Name:______________________________

1. (10 pt.) Consider the reaction:

   $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(g)$

The following data was obtained at 298 K.

$[H_2(g)]_0$ (M)	$[O_2(g)]_0$ (M)	Initial Rate (M/s)	Temp (K)
1.50	1.50	0.33	298 K
1.50	0.75	0.17	298 K
3.00	1.50	0.65	298 K

What is the rate constant for the reaction at 298 K?

1^{st}, I need the rate law. You can do it the long way, if you want.

Just looking at the 1^{st} two mixtures, when I doubled the O_2 (0.75 to 1.50 M) while keeping H_2 constant, the rate approximately doubled (0.17 to 0.33 M/s). It is 1^{st} order in O_2.

If I look at the 1^{st} and 3^{rd} mixtures, doubling the H_2 (1.50 to 3.00 M) while keeping O_2 constant resulted in the rate doubling (0.33 to 0.65 M/s). It is 1^{st} order in H_2.

So:

$$Rate = k[H_2][O_2]$$

Now, I can just plug in the data to get the rate constant. They are all slightly different, so I'll take the average.

$$0.33\frac{M}{s} = k[1.50\ M][1.50\ M]$$

$$k = 0.147\frac{1}{Ms}$$

$$0.17\frac{M}{s} = k[0.75\ M][1.50\ M]$$

$$k = 0.151\frac{1}{Ms}$$

$$0.65\frac{M}{s} = k[3.00\ M][1.50\ M]$$

$$k = 0.144 \frac{1}{Ms}$$

$$k_{avg} = 0.147 \frac{1}{Ms}$$