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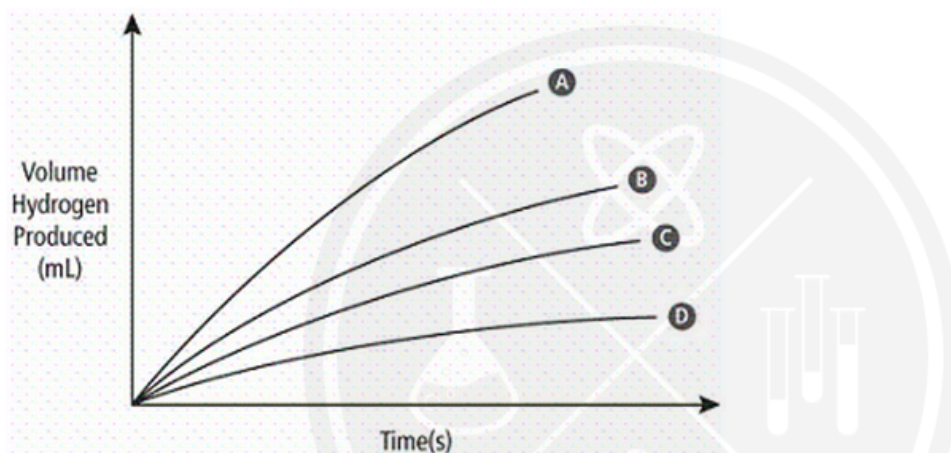
Sincerely,

REAL Science Challenge

Sample Question

Consider the following sets of reaction conditions and the graph of the rates of hydrogen production:

	Acid Concentration	Zinc	Temperature of Acid Solution
Trial I.	low	cube	40°C
Trial II.	high	crushed	5°C
Trial III.	low	cube	5°C
Trial IV.	high	crushed	40°C



Which of the above curves would match the reaction conditions in Trial III. Use the CERR (Claim, Evidence, Reasoning, Rebuttal) framework for your response.

REAL SC

A Proficient Response

Emerging	Developing	Proficient	Extending
		✓	

Curve D matches the reaction conditions in Trial III.

According to the volume-time graph, Curve D represents the slowest reaction rate because this reaction produced the least amount of hydrogen in the same amount of time as the other curves.

Concentration, surface area, and temperature are factors that affect reaction rate. When there is high concentration, high surface area, and high temperature, the reactants collide more frequently because particles are moving faster (high temperature) and there are more particles present (ie. high concentration). Thus, the reaction goes more quickly. Since Trial III has a low acid concentration, low surface area (ie. cubed zinc), and low temperature, the reaction rate should be the lowest because there are fewer collisions between reactants since particles are moving slower (ie. low temperature) and there are fewer particles present (ie. low concentration).

REAL SC

Student Response 1

Emerging	Developing	Proficient	Extending

(place a check mark in one of boxes)

Trial III would match curve D, the lowest. In the conditions on the graph, it has low concentration and temperature which means reaction rates are lower, and the zinc is a cube not crushed which means less surface areas, reducing reaction rate even more.

If concentration is low, which it is, it means less atoms to react with each other which is why the reaction rate slows down.

Zinc is cubed, the surface area coming in contact with the acid is less than what it is in crushed zinc because the acid can touch all the individual particles rather than the outside ones only.

The temperature is way lower than the rest, slowing down the speed of the particles which also affects speed of reaction rate, slowing it.

Student Response 2

Emerging	Developing	Proficient	Extending

(place a check mark in one of boxes)

I think that graph line C matches the conditions best because its reaction time to hydrogen produced ratio matches the table. I think this because Trial III on the table has a cubed zinc which means higher surface area, and higher surface area means a quicker reaction time. The lower temperature and acid concentration could correlate to the hydrogen produced amount which is the second lowest in the graph.

Student Response 3

Emerging	Developing	Proficient	Extending

(place a check mark in one of boxes)

I think that curve D would match the reaction conditions in Trial III. This is because curve D took the longest amount of time and produced the least amount of hydrogen. In the third trial, the concentration of acid is low, the zinc is a cube, and the acid solution temperature is 5°C. All of these things affect the reaction rate and slow it down. By having a low acid concentration, it won't react with the zinc as fast as if it were highly concentrated. Furthermore, the zinc is a cube in trial 3, which means it has less surface area than if it were crushed. This also significantly slows down the reaction rate. Lastly, the temperature in this trial is also very low which means the particles have less kinetic energy and are moving slower. This results in less collisions and reactions occurring.

Student Response 4

Emerging	Developing	Proficient	Extending

(place a check mark in one of boxes)

Curve D would match the reaction for Trial III. The trial's acid has low concentration and low temperature, and the zinc has less surface area as a cube rather than being crushed. All these factors affecting the reaction rate are low meaning the reaction rate would be slow. The trial even has the lowest factors, being under the second lowest, Trial I, through temperature, that means the curve representing reaction rate would be the lowest too, and that is curve D.

Student Response 5

Emerging	Developing	Proficient	Extending

(place a check mark in one of boxes)

Trial III matches curve D. This is because curve D produces the least amount of hydrogen in the most amount of time. Trial III has the worst acid concentration, surface area, and temperature out of the four girls. Therefore, Trial III should react the worst in the most amount of time. Trial I should be curve C since it has a high temperature, and Trial II should be curve B since it has a high acid concentration and surface area. Trial IV should be curve A since it has a high acid concentration, surface area, and temperature. In conclusion, Trial III aligns with curve D since the factors contributing to the trial reacts are the worst out of the four.

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“Answer Key”

Student Response 1

Emerging	Developing	Proficient	Extending
	✓		

Response 1 provides the correct answer and a correct scientific explanation as to how concentration, temperature, and/or surface area affects reaction rate (ie. by increasing the frequency of collisions between reactants). Response 1 does not provide an analysis of the graph as to why Curve D is the slowest (ie. Curve D produced the least amount of hydrogen in the same amount of time)

Student Response 2

Emerging	Developing	Proficient	Extending
✓			

Response 2 provides an incorrect answer and an incomplete scientific explanation as to how concentration, temperature, and/or surface area affects reaction rate (ie. by increasing the frequency of collisions between reactants). Response 2 also does not provide an analysis of the graph as to why Curve D is the slowest (ie. Curve D produced the least amount of hydrogen in the same amount of time)

Student Response 3

Emerging	Developing	Proficient	Extending
		✓	

Response 3 provides an correct answer and a complete scientific explanation as to how concentration, temperature, and/or surface area affects reaction rate (ie. by increasing the frequency of collisions between reactants). Response 3 also provides an analysis of the graph as to why Curve D is the slowest (ie. Curve D produced the least amount of hydrogen in the same amount of time).

“Answer Key” (cont’d)

Student Response 4

Emerging	Developing	Proficient	Extending
	✓		

Response 3 provides an correct answer and an incomplete scientific explanation as to how concentration, temperature, and/or surface area affects reaction rate (ie. by increasing the frequency of collisions between reactants). Response 3 also provides an analysis of the graph as to why Curve D is the slowest (ie. Curve D produced the least amount of hydrogen in the same amount of time).

Student Response 5

Emerging	Developing	Proficient	Extending
	✓		

Response 3 provides an correct answer and an incomplete scientific explanation as to how concentration, temperature, and/or surface area affects reaction rate (ie. by increasing the frequency of collisions between reactants). Response 3 also provides an analysis of the graph as to why Curve D is the slowest (ie. Curve D produced the least amount of hydrogen in the same amount of time).

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