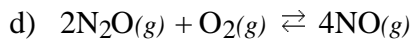
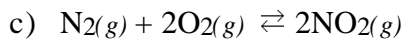
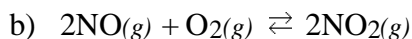
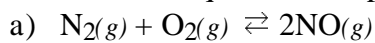


PS7.2. Write the equilibrium expression for each of the following chemical equations;



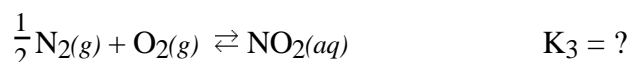
PS7.3. In each of the following you are given the equation for an equilibrium system and the magnitude of the equilibrium constant. Calculate the new equilibrium constant for the reaction in the alternative form;

Equilibrium reaction	Equilibrium constant	Alternative reaction
a) $\text{N}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{NO}(g)$	4.7×10^{-31}	$\frac{1}{2}\text{N}_2(g) + \frac{1}{2}\text{O}_2(g) \rightleftharpoons \text{NO}(g)$
b) $\text{CO}_2(g) + \text{H}_2(g) \rightleftharpoons \text{CO}(g) + \text{H}_2\text{O}(g)$	1.4	$\text{CO}(g) + \text{H}_2\text{O}(g) \rightleftharpoons \text{CO}_2(g) + \text{H}_2(g)$
c) $6\text{ClO}_3\text{F}(g) \rightleftharpoons 2\text{ClF}(g) + 4\text{ClO}(g) + 7\text{O}_2(g) + 2\text{F}_2(g)$	32.6	$\frac{1}{3}\text{ClF}(g) + \frac{2}{3}\text{ClO}(g) + \frac{7}{6}\text{O}_2(g) + \frac{1}{3}\text{F}_2(g) \rightleftharpoons \text{ClO}_3\text{F}(g)$

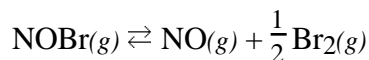
PS7.4. Equilibrium constants for the following reactions have been determined at 298 K:



Calculate K (at the same temperature) for the reaction



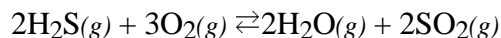
PS7.5. The reaction



has been carefully studied at 350 °C and the K_c is 0.079. Calculate Q and determine which direction (left-to-right or right-to-left) will the reaction proceed to establish equilibrium under each of the following initial conditions?

- a) $[\text{NOBr}]_o = 0.100 \text{ M} : [\text{NO}]_o = 0 : [\text{Br}_2]_o = 0$
- b) $[\text{NOBr}]_o = 0 : [\text{NO}]_o = 0.100 \text{ M} : [\text{Br}_2]_o = 0.100 \text{ M}$
- c) $[\text{NOBr}]_o = 0.100 \text{ M} : [\text{NO}]_o = 0 : [\text{Br}_2]_o = 0.100 \text{ M}$
- d) $[\text{NOBr}]_o = 0.100 \text{ M} : [\text{NO}]_o = 0.100 \text{ M} : [\text{Br}_2]_o = 0.100 \text{ M}$
- e) $[\text{NOBr}]_o = 0.200 \text{ M} : [\text{NO}]_o = 0.0500 \text{ M} : [\text{Br}_2]_o = 0.100 \text{ M}$

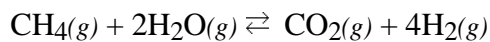
PS7.6. Consider the reaction



for which $\Delta H_{\text{rxn}} = -1036 \text{ kJ}$. Predict how the $[\text{H}_2\text{O}]$ will change when the equilibrium is disturbed by;

- a) Addition of O_2
- b) Addition of SO_2
- c) Addition of a catalyst
- d) Decrease in temperature
- e) Decrease in the volume of the reaction container

PS7.7. In the manufacture of ammonia from its elements hydrogen must be produced on site. An important source of hydrogen is the reforming of methane at high temperature. The reaction which describes the reforming of methane is;



a) A mixture of 1.00 mol of methane and 1.00 mol of water are heated to 1000 K in a 10.0 L flask. The mixture was allowed to reach equilibrium. The amount of unreacted methane was found to be 11.2 g. Calculate the amount of hydrogen at equilibrium.

b) Calculate the magnitude of the equilibrium constant for the reaction at 1000 K.

c) Calculate ΔH° for the reaction

d) Describe the effect on the equilibrium amount of H_2 produced by each of the following actions;

i) add a catalyst

iv) increase T to 1200 K

ii) add CH_4

v) transfer mixture to a 15.0 L flask

iii) remove CO_2

