Chemistry worksheet on reaction rates

1) Examine the following two statements and decide whether to classify it as a thermodynamic or kinetic statement

a. Sometimes molecules don't react because the reaction is unfavourable, and the products are higher in energy than reactants Thermodynamics * favourability *

b. Sometimes molecules don't react because there's an energy barrier that prevents it Kinetics * Rate *

2) Determine which of the following would make a reaction proceed more quickly

a. Decreasing the surface area of a solid F

b. Decreasing the concentration of reactants F

c. Increasing the concentration of reactants T

d. Decreasing the temperature F

3) Fill in the blanks

1. Reaction rate refers to how quickly or slowly the reagents disappear and the products appear
2. Change in concentration for products of a reaction are (+) and (-) for reagents
3. Increasing the temperature of a reaction ↑ the rate
4. Rates must be (+) and proportional to stoichiometry.

4) Consider the following reaction

$Zn_{(s)} + 2HCl_{(aq)} \rightarrow H_{2(g)} + ZnCl_{2(aq)}$

A piece of zinc is dropped into 1.00 L of 0.100M of HCl and the following data was obtained

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

a) Calculate the rate of reaction in grams of Zn consumed per second

$\text{rate} = \frac{\Delta \text{mass}}{\Delta \text{time}} = \frac{0.016 - 0.006\,g}{20 - 0} = \frac{0.010\,g}{20\,s} = 5 \times 10^{-4}\ g/s$

b) Calculate the rate of reaction of moles of Zn consumed per second

$5 \times 10^{-4}\ g\ Zn/s \times \frac{1\ mol\ Zn}{65.4\ g\ Zn} = 7.6 \times 10^{-6}\ mol\ Zn/s$ OR $8.0 \times 10^{-6}\ \frac{mol}{s}\ Zn$

c) What will happen to the concentration of $[H^+]$ as the reaction proceeds?

decrease

d) What happens to the concentration of $[Cl^-]$ as the reaction proceeds

No change (spectator)

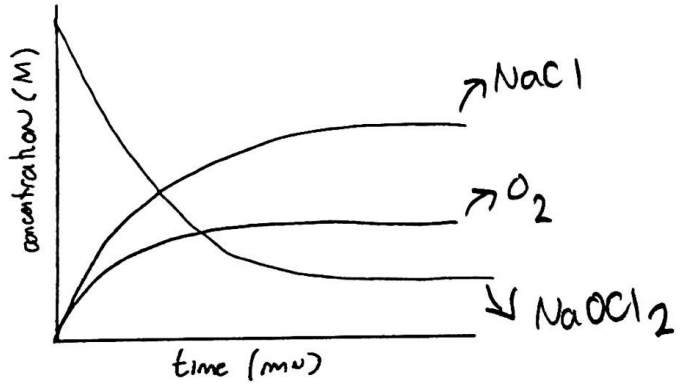
e) What happens to the concentration of $[ZnCl_2]$ as the reaction proceeds

increases

5) Consider the following reaction

$2NaOCl_{2(aq)} \rightarrow 2NaCl_{(aq)} + O_{2(g)}$

Consider the relative graph below



a. Which line corresponds to the concentration of O_2?

Green

b. What line corresponds to NaCl?

black

c. What line corresponds to $NaOCl_2$?

Red

d. Write the rate of this reaction in the following form

$$\text{RATE} = -\frac{1}{a}\frac{\Delta[A]}{\Delta t} = -\frac{1}{b}\frac{\Delta[B]}{\Delta t} = +\frac{1}{g}\frac{\Delta[G]}{\Delta t} = +\frac{1}{h}\frac{\Delta[H]}{\Delta t}$$

$$= -\frac{1}{2}\frac{d[NaOCl_2]}{dt} = \frac{1}{2}\frac{d[NaCl]}{dt} = \frac{d[O_2]}{dt}$$

e. If over the first 20 minutes the change in concentration for O_2 is 0.32M what is the rate?

$$20\text{MIN} \times \frac{60\text{s}}{1\text{MIN}} =$$

$$\text{Rate} = \frac{0.32\text{M}}{1200-0\text{ s}} = 2.6\times10^{-4}\ \text{M s}^{-1}$$

6) A reaction A→ B with the rate equation rate = k [A]^1 has a rate of 100 M/hr when [A] = 6M what is the overall order of the reaction and what is the value of k?

$$100\frac{\text{M}}{\text{hr}} = K\ [6\text{M}]$$

$$K = \frac{100\text{ M}}{6\text{M hr}} \quad \boxed{K = 16.67\ \text{hr}^{-1}} \quad \text{Reaction is } 1^{st} \text{ order}$$

7) Make two examples of a rate equation with an overall order of reaction = 2

$$\text{Rate} = k\,[A][B]$$

$$\text{Rate} = k\,[A]^2$$

8) Determine the orders of the following reactions

a. Rate = k $[A]^2[B]^2$ 4

b. Rate = k [A] [B] 2

c. Rate = k $[A]^3$ 3

9) Consider the data below and given the equation

$A + B \rightarrow C$

Rate = $k [A]^m [B]^n$

Exp	[A]/M	[B]/M	Initial rate Ms^{-1}
1	0.6	0.3	2.6×10^{-4}
2	0.6	0.9	7.8×10^{-4}
3	1.2	0.3	20.8×10^{-4}

[A] Rates

a. Given the data above what are the orders of A, B and the overall order of the reaction?

A = 2 : 8 $2^n = 8$ $2^3 = 8$ A = 3

B = 3 : 3 1 : 1 ratio B = 1

b. What happens to the rate when B is doubled?

Rate is also doubled

Rate $\propto$ [B]^1