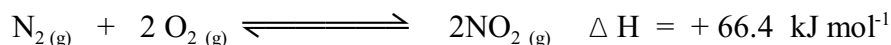


# GRAPHING EQUILIBRIUM

1. Plot the equilibrium graph (# moles verses time) for the following reaction (in a 1.0 L container):

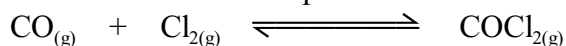


Initially there is 4.5 moles of  $\text{N}_2$ , and 7.5 moles of  $\text{O}_2$  and 0(zero) moles of  $\text{NO}_2$ .

- (a) After 2 minutes equilibrium is attained with the following equilibrium concentrations:  
[ $\text{N}_2$ ] = 2.5 mol/L, [ $\text{O}_2$ ] = 3.5 mol/L, [ $\text{NO}_2$ ] = 4.0 mol/L
- (b) Show the influence after 3 min of adding  $\text{N}_2$ , to the equilibrium, equilibrium is attained at 5 minutes.
- (c) show the influence at 5 min of increasing the volume of the system.
- (d) show the affect at 7 min of decreasing the temperature of the system.
- (e) show the affect at 9 min of increasing the pressure of the system.
- (f) show the affect 11 min of removing  $\text{NO}_2$ .

**NOTE: Assume equilibrium is reached 2 min after each change**

2. The following graph shows the number of moles of all 3 species of the following system plotted against time ...



Under a given set of conditions:

- (a) how much time was required for the system to reach equilibrium?
- (b) Approximate the value of K using the concentrations at  $t = 17 \text{ s}$
- (c) Explain the changes 20 s after the initiation of the reaction
- (d) What change in conditions might have been imposed on the system 30 s after the initiation of the reaction?
- (e) Are any events taking place between the interval of 15 s and 20s? Explain.
- (f) What changes may have taken place at  $t = 45 \text{ s}$ ?
- (g) What differences would you have noted if a catalyst had been present during the entire course of this reaction?
- (h) List the changes you might impose on this system if you wanted to produce a maximum amount of  $\text{COCl}_2$ ?
- (i) How could you account for the differences in the value of K at different points on the graph?

Graph used for question 2

