

On-line Science Simulations - Marble Chip Student Worksheet

When hydrochloric acid is added to calcium carbonate (marble chips) carbon dioxide is evolved.

In the experiment shown, 21.6g of calcium carbonate is added to 200 cm³ of hydrochloric acid. The number of chips can be varied but the total mass is always 21.6 g and the volume of acid is always 200 cm³ but the concentration can be varied.

The apparatus is placed on a balance that has been zeroed so that it always shows the same initial mass at the start of the experiment. During the reaction, carbon dioxide is evolved and the mass decreases.

Task 1

Choose 1 marble chip and an acid concentration of 1.0mol/dm³.

Click start and take readings approximately every 5 seconds (by clicking the take readings button) until the mass reaches 0.0g.

Stop the reaction immediately. Use the results to plot a graph of mass against time.

From your graph, how does the rate of reaction change with time?

Suggest **two** reasons for this change.

Task 2

Press **back** but not **clear** and change the number of chips to 10 but leave the acid concentration at 1.0mol/dm³.

Click start and take readings approximately every 3 seconds (by clicking the take readings button) until the mass reaches 0.0g.

Stop the reaction immediately. Plot these results on the same grid as the results of your first experiment.

How does the rate of reaction in Task 2 compare with the rate in Task 1? Suggest a reason for the change.

By comparing the two curves and the times taken to reach 0.0 g (the last times on the list), predict the time it would take for the reaction to finish if 100 chips were used.

Task 3

Press back but not clear and change the number of chips to 100 but leave the acid concentration at 1.0mol/dm³.

Click start and take readings as often as possible (by clicking the take readings button) until the mass reaches 0.0g.

Stop the reaction immediately. Plot your results on the same grid as the previous two experiments.

How long did it actually take for the reaction to finish?

Clear all the results by clicking clear.

Repeat Task 1

Choose 1 marble chip and an acid concentration of 1.0 mol/dm^3 .

Click start and take readings approximately every 5 seconds (by clicking the take readings button) until the mass reaches 0.0g.

Stop the reaction immediately and, on a new piece of graph paper, plot a graph of mass against time.

Task 4

Press **back** but not **clear** and change the acid concentration at 0.75 mol/dm^3 . Leave the number of marble chips at one.

Click start and take readings approximately every 5-10 seconds (by clicking the take readings button) until the mass reaches 0.0g.

Stop the reaction immediately. Plot your results on the same grid as the previous experiment.

Task 5

Press **back** but not **clear** and change the acid concentration at 0.25 mol/dm^3 leave the number of marble chips at one.

Click start and take readings approximately every 10 seconds (by clicking the take readings button) until the mass reaches 0.0g.

Stop the reaction immediately and plot your results on the same grid as the previous two experiments.

Give **two** ways in which the results for Task 4 differ from the results in Task 5 and suggest reasons for these differences.