



RATES OF REACTION

SURFACE AREA

Answer all the questions below then check your answers

1. Which of the following will have the largest surface area?

- a) A single large lump of calcium carbonate
- b) Several small lumps of calcium carbonate
- c) Calcium carbonate powder
- d) A block of calcium carbonate with a smooth surface

2. Fill in the Gap to complete the question below:

The rate of a chemical reaction typically _____ as the surface area of the reactants increases.

3. Which of the following is a way to increase the surface area of a solid reactant?

- a) Cooling the reactant
- b) Breaking it into smaller pieces
- c) Compressing the reactant into a lump
- d) Submerging it in water

4. Match the following substances with their surface area characteristics:

powder
lumps
Single large block

Small surface area
Large surface area
Medium surface area

- a. State the relationship between surface area and the rate of reaction.
- b. Explain why firewood burns faster when chopped up into smaller pieces.
- d. Catalytic converters in cars use a honeycomb structure with a large surface area. Explain how this structure helps reduce pollution.
5. Explain why powdered calcium carbonate reacts faster with hydrochloric acid than a single lump of calcium carbonate.
6. Fill in the Gaps to complete the sentence below:



When a solid reactant is broken down into smaller pieces, its _____ increases, which in turn _____ the rate of reaction.

7. Describe how you could increase the surface area of a solid reactant and explain how this would affect the rate of a reaction.
8. Which statement is correct?
- A powder has less surface area than a lump of the same substance.
 - Larger lumps of a substance react faster than smaller lumps.
 - Smaller lumps have a larger surface area compared to larger lumps.
 - Surface area does not affect the rate of reaction.

9. Design a simple experiment to investigate how surface area affects the rate of a reaction between calcium carbonate and hydrochloric acid. Include the steps you would take, the variables you would control, and how you would measure the rate of

Answers

1. Which of the following will have the largest surface area?
- a) A single large lump of calcium carbonate
 - b) Several small lumps of calcium carbonate
 - c) Calcium carbonate powder
 - d) A block of calcium carbonate with a smooth surface

Answer: c) Calcium carbonate powder

2. Fill in the Gap to complete the question below:

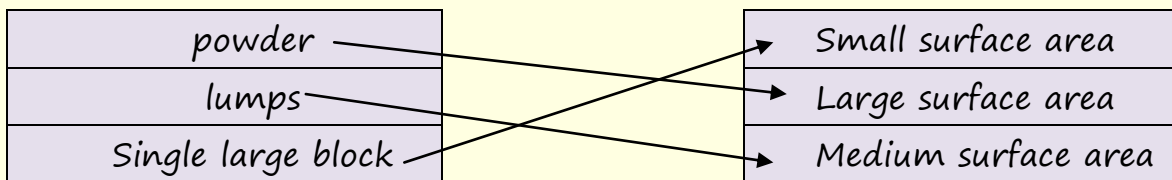
The rate of a chemical reaction typically _____ as the surface area of the reactants increases.

Answer: Increases

3. Which of the following is a way to increase the surface area of a solid reactant?
- a) Cooling the reactant
 - b) Breaking it into smaller pieces
 - c) Compressing the reactant into a lump
 - d) Submerging it in water

Answer: b) Breaking it into smaller pieces

4. Match the following substances with their surface area characteristics:



- a. State the relationship between surface area and the rate of reaction.

As the surface area increases the rate of reaction increases, this is simply because the number of collisions between the reacting particles increases.

- b. Explain why firewood burns faster when chopped up into smaller pieces.

Chopping the firewood up increases its surface area therefore allowing the combustion reaction to occur faster.

- d. Catalytic converters in cars use a honeycomb structure with a large surface area. Explain how this structure helps reduce pollution.

Larger surface area means a faster reaction.



5. Explain why powdered calcium carbonate reacts faster with hydrochloric acid than a single lump of calcium carbonate.

Answer:

Powdered calcium carbonate has a larger surface area compared to a single lump, which means more particles are exposed to the acid. This increases the frequency of collisions between the reactant particles, leading to a faster reaction rate.

6. Fill in the Gaps to complete the sentence below:

When a solid reactant is broken down into smaller pieces, its _____ increases, which in turn _____ the rate of reaction.

Answer: Surface area; increases

7. Describe how you could increase the surface area of a solid reactant and explain how this would affect the rate of a reaction.

Answer:

You could increase the surface area of a solid reactant by grinding it into a fine powder or breaking it into smaller pieces. This exposes more particles of the reactant to the other reactant(s), increasing the frequency of collisions and thus speeding up the rate of the reaction.

8. Which statement is correct?

- a) A powder has less surface area than a lump of the same substance.
- b) Larger lumps of a substance react faster than smaller lumps.
- c) Smaller lumps have a larger surface area compared to larger lumps.
- d) Surface area does not affect the rate of reaction.

Answer: c) Smaller lumps have a larger surface area compared to larger lumps.

9. Design a simple experiment to investigate how surface area affects the rate of a reaction between calcium carbonate and hydrochloric acid. Include the steps you would take, the variables you would control, and how you would measure the rate of reaction.

Answer:

Experiment Steps:

Measure equal masses of calcium carbonate in three forms: a single lump, small pieces, and powder.

Add 50 cm³ of 2M hydrochloric acid to three separate conical flasks.

Add the lump of calcium carbonate to the first flask, the small pieces to the second, and the powder to the third.

Immediately start the stopwatch as you add each form of calcium carbonate.

Observe the reaction and measure the time taken for the reaction to stop (i.e., when bubbling ceases) or measure the volume of gas produced at regular intervals using a gas syringe.

Variables to Control:

Concentration and volume of hydrochloric acid (2M, 50 cm³).

Mass of calcium carbonate (same for all forms).

Measurement:

Record the time taken for the reaction to complete or the volume of gas produced over time.

Compare the rates by analyzing which form of calcium carbonate reacted fastest.

Conclusion:

The powder will react fastest due to its largest surface area, followed by small pieces, and then the lump.

Summary

Surface area affects the rate of reaction: Larger surface area results in a faster reaction due to increased collision frequency.

Powders have the largest surface area, lumps have a medium surface area, and single blocks have the smallest.

Increase surface area by breaking down the reactant into smaller pieces.

Practical experiments can be designed by comparing reaction times or gas production rates for different surface areas.