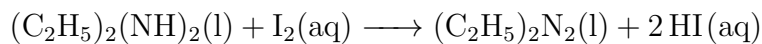# Chapter 11 − Problems 28

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1. Diethylhydrazine reacts with iodine according to the following equation. The rate of reaction is followed by monitoring the disappearance of the purple color due to iodine. The following data are obtained at a certain temperature.

$$(C_2H_5)_2(NH)_2(l) + I_2(aq) \longrightarrow (C_2H_5)_2N_2(l) + 2\,HI(aq)$$

Expt.	$[(C_2H_5)_2(NH)_2]$	$[I_2]$	Initial Rate
1	.15	.25	$1.08 \cdot 10^{-4}$
2	.15	.362	$1.56 \cdot 10^{-4}$
3	.2	.4	$2.3 \cdot 10^{-4}$
4	.3	.4	$3.44 \cdot 10^{-4}$

(a) What is the order of the reaction with respect to diethylhydrazine, iodine, and overall?

$$\frac{1.08}{1.56} = \left(\frac{.25}{.362}\right)^m$$
$$m = 1$$
$$\frac{2.30}{3.44} = \left(\frac{.2}{.3}\right)^n \tag{1}$$
$$n = 1$$

Order of reaction is 2

(b) Write the rate expression for the reaction.

$$rate = k[(C_2H_5)_2(NH)_2)][I_2] \tag{2}$$

(c) Calculate k for the reaction.

$$3.44 \cdot 10^{-4} = k(.3)(.4)$$
$$k = .0029 \left[\frac{\text{L}}{\text{mol h}} \right] \tag{3}$$

(d) What must $[(C_2H_5)_2(NH)_2]$ be so that the rate of the reaction is $5 \cdot 10^{-4} \left[\frac{M}{h} \right]$ when $[I_2] = .5[M]$?

$$5 \cdot 10^{-4} = .0029(a)(.5)$$
$$a = .345[M] \tag{4}$$