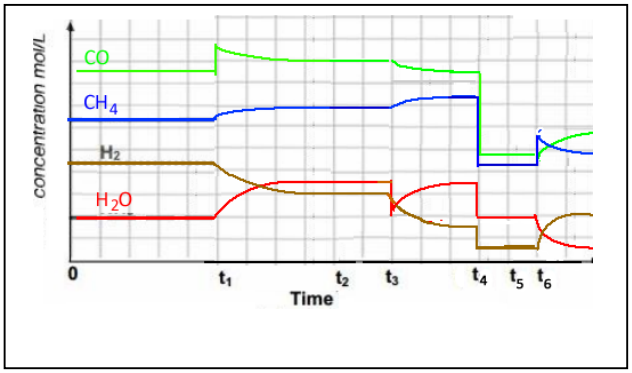
Lesson 1 Dynamic Equilibrium solutions

Predict the response of the reaction, below, which is at equilibrium when:

$CO(g) + 3H_2(g) \leftrightharpoons CH_4(g) + 3H_2O(g)$

- CO (g) is added (t_1)



The system will move a net forward direction to partially undo the increase in [CO]

- Pressure is increased by the addition of N_2 gas (t_2)

Since N_2 is not part of the system and does not impact on the concentration of any of the species that form the system, the system does not respond.

- Steam is removed (t_3)

Since a product is removed the system moves in a net forward direction to partially undo the decrease in the [H_2O].

- Pressure is decreased when volume is doubled (t_4)

The concentration of each species halves and the system does not respond by moving either in a net forward or a net reverse reaction. Same number of particles exist on both sides of the equation so there is no change in K_c.

$$K_c = \frac{[CH_4]\,[H_2O]^3}{[CO]\,[H_2]^3}$$

$$K_c = \frac{[\tfrac{1}{2}\,CH_4]\,[\tfrac{1}{2}\,H_2O]^3}{[\tfrac{1}{2}\,CO]\,[\tfrac{1}{2}\,H_2]^3}$$

$$K_c = \frac{\cancel{\tfrac{1}{2}}\,[CH_4]\,\cancel{(\tfrac{1}{2})^3}\,[H_2O]^3}{\cancel{\tfrac{1}{2}}\,[CO]\,\cancel{(\tfrac{1}{2})^3}\,[H_2]^3}$$

$$K_c = \frac{[CH_4]\,[H_2O]^3}{[CO]\,[H_2]^3}$$

Volume change has no impact on K_C

- addition of a catalyst. (t_5)

No change in the concentration of reactants and products at equilibrium as the reverse and forward reactions are increased equally.

- CH_4 gas is added (t_6)

Net backward reaction to partially undo the increase in [CH_4].