Kinetics Worksheet Answers

1. A 2.50 M solution undergoes a chemical reaction. After 3.00 minutes, the concentration of the solution is 2.15 M. What is the rate of the reaction in M/s?

   Rate=change in concentration of reactant/change in time = (2.5M-2.15M)/180 sec = .0019 M/s

2. Zinc metal reacts with hydrochloric acid. Which of the following would result in the highest rate of reaction?

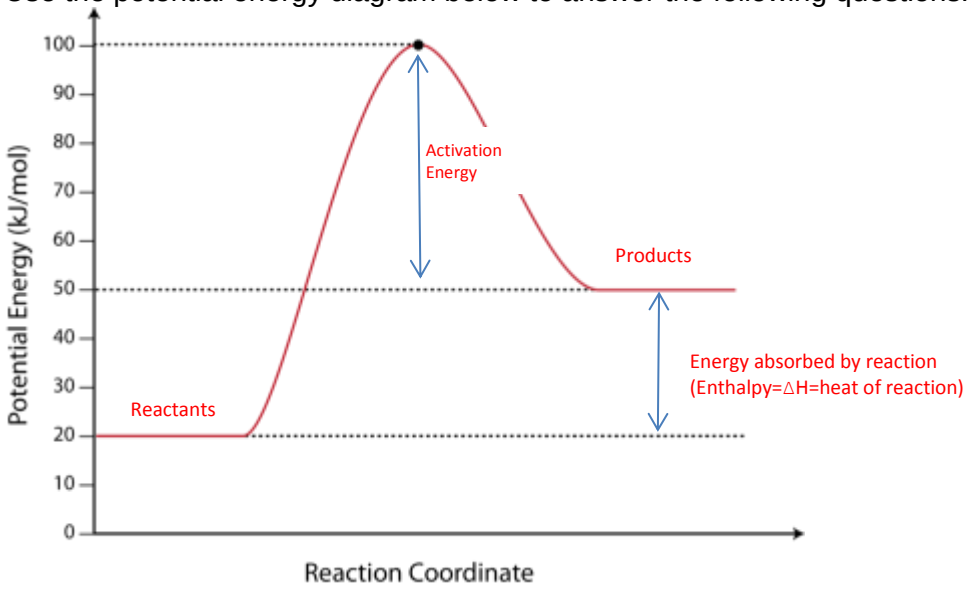
   a. A solid piece of zinc in 1 M HCl

   b. A solid piece of zinc in 3 M HCl

   c. Zinc powder in 1 M HCl

   d. *Zinc powder in 3 M HCl* (higher concentration, higher surface area)

3. Use the potential energy diagram below to answer the following questions.



   a. What is the potential energy of the reactants? 20

   b. What is the potential energy of the products? 50

   c. What is the heat of reaction (ΔH)? 30

   d. What is the potential energy of the activated complex? 100

   e. What is the activation energy for the reaction? 50

   f. Is the reaction endothermic or exothermic? Endothermic (because energy was absorbed)

   g. Which of the values in a-e above would be changed by the use of a catalyst in the reaction? e

Answer questions 1-8 using the following table:

$$2ICl + H_2 \rightarrow I_2 + 2HCl$$

Experiment	[ICl]	[H_2]	Initial Rate
1	0.10 mol/L	0.01 mol/L	0.002 mol/L · s
2	0.20 mol/L	0.01 mol/L	0.004 mol/L · s
3	0.10 mol/L	0.04 mol/L	0.008 mol/L · s

4) Examine the [ICl] concentration between experiment 1 and 2. What happens? Doubles
5) What happens to the [H_2] between experiment 1 and 2? Remains constant
6) What happens to the initial rate between experiment 1 and 2? Doubles
7) What happens to the [H2] between experiments 1 and 3? it quadruples , four times greater
8) What happens to the [ICl] between experiments 1 and 3? it remains constant
9) What happens to the initial rate between experiments 1 and 3? it quadruples , four times greater
10) Calculate the rate law of this reaction: Rate = $k[ICl]^1[H_2]^1$
11) Determine the rate law constant (k) for this reaction:
Rate = $k[0.10\ mol/L]^1[0.01\ mol/L]^1$
Initial Rate = 0.002 mol/(L · s)
$0.002\ mol/(L \cdot s) = k[0.10\ mol/L]^1[0.01\ mol/L]^1$
k = 2

12) What is the overall reaction order for the following rate law:

Rate = $k[A]^1[B]^1$

a) 1 **b) 2** c) 3 d) 4

13) Write the rate constant from the information below:

$$A + B \rightarrow Products$$

Experiment	Initial [A]	Initial [B]	Initial Rate
1	0.01 mol/L	0.03 mol/L	2.4×10^{-4} mol/L · s
2	0.03 mol/L	0.03 mol/L	7.2×10^{-4} mol/L · s
3	0.01 mol/L	0.06 mol/L	2.4×10^{-4} mol/L · s

Rate = $k[A]^1[B]^0$

14) NO reacts with chlorine in a gas phase reaction to form nitrosyl chloride, NOCl. From the following experimental data, determine the form of the equation that describes the relationship of reaction rate to initial concentrations of reactants.

$$2NO + Cl_2 \rightarrow 2NOCl$$

Experiment	Initial [NO]	Initial [Cl_2]	Rate of reaction
1	0.50 M	0.35 M	1.14 M/hr
2	1.00 M	1.00 M	9.12 M/hr
3	1.00 M	0.35 M	4.56 M/hr

a) Rate = k[NO]
b) Rate = k[NO][Cl2]
c) Rate = $k[NO]^2$
d) Rate = $k[NO]^2[Cl_2]$
e) Rate = $k[NO]^2[Cl_2]^2$