Worksheet 1

1. All of the following affect the rate of a reaction except
    a. Concentration of reactants
    b. Surface area of reactants
    c. Temperature
    d. The presence of a catalyst
    e. None of the above
2. For the reaction $N_2 + 3 H_2 \rightarrow 2 NH_3$, the
    a. rate of reaction = _____ rate of production of NH_3
    b. rate of reaction = _____ rate of consumption of H_2

Use the following table for questions 3-4

Time (s)	[A] (M)
0	0.165
200	0.112
500	0.054
800	0.028
1200	0.015
1500	0.013

3. What is the average reaction rate between 0 and 1500 seconds?
4. What is the instantaneous reaction rate at 800 seconds?
5. At a certain time in a reaction, substance A is disappearing at a rate of 2.0×10^{-2} M/s, substance B is appearing at a rate of 4.0×10^{-2} M/s, and substance C is appearing at a rate of 8.0×10^{-2} M/s. Propose a chemical equation relating the three substances.

6. Consider the reaction: $3I^- + IO_2^- + 4H^+ \rightarrow 2 I_2 + 2H_2O$. The reaction is first order with respect to I^-, second order with respect to H^+ and fifth order overall. What is the rate law?

7. If the concentration of IO_2^- were doubled, what would happen to the reaction rate?

8. Considering the reaction $2 UO_2^{+} + 4H^{+} \rightarrow U^{4+} + UO_2^{2+} + 2H_2O$ and the initial rate data below, derive the rate law for the reaction and find the rate constant k with the correct units.

Experiment	Initial Concentration UO_2^{+}	Initial Concentration H^{+}	Initial Rate of Reaction
1	0.0012	0.22	4.12×10^{-5}
2	0.0012	0.35	6.55×10^{-5}
3	0.0030	0.35	4.10×10^{-4}

9. What are the units of the rate constant for $Rate=k[CHCl_3][Cl_2]^{3/2}$?

10. A certain reaction X + Y → Z is described as being second order in [X] and fourth order overall. Which of the following statements are true?
    a. The rate law for the reaction is Rate = k[X]^2[Y]
    b. If the concentration of X is increased by a factor of 1.5, the rate will increase by a factor of 2.25
    c. If the concentration of Y is increased by a factor of 1.5, the rate will increase by a factor of 2.25

Part 2

Question 8 Extension: What is the rate of disappearance of UO2(+) when [UO2(+)]= 4.5×10−2 M and [H+]= 0.18 M ? Assume the rate of reaction relates to U(4+).

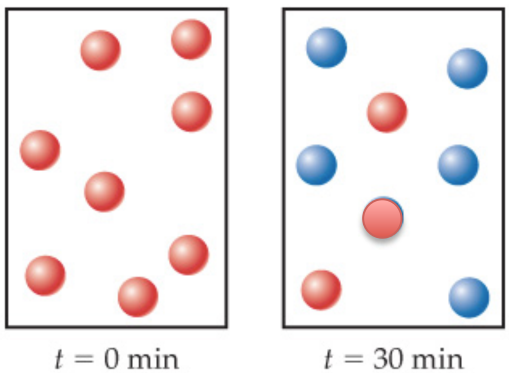
Time (min)	[X](M)
0	0.467
1	0.267
2	0.187
3	0.144
4	0.117
5	0.099
6	0.085
7	0.075

1. Using the table above how would you decide the order of the reaction with respect to [X]? What is the order?
   a. 0
   b. 1
   c. 2
2. Given that the rate constant for the decomposition of hypothetical compound X from part A is 1.15 M−1·min−1, calculate the concentration of X after 25.0 min.
3. What is the definition of half-life?
4. Calculate the half-life of potassium-43 assuming it follows second-order kinetics with a rate constant of 8.634 x 10^-6 and starting with 2 M potassium.

5. Calculate the half-life of potassium-43 assuming it follows second-order kinetics with a rate constant of 8.634 x 10^-6 and starting with 4 M potassium.

6. Calculate the half-life of potassium-43 assuming it follows first-order kinetics with a rate constant of 8.634 x 10^-6 and starting with 2 M potassium.

7. Calculate the half-life of potassium-43 assuming it follows first-order kinetics with a rate constant of 8.634 x 10^-6 and starting with 4 M potassium.



8. Given the picture above, find the rate constant k assuming the reaction follows first-order kinetics.

9. At 25∘C, the decomposition of dinitrogen pentoxide, N2O5(g), into NO2(g) and O2(g) follows first-order kinetics with k=4.3×10−4 s−1. A sample of N2O5with an initial pressure of 760 torr decomposes at 25∘C until its partial pressure is 450 torr. How much time (in s) has elapsed?