

Unit 5: AP Free Response Practice #1 [4 points]

1. The rate of decomposition of azomethane ($C_2H_6N_2$) was studied by monitoring the partial pressure of the reactant as a function of time, and the data below was collected.

	Time (s)	P (mmHg)	ln(P)
	0	284	5.51 ← 5.65
100 sec. ↙	100	220	5.39
50 sec. ↙	150	193	5.26
" ↙	200	170	5.14
" ↙	250	150	5.01

Handwritten annotations: A box around 5.65 with an arrow pointing to the ln(P) value at 0s. Brackets on the right indicate differences: 0.26 between 5.65 and 5.39, 0.13 between 5.39 and 5.26, 0.12 between 5.26 and 5.14, and 0.13 between 5.14 and 5.01.

- Determine if the data above support a first order reaction. Justify your answer. [1 point]
- Calculate the rate constant for the reaction, including units. [2 points]
- In a second trial, the initial pressure of azomethane was doubled. Does the rate constant, k , for the reaction increase, decrease, or stay the same? Justify your answer. [1 point]

a.) The provided data does support a 1st order rxn, b/c a plot of $\ln(P)$ vs. time will be linear (as shown by the approximately constant rate of change in $\ln(P)$ every 50 seconds).

$$b.) k = |\text{slope}| = \left| \frac{\Delta \ln(P)}{\Delta \text{time}} \right| = \left| \frac{5.39 - 5.65}{100 - 0} \right| = \frac{0.26}{100} = 0.0026 \text{ Sec}^{-1}$$

c.) The rate constant, k , will stay the same when pressure is doubled, b/c k is independent of pressure (or concentration) (remember: k can only be changed by temp. changes or addition of a catalyst!)