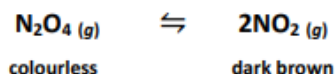


Chemical Equilibrium Sample Questions

2017 Q7

7. (a) What is meant by a chemical equilibrium?
Why is it described as a dynamic state?
State Le Châtelier's principle. (14)

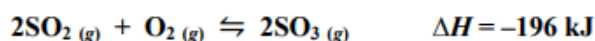
Consider the following chemical equilibrium established between dinitrogen tetroxide (N_2O_4) and nitrogen dioxide (NO_2) at a certain temperature T .



- (b) Write the equilibrium constant (K_c) expression for the reaction. (6)
- (c) The value of K_c for the reaction at T is 0.2.
One mole of pure dinitrogen tetroxide was sealed into a container of fixed 10 litre capacity. Calculate the equilibrium concentration, in moles per litre, of each of the gases at temperature T . (18)
- (d) The colour of the equilibrium mixture is paler at 0°C than at T , where $T > 0^\circ\text{C}$.
Explaining your reasoning, deduce whether the decomposition of dinitrogen tetroxide into nitrogen dioxide is an exothermic or an endothermic reaction. (6)
- (e) Would there be a change in the value of K_c at T if a different initial concentration of dinitrogen tetroxide were used?
Explain your answer. (6)

2016 Q7

7. In the Contact process for the manufacture of sulfuric acid, the key stage is the reaction of sulfur dioxide and oxygen, in contact with a vanadium(V) oxide (V_2O_5) catalyst, to form sulfur trioxide. Chemical equilibrium is established according to the following balanced equation.



- (a) State Le Châtelier's principle.
Use Le Châtelier's principle to predict and explain the conditions (i.e. high or low) of (i) temperature, (ii) pressure, that would maximise the yield of sulfur trioxide.
Explain why the temperature conditions predicted are *not* used industrially. (20)
- (b) State and explain the effect, if any, of the presence of the catalyst on the equilibrium yield of sulfur trioxide. (6)
- (c) A mixture of 96 g of sulfur dioxide and 24 g of oxygen was placed in a 50 litre container and reached equilibrium with sulfur trioxide at a certain temperature according to the balanced equation above. At equilibrium, 112 g of sulfur trioxide were present.
Write the equilibrium constant (K_c) expression for this reaction.
Calculate the value of K_c under these conditions. (24)

2015 Q11 b)

(b) Gas **A** is in equilibrium with gases **B** and **C** according to the following equation.



The equilibrium constant (K_c) value at 15 °C for the dissociation reaction is 4.0.

A rigid 10 litre container was filled with 30 moles of gas **A** and stored at 15 °C.

Calculate the number of gaseous moles at equilibrium in the container. (13)

The graph shows the relationship between temperature (T) and K_c for this equilibrium.

Deduce whether the dissociation of gas **A** is exothermic or endothermic.

Explain your reasoning. (6)

Explain how an increase in the storage temperature would affect the pressure of the equilibrium mixture. (6)

