CHM 330 - Worksheet 3
Prof. A.J. Pounds
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1. At 320°C and normal atmospheric pressure, the unimolecular decomposition of sulfuryl chloride,

$$SO_2Cl_2(g) \longrightarrow SO_2(g) + Cl_2(g)$$

proceeds via first order kinetics with a half life of 525 minutes. If the initial concentration of sulfuryl chloride is 0.125 M:

   (a) What will be the concentration after 12 hours?

   (b) How long, in hours, will it take 95% of the SO_2Cl_2 to decompose?

2. The following kinetic data were obtained for the reaction

$$2ICl(g) + H_2(g) \longrightarrow I_2(g) + 2HCl(g)$$

Experiment	Initial [ICl] $mol \cdot L^{-1}$	Initial [H_2] $mol \cdot L^{-1}$	Initial Rate $mol \cdot L^{-1} \cdot s^{-1}$
1	1.5×10^{-3}	1.5×10^{-3}	3.7×10^{-7}
2	3.0×10^{-3}	1.5×10^{-3}	7.4×10^{-7}
3	3.0×10^{-3}	4.5×10^{-3}	2.2×10^{-6}
4	4.7×10^{-3}	2.7×10^{-3}	?

   What is the initial rate in experiment 4?

3. For the following two-step mechanism;

$$A + B \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} C$$
$$C \xrightarrow{k_2} D + B$$

   Use the steady state approximation and derive the proposed rate law for the disappearance of A.

4. Kinetic experiments were performed on the **first order** reaction

$$B_2 \longrightarrow 2B$$

to determine the reaction's temperature dependence. The resulting data are found in the table below

Experiment	Initial $[B_2]$ $mol \cdot L^{-1}$	Temperature °C	Initial Rate $(mol\ B_2) \cdot L^{-1} \cdot s^{-1}$
1	0.10	150	3.2×10^{-4}
2	0.20	300	6.0×10^{-3}
3	0.15	250	?

What is the **predicted rate** in the third experiement?

5. For a sugar (S) that reacts with an enzyme (E) via the Michaelis-Menten mechanism

$$S + E \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_2} P + E$$

the following two points of kinetic data were obtained:

Experiment	Initial [S] $mol \cdot L^{-1}$	Initial Rate $(mol\ S) \cdot L^{-1} \cdot s^{-1}$
1	1.0	0.5459
2	2.5	0.9208

Using the Lineweaver-Burk method what is the value of

(a) $V_{\max}$

(b) K_M

Please express your results to two significant figures.