**Name:** _____ **Period:** _____ **Seat#:** _____

Conceptual Questions

1) A study of reaction _____ is called

chemical _____.

2) What are the FOUR major factors that affect reaction rate?

3) Reaction rate refers to how quickly or slowly the _____ disappear and the

_____ appear. It is measured in terms of the _____ of the reactants.

4) Write a generic equation for Reaction Rate

5) Why would a mixture of gases react faster when the volume they occupy is decreased?

6) Why would iron filings rust faster than an iron nail?

7) What is meant by the rate-determining step?

8) How would the increasing of partial pressure of reactive components of a gaseous mixture affect the rate at which the components react with one another?

9) What information is needed to relate the rate of disappearance of reactants to the rate of appearance of products? (Hint: Chemical equation)

10) How would you change temperature of a reaction if you wanted to increase the rate of reaction? Explain how this effects the reaction using the collision theory.

11) Why would the rate of reaction decrease as the reaction produces more products?

12) If you put 100g of NaOH in cube form and 200g of NaOH in powered form which will react with HCl at a faster rate? Explain why

13) What is the activation energy? In other words, what two things is the Activation Energy being used for?

14) What is a catalyst and why is it different from a reactant in an equation?

15) In the following three step reaction, which step is the fastest? Which step is the slowest?
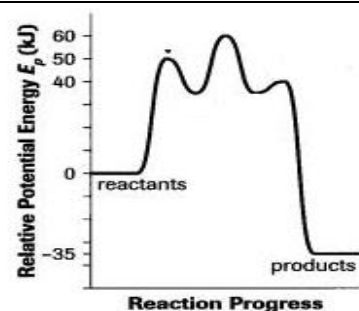
16) Draw an exothermic reaction graph shown with and without a catalyst

17) Write the rate expression for $2H_2O \rightarrow 2H_2 + O_2$

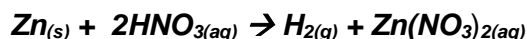**18)** Write the rate expression for $2SO_2 + O_2 \rightarrow 2SO_3$

19) Write the rate expression for $2NO + 2H_2 \rightarrow N_2 + 2H_2O$

Mathematical Questions

- Show all work involved.
- Get an actual answer when applicable, including units! Box your answer!

20) The following table relates the *time* and the *mass of Zn* during the reaction between Zn and 0.5M HNO_3:

$$Zn_{(s)} + 2HNO_{3(aq)} \rightarrow H_{2(g)} + Zn(NO_3)_{2(aq)}$$

Time	Mass of Zn (g)
0.0 s	36.2 g
60.0 s	29.6 g
120.0 s	25.0 g
180.0 s	22.0 g

a) Calculate the rxn rate, in g/s, from 0s to 60 s.

b) Calculate the rxn rate, in g/s, from 120s to 180 s.

21) A chemist wishes to determine the rate of reaction of zinc with hydrochloric acid.
   The equation for the reaction is:

$$Zn_{(s)} + 2HCl_{(aq)} \rightarrow H_{2(g)} + ZnCl_{2(aq)}$$
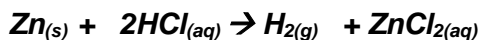
A piece of zinc is dropped into 1.00 L of 0.100 M HCl and the following data were obtained:

Time	Mass of Zinc (g)
0 s	0.016 g
4 s	0.014 g
8 s	0.012 g
12 s	0.010 g
16 s	0.008 g
20 s	0.006 g

a) Calculate the Rate of Reaction in *grams of Zn consumed per second.*

b) Calculate the Rate of Reaction in *moles of Zn consumed per second.*

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22) Solid phosphorus and oxygen gas react to form tetraphosphorus decoxide. Determine the average rate of reaction for oxygen during the first 40 s if the concentration changes from 0.200 mol/L to 0.0001 mol/L during this time interval.

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23) At 40ºC, hydrogen chloride gas will form from the reaction of gaseous hydrogen and chlorine, according to the following balanced chemical equation:

$$H_2 (g) + Cl_2 (g) \rightarrow 2\ HCl (g).$$
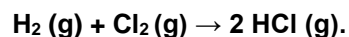
Time (s)	Concentration (mol/L)		
	H_2 (g)	Cl_2 (g)	HCl (g)
0	1.000	1.000	0.000
2.16	0.500	0.500	1.000
4.32	0.250	0.250	1.500

Using the data provided, calculate the following average rates:

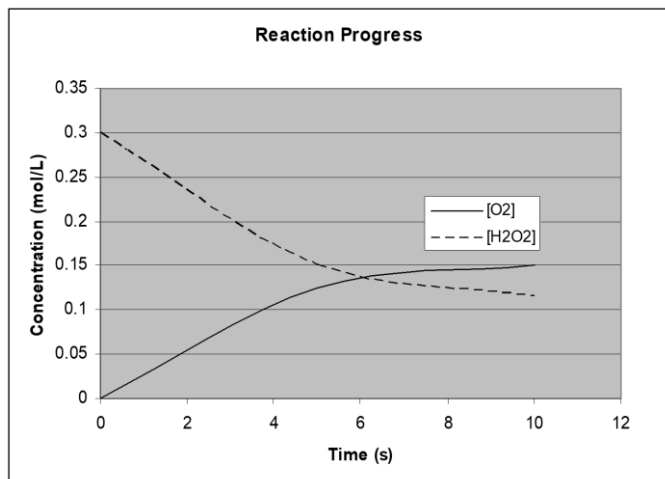**a)** hydrogen gas in the first 2.16 s.

a) hydrogen chloride gas in the first 4.32 s

b) chlorine gas between 2.16 s & 4.32 s

c) hydrogen gas in the first 4.32 s

24) Hydrogen peroxide in aqueous solution will decompose to produce oxygen gas and water. Use the graph to:

Reaction Progress

a) Calculate the average reaction rate of hydrogen peroxide between 0 s and 5 s.

b) Calculate the average reaction rate for the oxygen gas between 0 s and 2 s.

c) Calculate the average reaction rate for the oxygen gas between 4 s and 6 s.

d) Calculate the average reaction rate for the oxygen gas between 6 s and 8 s.

e) Using your answers for 3b-3e, is the rate of a reaction a constant value from start to finish? Why do you think it is or isn't a constant value? What is causing the rate to stay the same or change?

25) Consider the following reaction: 8A + 5B → 8C + 6D   [C] is increasing at a rate of 4.0 mol L-1 s-1

a) Write a rate expression for this reaction that you will use to calculate answers to parts b-d

b) At what rate is [B] changing?

c) At what rate is [C] changing?

d) At what rate is [D] changing?