Reaction Kinetics

1.) A $5.0\ g$ sample of magnesium reacts completely with a hydrochloric acid solution after $150\ s$. Express the average rate of consumption of magnesium, in units of $\frac{g}{min}$.

2.) How long will it take to completely react $45.0\ g\ CaCO_{3\ (s)}$ with dilute $HCl_{\ (aq)}$ if the reaction proceeds at an average rate of $\frac{2.35\ g\ CaCO_{3\ (s)}}{min}$ under a given set of conditions?

3.) The electrolysis of water produces oxygen gas at the rate of $\frac{32.5\ mL}{min}$ in a certain experiment. What volume of oxygen gas can be produced in $7.50\ min$?

4.) Which of the following are acceptable units of expressing reaction rate?

a.) $\frac{moles}{second}$ c.) $\frac{\frac{moles}{litre}}{second}$ e.) $\frac{millilitres}{hour}$

b.) $\frac{minutes}{metre}$ d.) $\frac{grams}{litre}$ f.) $\frac{grams}{minute}$

5.) Hydrogen and oxygen gas react in a fuel cell to produce water according to the equation:

$$2\ H_{2\ (g)} + O_{2\ (g)} \rightarrow 2\ H_2O_{\ (l)}$$

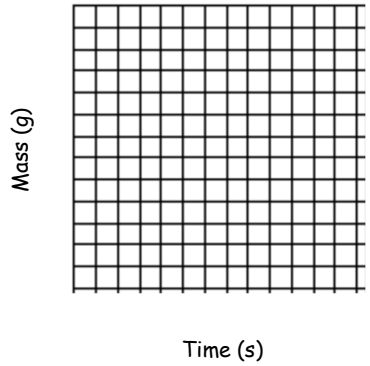
If the rate of water production s $1.34\frac{mol}{min}$, what is the rate of oxygen gas consumption expressed in $\frac{mol}{min}$?

6.) When an Alka Seltzer™ tablet is dropped in water, it immediately begins to produce bubbles of CO_2 forming. The reaction is as follows:

$$NaHCO_{3\ (s)} + H^+_{\ (aq)} \rightarrow CO_{2\ (g)} + Na^+_{\ (aq)} + H_2O_{\ (l)}$$

The H^+ is produced in the reaction and the $NaHCO_3$ (baking soda) is an ingredient of the tablet. If the following data was found for the above reaction, plot the data on the graph below.

Time (s)	Mass (g)
0	150.00
10	149.94
20	149.88
30	149.82



Using the graph you created above, answer the following questions.

a.) Why is the mass decreasing?

b.) What is the slope of the line in the above graph including units?

c.) What units would you expect to use for the rate of this reaction?

d.) What relationship exists between the slope of the graph and the rate of the reaction?

7.) When measuring the rate at which the mass of copper metal decreases in a reaction with nitric acid, why can't you just put the reaction vessel on a digital balance and record the decrease in mass of the copper?

8.) a.) Solutions of $Cu^{+2}_{(aq)}$ are blue, while solutions of $Ag^{+}_{(aq)}$ are colourless. Use only this information to describe how you would measure the rate of the reaction:

$$2\ Ag^{+}_{(aq)} + Cu_{(aq)} \rightarrow 2\ Ag_{(s)} + Cu^{+2}_{(aq)} + 35\ kJ$$

b.) Suggest two more methods that could be used to determine the reaction rate for the equation above. Be sure to state the property you are monitoring.

9.) a.) You are to measure the rate of this reaction: $H_{2\,(g)} + Cl_{2\,(g)} \rightarrow 2\ HCl_{\,(g)}$. Why is gas pressure NOT a good property to monitor in order to determine the reaction rate?

b.) Calculate the reaction rate, in $\frac{mol\ HCl}{s}$, if $1.2\ g$ of $HCl_{\,(g)}$ are produced in $2.0\ min$.

c.) If the rate of consumption of hydrogen gas under certain conditions is $0.200\ L/min$, what is the rate of production of $HCl_{\,(g)}$?