Calculating and interpreting Kc

**2022**



At 490 °C, the equilibrium mixture has a concentration of 0.105 mol L–1 for both H2(*g*) and I2(*g*), while

the concentration of HI is 0.711 mol L–1.

(i) Calculate the value of *K*c at 490 °C.



(ii) Explain what would happen to the value of *K*c if the temperature of the equilibrium mixture was

increased.

**2021**

The equilibrium constant expression for a reaction is:



For the above reaction, the value for *K*c at 230 °C is 6.44 × 105 (644 000). At the concentrations below, the reaction is not at equilibrium.



(i) By using the *K*c expression above and the concentrations shown in the table, explain why the reaction is not at equilibrium.

(ii) To reach equilibrium, would the forward or backward reaction need to be favoured?

Justify your answer.

**2020**



(i) At equilibrium, carbonyl fluoride, COF2, has a concentration of 0.040 mol L–1. The concentration of

both carbon tetrafluoride, CF4, and carbon dioxide, CO2, is 0.80 mol L–1.

Calculate the *K*c for this equilibrium.

(ii) At a **different** temperature, the *K*c value is 50.

Explain what the value of the *K*c indicates about the extent of this reaction

(iii) The enthalpy change, Δr*H*, for the decomposition of carbonyl fluoride is –24 kJ mol–1.

Explain what happens to the value of *K*c when the temperature is decreased.

**2019**

1. N2(*g*) + 3H2(*g*) ⇌ 2NH3(*g*) Δr*H* = –92 kJ mol–1

Explain, using equilibrium principles, whether the value of *K*c would increase or decrease if the temperature of the reaction is increased.

2. Nitrogen, N2(*g*), can be reacted with oxygen, O2(*g*), to give nitrogen dioxide, NO2(*g*), and the following *K*c expression would apply. The *K*c for the reaction at 25°C is 8.30 × 10–10.

****

(i) Calculate the concentration of nitrogen dioxide, NO2, if the concentration of oxygen, O2 0.230 mol L-1

and the concentration of nitrogen, N2, is 0.110 mol L–1. (Answer to appropriate significant figures.)

(ii) Explain the effect on *K*c if the concentration of nitrogen, N2(*g*), is increased to 0.200 mol L–1 at 25°C (no calculations are necessary).

N2(*g*) + 2O2(*g*) ⇌ 2NO2(*g*)

**2018**

The Contact Process is used industrially in the manufacture of sulfuric acid. One step in this process is the oxidation of sulfur dioxide, SO2(*g*), to sulfur trioxide, SO3(*g*).

2SO2 *(g)* + O2 *(g)* ⇌ 2SO3 *(g)*

(i) Calculate the equilibrium constant (*K*c) for this reaction at 600ºC using the following

concentrations:

[SO2] = 0.100 mol L–1

[O2] = 0.200 mol L–1

[SO3] = 0.0930 mol L–1

(ii) Explain what the size of the *K*c value indicates about the extent of the reaction at equilibrium.

**2017**

(i) The value of the equilibrium constant, *K*c, is 640 at 25ºC.

Show, by calculation, using the concentrations of the gases given in the table below, whether or not the

reaction is at equilibrium. Explain your answer.



(ii) As the temperature increases, the value of the equilibrium constant, *K*c, decreases from 640 at 25ºC to

0.440 at 200ºC.

Justify whether the formation of ammonia, NH3(*g*), is an endothermic or exothermic reaction.

**2016**

When hydrogen gas, H2(*g*), and iodine gas, I2(*g*) are mixed, they react to form HI(*g*), and an equilibrium is established.



(i) Calculate the concentration of HI in an equilibrium mixture at 445°C when the concentrations of H2(*g*) and I2(*g*) are both 0.312 mol L–1

(ii) Explain the effect on the position of equilibrium if the overall pressure of the equilibrium system is increased.

(iii) When the temperature of the equilibrium system is increased to 510°C, the *K*c value decreases to 46.

Justify, using equilibrium principles, whether the forward reaction is exothermic or endothermic.

**2015**

The following chemical equation represents a reaction that is part of the Contact Process which produces sulfuric acid.



A reaction mixture has the following concentration of gases at 600°C



(i) Justify why this reaction mixture is not at equilibrium

In your answer you should use the equilibrium expression and the data provided above to show that the reaction mixture is not at equilibrium.

(ii) The reaction above was repeated at 450°C Explain, using equilibrium principles, how the change in temperature will affect

• the value of *K*c

© <https://www.chemical-minds.com>

NCEA questions and answers reproduced with permission from NZQA

• the position of equilibrium.