FLINN SCIENTIFIC

Name_____

Activity A. Surface Area

Observations and Analysis

1. Describe the observations and compare and contrast the reactions of granular zinc and zinc shot with hydrochloric acid. Be as specific as possible.

2. Based on your observations, estimate the relative rates of reaction for granular zinc compared to zinc shot.

3. Describe quantitatively (explain) which form of zinc has the greater surface area.

4. The average shot piece is a cylinder with a diameter of 7.5 mm, a height of 2.0 mm, and a mass of 0.40 g. The average zinc granule is a sphere with a diameter of 0.84 mm. Using the formulas listed below, calculate the total surface area for 0.40 g of each form of zinc.

   Surface area of a cylinder $= 2\pi r^2 + 2\pi rh$
   Surface area of a sphere $= 4\pi r^2$
   Volume of a sphere $= 4/3\pi r^3$
   Volume of cylinder $= \pi r^2 h$
   Density of zinc $= 7.141\ g/mL$

5. What is the ratio of the granular surface area to the shot surface area? How does this compare to your estimate of the relative reaction rates between the two?

Activity B. Reactant Concentration

Data and Results Table

Concentration	0.5 M HCl	1.0 M HCl	2.0 M HCl
Reaction Time, t (sec)			
Reaction Rate (1/t), sec^{-1}			

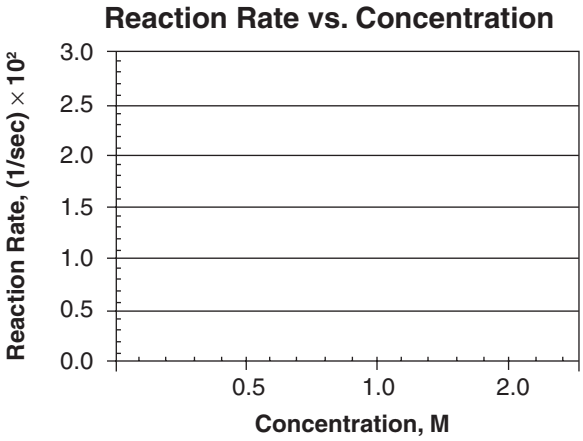
Observations and Analysis

1. As reaction times increase, the rate of the reaction decreases, in other words, the rate of reaction is inversely proportional to the time required for the reaction to go to completion.

   Rate of reaction = k (1/*t*), where *t* is the reaction time in seconds.

   Calculate 1/*t* for the average reaction time for each concentration of HCl and enter the results in the data table. Graph 1/*t* versus HCl concentration. Place 1/*t* on the *y*-axis and HCl concentration on the *x*-axis.

   Describe the mathematical relationship between the reaction rate and the concentration.



2. How much did the rate of reaction change when the concentration of HCl was doubled?

3. Using the graph and the definition of reaction rate, estimate the reaction time for the same size piece of magnesium ribbon to react with 18 mL of 1.5 M HCl.

Activity C. Temperature

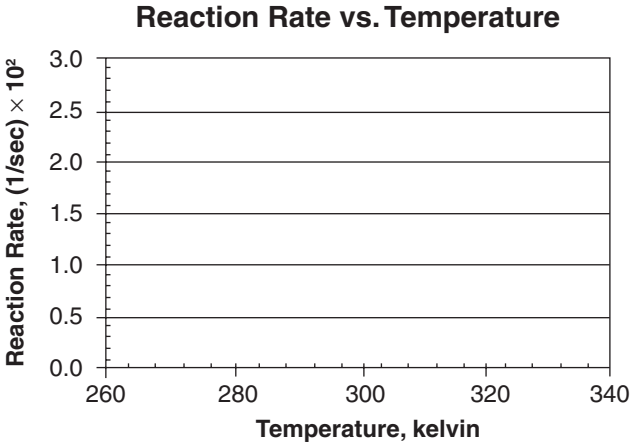
Data and Results Table

	Ice Water	Room Temperature Water	Hot Water
Temperature, °C			
Reaction Time, *t* (sec)			
Reaction Rate, (1/*t*), sec^{-1}			
Temperature, Kelvin			

Observations and Analysis

Rate of reacton = $k(1/t)$, where t is the reaction time in seconds.

1. Calculate $1/t$ for the reaction time for each temperature and enter those results in the data table.
2. Convert each temperature to kelvin and enter the values in the data table. *(K = °C + 273.15)*
3. Graph $1/t$ on the y-axis versus $T(K)$ on the x-axis for each temperature studied.



4. Describe the mathematical relationship between the reaction rate and the temperature in kelvins.

5. The collision theory of reaction rates states that the rate of a reaction depends on the number of collisions between molecules, the average energy of the collisions, and the effectiveness of the collisions. (a) How does temperature affect each of these factors in collision theory? (b) Does the effect of temperature on the reaction rate support the collision theory of reaction rates? Explain.

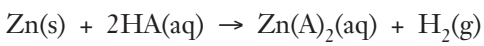
Activity D. The Nature of the Reactants

Observations and Analysis

1. What did you observe about the two reactions?

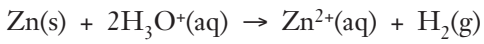
2. Based on your observations, estimate the relative rates of reaction between the two forms of acid with zinc.

3. Zinc reacts with acids according to the following equation;



$$Zn(s) + 2HA(aq) \rightarrow Zn(A)_2(aq) + H_2(g)$$

The net ionic reaction is;



$$Zn(s) + 2H_3O^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$$

Hydrochloric acid is a strong acid and acetic acid is a weak acid. Based on the above information, explain the differences in the two reaction rates.

Activity E. Catalysts

Observations and Analysis

Part 1.

1. What did you observe about the reactions in the three test tubes?

2. Based on your observations, estimate the relative rates of reaction for each catalyst.

3. What did you observe with the glowing splint? Would this confirm that a decomposition reaction is taking place? Explain.