**Quiz 5**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Consider the following reaction: C4H8 (g) → 2 C2H4 (g)

The following data was collected for the concentration of C4H8 as a function of time (6 points):

|  |  |
| --- | --- |
| Time (s) | [C4H8] (M) |
| 0. | 1.000 |
| 10. | 0.913 |
| 20. | 0.835 |
| 30. | 0.763 |
| 40. | 0.697 |
| 50. | 0.637 |

* 1. What is the average rate of reaction between 0 and 10 s?

$$rate=\frac{∆[C\_{4}H\_{8}]}{∆t}=\frac{(0.913 M-1.000 M)}{(10 s-0 s)}=-0.0087\frac{M}{s}$$

* 1. What is the rate of formation of C2H4 between 20 and 30 s?

$$rate=-\frac{∆[C\_{4}H\_{8}]}{∆t}=-\frac{(0.763 M-0.835 M)}{(30 s-20 s)}=-0.072 \frac{M}{s}$$

$$rate=-\frac{∆\left[C\_{4}H\_{8}\right]}{∆t}=+\frac{1}{2}\frac{∆\left[C\_{2}H\_{4}\right]}{∆t}$$

$$\frac{∆\left[C\_{2}H\_{4}\right]}{∆t}=-\left(2\right)\left(-0.072 \frac{M}{s}\right)=0.014\frac{M}{s}$$

1. How is the order of a reaction generally determined (4 points)?

The reaction order cannot be determined by stoichiometry of the reaction. It can only be determined by running controlled experiments where the concentrations of the reactants are varied and the reaction rates are measured and analyzed.

1. The reaction between chlorine monoxide and nitrogen dioxide (5 points):

ClO­ ­(g) + NO­2 (g) + M (g) → ClONO2 (g) + M (g)

Produces chlorine nitrate (ClONO2). A third molecule (M) takes part in the reaction, but is unchanged by it. The reaction is first order in NO2 and ClO.

1. Write the rate law for this reaction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_rate = k[NO2][ClO]\_\_\_
2. What is the reaction order with respect to M? \_\_\_\_\_\_\_\_zero\_\_\_\_\_\_\_\_
3. What is the overall order of the reaction? \_\_\_\_\_\_\_second order\_\_\_\_\_\_\_\_\_