

1. Attempt questions 1 on **pg 366** (/4)
2. Attempt questions 3, 4 on **pg 371** (/4)
3. Attempt questions #2 on **pg 390**, and #1 on **pg 397** (4)
4. A reaction occurs between A, B, and C. (/2)
  - i) doubling [A] doubles the rate
  - ii) doubling [B] has no effect
  - iii) doubling [C] increases the rate x 4
 \* Write the Rate Law Expression for this rx.
5. A reaction occurs between P, Q, & R. Experiments to measure the rate produced the following results: (/3)

Initial [P]	Initial [Q]	Initial [R]	RATE (mol/L.s)
0.01	0.04	0.10	$2 \times 10^{-3}$
0.03	0.04	0.10	$2 \times 10^{-3}$
0.01	0.12	0.10	$18 \times 10^{-3}$
0.01	0.04	0.30	$6 \times 10^{-3}$

\* Write the rate law expression for this reaction and calculate the rate law constant.

6. A reaction occurs between X, Y, & Z. The rate law expression is  $RATE = k [X]^2 [Z]^{1/2}$ . (/4)

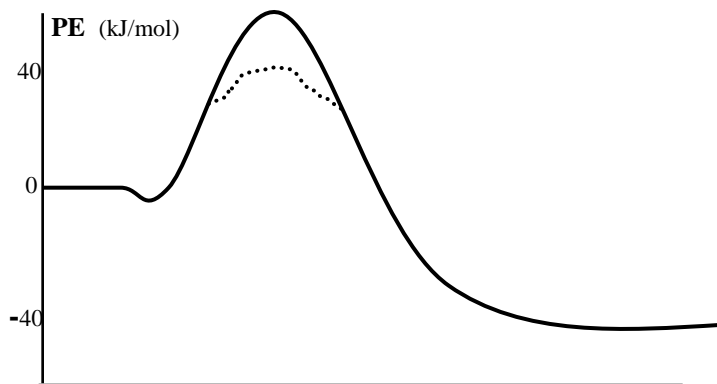
\* Calculate numerical values for the rates (a), (b) & (c) in the chart below.

Initial [X]	Initial [Y]	Initial [Z]	RATE (mol/L.s) x $10^3$
0.02	0.10	0.06	$4 \times 10^3$
0.10	0.10	0.06	<b>a</b>
0.02	0.30	0.06	<b>b</b>
0.02	0.10	0.90	<b>c</b>

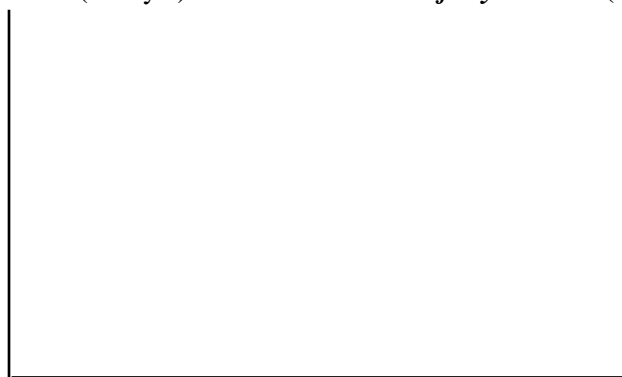
7. The decomposition of  $SO_2Cl_2$  ( $SO_2Cl_2 \rightarrow SO_2 + Cl_2$ ) has a 1<sup>st</sup> order rate constant of  $2.2 \times 10^{-5} s^{-1}$  at 320 °C. If the original concentration of  $SO_2Cl_2$  is 0.004 M, what will its concentration be (a) after 1 hour and (b) after 1 day? (/4)
8. The initial dose of a drug in an animal was 25 mg/kg body weight. After 2 h this dropped to 15.0 mg/kg. If this drug is metabolized by a 1<sup>st</sup> order process, what is the rate constant for this process ( $min^{-1}$ ). (/2)
  - b) If the drug concentration was 5.0 mg/kg 3.0 hours after ingestion, what was the initial dose of the drug? (/2)
9. Strontium-90 has a half life of 28 years. A rock sample was found & analyzed to find only 2% of the expected strontium-90 present. How old is the rock? (/2)

10. a) Is the rxn endo or exothermic ?
- b) What is  $\Delta H_{rx}$ ? ..... With the catalyst? .....
- c) What is  $E_a$  ..... With the catalyst? .....
- d) Explain how this diagram proves a catalyst increases the rate of reaction.

(/6)



11. On the 1<sup>st</sup> set of axes below, draw a PE diagram showing a reaction with a  $\Delta H_{rx} = -150 kJ$  /  $E_a(\text{no catalyst}) = 120 kJ$  /  $E_a(\text{catalyst}) = 80 kJ$  - **Be sure it is fully labeled** (/3)



12. Radioactive iodine-129 has a 1/2 life of **28 min**. If the amount of  $^{129}\text{I}$  remaining in a sample is only 1/50 of the amount originally present, how many **hours** has the sample been decaying? (/2)

13. Organic compounds that contain large proportions of nitrogen and oxygen tend to be unstable and are easily decomposed. Hexanitroethane,  $\text{C}_2(\text{NO}_2)_6$ , decomposes according to this equation:



The reaction is 1<sup>st</sup> order with respect to  $\text{C}_2(\text{NO}_2)_6$ . At  $70^\circ\text{C}$ ,  $k=2.41 \times 10^{-6} \text{ s}^{-1}$  & at  $100^\circ\text{C}$   $k=2.22 \times 10^{-4} \text{ s}^{-1}$

a) What is the 1/2 life of this reaction( in **minutes & hours**) of  $\text{C}_2(\text{NO}_2)_6$  @ i)  $70^\circ\text{C}$  and ii)  $100^\circ\text{C}$  (/4)

b) If 0.10 mol of  $\text{C}_2(\text{NO}_2)_6$  is dissolved in 1.0 L of  $\text{CCl}_4$  @  $70^\circ\text{C}$  what will the concentration of  $\text{C}_2(\text{NO}_2)_6$  be in 8.33 h ? (/2)

### **Application Questions (text questions may ask for a report. Don't do this; a brief paragraph will suffice)**

14. Do questions 6, 7 on **pg 371**. (/6)

15. Do question 9 on **pg 381**. (/6)

### **Lab (/15)**

16. Lab 4 Determination of the Order of a Reaction: Write the following:

- **Purpose:** 2-3 sentences stating why we performed this lab
- **Observations:** draw the table filling in all blocks. Include your graph of  $\ln(1/t)$  vs.  $\ln[\text{H}^+]$ .
- **Sample calculations:** for calculations done, do **1 sample calculation** to show how values were determined
- **Conclusion:** state rate law expression including **order of reaction** and "**k**", and explain errors/discrepancies found in your experiments

**\*\* for lab:**

$\ln(1/t)$  is the y-axis (vertical)

$\ln[\text{H}^+]$  is the x-axis (horizontal)

**To find order of reaction:**

Slope of line = rise/run

**To find "k"**

y-intercept = k