



## Year 12 Chemistry

## Tutorial 9.5.B – Quantitative Equilibrium

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**Module** 9.5 – Industrial Chemistry

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**Topic** 9.5.B – Quantitative Equilibrium

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**Name****Date**

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1. For the reaction:



How would the equilibrium change if the following changes were made?

(a) The temperature was decreased.

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(b) The chlorine concentration was increased.

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(c) A catalyst was added at the start of the reaction.

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(d) Neon gas was injected into the system.

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(e) The pressure was halved.

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2. In the reaction  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$ , carried out at  $27^\circ\text{C}$ , the equilibrium concentrations were  $[\text{H}_2] = 0.8\text{M}$ ,  $[\text{I}_2] = 0.9\text{M}$  and  $[\text{HI}] = 0.6\text{M}$ .

(a) Write an expression for the equilibrium constant and find the value for K.

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(b) Comment on the relative position of equilibrium at this temperature.

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(c) If K for the above reaction was 50 at a temperature of 450°C, would you expect the forward reaction to be exothermic or endothermic? Explain your answer.

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3. An equilibrium mixture contains 1.00 mol of Br<sub>2</sub>, 0.125 mol of HBr and 0.0500 mol of H<sub>2</sub> gases in a 5.00 L flask. The heat of reaction for the synthesis of HBr is -165 kJ mol<sup>-1</sup>.

(a) Write an equation for the reaction.

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(b) Find the equilibrium constant for the reaction.

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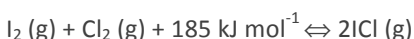
(c) Comment on the relative position of equilibrium at this temperature.

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(d) If the pressure on the reaction vessel were doubled, how would the reaction be affected?

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4. Iodine reacts with chlorine gas according to the following reaction:



(a) Write an equilibrium expression for the reaction.

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(b) 0.5 mol of I<sub>2</sub> and 0.5 mol of Cl<sub>2</sub> were mixed in a 1L flask at a certain temperature. When equilibrium was reached, 0.4 mol of ICl was present. Find the value of K.

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(c) How would K change when the temperature was doubled?

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(d) How would an increase in pressure affect the equilibrium?

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(e) Use Le Chatelier's principle to explain how the equilibrium would shift if the chlorine concentration was halved.

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5. Consider the equilibrium reaction:



At a certain temperature 3.0 mol of F<sub>2</sub> and 2.0 mol of I<sub>2</sub> are introduced into a 10.0 L container. At equilibrium, the [I<sub>4</sub>F<sub>2</sub>] is 0.02 M.

(a) Calculate K for the reaction.

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(b) What does this tell you about the position of equilibrium at this temperature?

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