

### Answer on Question #79438, Chemistry/ General Chemistry

For the equation  $\text{CaCO}_3 (\text{s}) + 2\text{HCl} (\text{aq}) \rightarrow \text{CaCl}_2 (\text{s}) + \text{H}_2 (\text{aq}) + \text{H}_2\text{O} (\text{l})$ , 100.00 g of  $\text{CaCO}_3$  pellets are combined with 250 mL of HCl of a 2.0 M solution. Which of the following will increase the rate of the chemical reaction?

- A. Add heat to the reaction.
- B. Increase the concentration of HCl to 3.0 M.
- C. Crush the  $\text{CaCO}_3$  into powder.
- D. All of the Above
- E. None of the Above

#### Solution

A. Increasing the temperature (adding heat to the reaction) of a system increases the average kinetic energy of its constituent particles. As the average kinetic energy increases, the particles move faster and collide more frequently per unit time and possess greater energy when they collide. Both of these factors increase the reaction rate. Hence the reaction rate of virtually all reactions increases with increasing temperature. The statement is true.

B. In terms of the collision theory, increasing the concentration of a reactant (we increase concentration of HCl from 2.0M to 3.0M) increases in the number of collisions between the reacting species per second and therefore increases the reaction rate. The statement is true.

C. The rate of reaction of a solid substance is related to its surface area. In a reaction between a solid and an aqueous/liquid/gas species, increasing the surface area of the solid-phase reactant increases the number of collisions per second and therefore increases the reaction rate. The statement is true.

So, A, B, and C are true statements. The answer is D. All of the above

**Answer: D. All of the above**