**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_**

**Homework**

**Chapter 14: *Chemical Kinetics***

**Exercises: Sections 14.1, 14.2:** *Reaction Rates*

**1.** **(a)** What are the units usually used to express the rates of reactions occurring in solution?

**(b)** What is the difference between ***average rate*** and ***instantaneous rate***?

**2.** A flask is charged with 0.100 mol of A and allowed to react to form B according to the hypothetical gas-

phase reaction A(g) → B(g). The following data are collected:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Time (s)**  0.0 40. 80. 120. 160.

**Moles of A** 0.100 0.067 0.045 0.030 0.020

**(a)** Calculate the number of moles of B at each time in the table.

**(b)** Calculate the average rate of disappearance of A for each 40-s interval, in units of mol/ s.

**(c)** What additional information would be needed to calculate the rate in units of concentration per time?

**3.** The rate of disappearance of HCl was measured for the following reaction:

**CH3OH(*aq*) + HCl(*aq*) → CH3Cl(*aq*) + H2O(*l*)**

The following data were collected:

**Time (min) [HCl] (M)**

*i.* 0.0 1.85

*ii.* 54.0 1.58

*iii*. 107.0 1.36

*iv.* 215.0 1.02

*v.* 430.0 0.580

Calculate the average rate of reaction, in M/ s, for the time interval between each measurement.

**4.** Using the data provided in Exercise 3, make a graph of [HCl] versus time.

**(a)** Draw tangents to the curve at:  ***t = 100 and t = 400 min***

**(b)** Use the lines in part (a) to determine the ***instantaneous rates*** in M/ min **and** M/ s at:

***t = 100 and t = 400 min***

**6.** **(a)** Consider the combustion of ethylene,

**C2H4(*g*) + 3 O2(*g*) → 2 CO2(*g*) + 2 H2O(*g*)**

If the concentration of C2H4 is decreasing at the rate of 0.18 M/ s, what are the rates of change in

concentrations of CO2 and H2O?

**reaction = aA + bB → cC + dD**

**rate = ─ Δ [A] = ─ Δ [B] = Δ [C] = Δ [D]**

**a Δ*t* b Δ*t* c Δ*t* d Δ*t***

**(b)** The rate of decrease in N2H4 partial pressure in a closed reaction vessel from the reaction

**N2H4(*g*) + H2(*g*) → 2 NH3(*g*)**

is 60. torr/ hr. What are the rates of change of both the NH3 partial pressure and total pressure in

the vessel?