equilibrium is disturbed, the equilibrium moves in the direction that tends to reduce the disturbance.



In the equation:



$$\Delta H^\circ = +210 \text{ kJ mol}^{-1}$$

What effect would increasing the **temperature** have on the position of equilibrium?



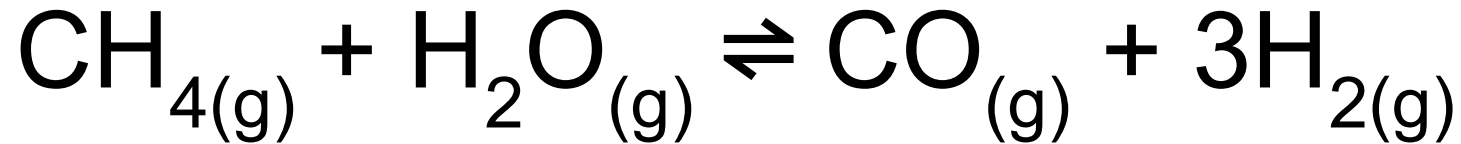
What effect would increasing the temperature have on the position of equilibrium? In the equation:  $\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + 3\text{H}_2(\text{g})$   $\Delta H^\ominus = +210 \text{ kJ mol}^{-1}$

The equilibrium position **shifts to the right.**

(This is because the forward reaction is endothermic. Yield of hydrogen increases.)



In the equation:

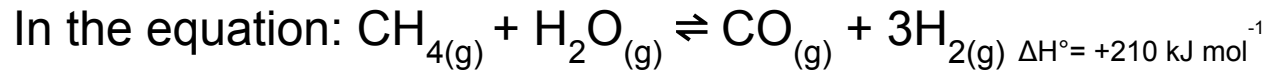


$$\Delta H^\circ = +210 \text{ kJ mol}^{-1}$$

What effect would increasing the **pressure** have on the position of equilibrium?



What effect would increasing the pressure have on the position of equilibrium?

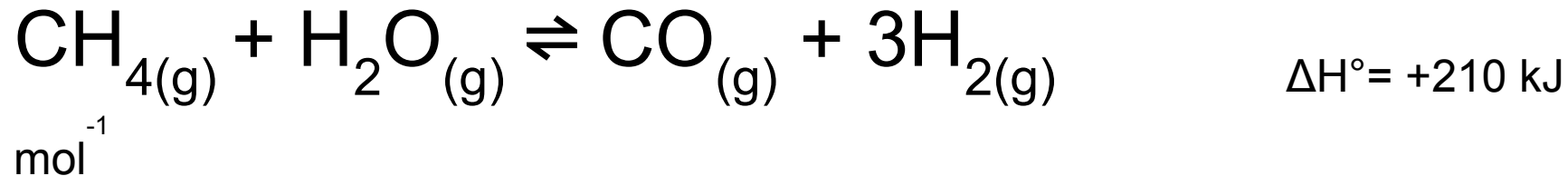


The equilibrium position **shifts to the left.**

This is because the forward reaction produces more moles of gas than the reverse reaction (4 moles of product, 2 moles of reactant). Yield of hydrogen decreases.



The reaction:



Suggest and explain why an industrial chemist may use a **high pressure** for this production of hydrogen from the above reaction?



Suggest and explain why an industrial chemist may use a high pressure for the production of hydrogen from:  $\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + 3\text{H}_2(\text{g}) \quad \Delta H^\circ = +210 \text{ kJ mol}^{-1}$

1. The high pressure increases the **collision frequency**, increasing the **rate of reaction**.
2. This is a **compromise pressure** between an economically viable rate of reaction and a slightly lower yield of hydrogen.



What effect does a catalyst have on the position of equilibrium?



What effect does a catalyst have on the position of equilibrium?

**No effect.**

(because catalyst affects rate of forward and reverse reactions equally)



# What condition affects the value of $K_c$ ?

Concentration

Catalyst

Pressure

Temperature



# What condition affects the value of $K_c$ ?

Concentration

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For the reaction below, deduce an expression for  $K_c$ .



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$$K_c = \frac{[D][E]^4}{[A]^2[B]^3[C]}$$



Deduce units for the value of  $K_c$

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Deduce units for the value of  $K_c$

**mol<sup>-1</sup> dm<sup>-3</sup>**



What type of system is  $K_c$   
relevant for?



What type of system is  $K_c$  relevant for?

Homogeneous systems in  
equilibrium



What does  $K_c$  being greater of lesser than 1 suggest for the position of equilibrium?



What does  $K_c$  being greater or lesser than 1 suggest for the position of equilibrium?

Greater than 1 = over to the right

Lesser than 1 = over to the left



What effect does **decreasing the temperature** in an **endothermic reaction** have on  **$K_c$**  ?



What effect does **decreasing the temperature** in an **endothermic** reaction have on  $K_c$ ?

$K_c$  decreases



What effect does **increasing the temperature** in an **endothermic reaction** have on  **$K_c$** ?



What effect does **increasing the temperature** in an **endothermic** reaction have on  $K_c$ ?

$K_c$  increases



What effect does **decreasing the temperature** in an **exothermic** reaction have on  $K_c$  ?



What effect does **decreasing the temperature** in an **exothermic** reaction have on  $K_c$ ?

$K_c$  increases



What effect does **increasing the temperature** in an **exothermic** reaction have on  **$K_c$**  ?



What effect does **increasing the temperature** in an **exothermic** reaction have on  $K_c$ ?

$K_c$  decreases

