

Blk 2: Thurs Sep 28
Blk 3: Wed Sept 27
Blk 4: Wed Sep 27
Blk 6: Tues Sept 26

Reaction Rate Graphing Assignment

Chemistry 12
Assignment: Reaction Rate

Name: _____ DUE: _____ Block: _____
Name: _____ Teacher: Miss Zukowski

Equipment:

- Graph Paper
- Pen/Pencil
- Eraser/White-out
- Ruler
- Calculator

Results Summary:

30

- Groups of 2
- Answer questions on a separate page
- Show ALL working out
 - Correct significant figures
 - Use and show units
- DUE in 1 week!
- Organize with your partner to meet at focus...no excuses for late assignments if partner is away.

Objective: To calculate the average reaction rate, reaction rate at a particular time for a particular reaction.

Reaction: Solid calcium carbonate reacting with hydrochloric acid to produce carbon dioxide gas, water, and a precipitate of calcium chloride.

Data: Use the following data set to complete the assignment

Table 1: CO₂ released over time

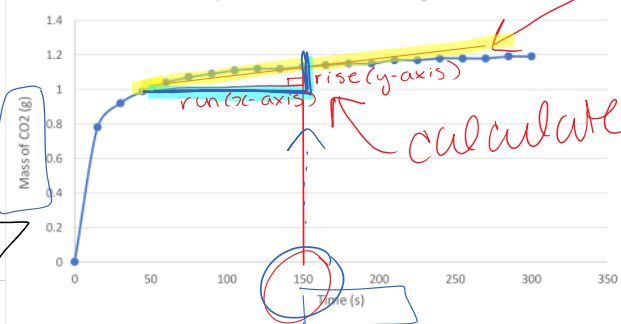
Time (min)	Time (s)	Mass CO ₂ released (g)
0		0
:15		0.78
:30		0.92
:45		0.99
1:00		1.04
1:15	60	1.07
1:30	75	1.09
1:45		1.11
2:00		1.12
2:15		1.12
2:30		1.13
2:45		1.14
3:00		1.15
3:15		1.15
3:30		1.17
3:45		1.17
4:00		1.18
4:15		1.18
4:30		1.18
4:45		1.18
5:00	300	1.19

GRAPH MUST INCLUDE:

- Meaningful, detailed title
- Labelled axis (with units)
- Appropriate scale which uses the entire page
- Tidy, show calculations (ie: tangent triangle for scale...best fit line, etc)
- YES connect the dots to show a best fit curve

5 marks

Graph 1: Calcium Carbonate reacts with Hydrochloric Acid to produce Carbon Dioxide gas



$$\text{rxn rate} = \frac{\Delta g}{\Delta t}$$

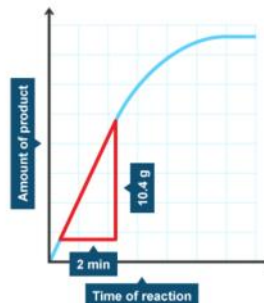
Discussion Questions:

- Graph the mass of CO₂ released against time. (5) (5 marks)
- The slope of the graph at any point on the curve gives the rate of the reaction at that point. Find the reaction rate halfway through the timed period by drawing a tangent and finding its slope. Use a large slope triangle for better accuracy. Include units. (2 marks)
- Use your data table (do not use a tangent) to find the average rate of reaction, expressed in g CO₂/s, between 1 and 2 minutes. (1 mark)
- In general, what quantities are involved in expressing reaction rate? Give some typical units for reaction rate. (1 mark)
- Write the balanced equation for the reaction. Include states. (3 marks)
- Using the average reaction rate between 1 and 2 minutes (from #3 above), express the reaction rate in terms of: (3 marks)
 - Moles of CO₂/s
 - Moles of HCl/s
 - Moles of HCl/min
- What happens to the reaction rate during the overall timed period? Explain two reasons why this happens. (3 marks)
- List factors which would cause a greater initial reaction rate, and explain how each would lead to an increased reaction rate. (6 marks)
- How would your graph look different if you increased the initial reaction rate? (1 mark)
- How would your graph appear if the reaction rate: (3 marks)
 - Was constant?
 - Increased during the timed period?
 - Decreased during the timed period?
- The reaction rate could have been found by measuring the total time for the reaction to stop. Why would this kind of measurement be less informative? (2 marks)

Rates from gradients

The rate of reaction can be calculated from the gradient of a graph of amount of product against time of reaction:

- Draw a tangent to the curve (a straight line that represents the gradient at that point).
- Draw a vertical line and horizontal line to form a right-angled triangle with the line from step 1.
- Read off the change in amount of product (the vertical line in your triangle).
- Read off the change in time (the horizontal line in your triangle).
- Calculate the gradient. This will be the answer from step 3 divided by answer from step 4.



In the example above:

$$\text{rate of reaction} = 10.4 \div 2 = 5.2 \text{ g/min}$$

Make sure that the unit for rate matches the units used in the graph:

