

Title: Rates of Reaction

Topics: Molarities, dilution, chemical reactions, recording and presenting results and evaluating.	Time: 120 minutes	Age: 14-16
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Differentiation:

There are numerous opportunities for differentiation, students may be provided with different dilutions or prepare their own. Lots of opportunities for evaluation and discussion.

Guidelines, ICT support etc.:

Teachers have reported that this investigation is particularly good for providing opportunities to develop organisational and practical skills related to the task. Using a PC and allowing pupils to type up as they go is a quick method of producing course work.

Pupils were able to discuss results and factors which produce anomalous results. Evaluation is a particular strength.

Equipment needed for this activity:

HCl 1.0M

Distilled water

Burette

Magnesium ribbon cut into uniform lengths.

Sidearm flask with bung

Gas syringe

Timer

Beakers

Health and Safety:

There are health and safety issues regarding the safe handling of both acid and glassware, goggles must be worn at all times.

Learning outcomes for this activity:

Students will measure out accurately fixed volumes of HCl using appropriate equipment. Students also have the opportunity to dilute the acid to different molarities.

Students will unaided, record the time taken to produce fixed amounts of gas and calculate the rate of reaction. These will be displayed in an appropriate table and graphically.

Students will be able to relate shape of the graph to the availability of Hydrogen ions and describe in abstract terms their numbers and fate.

Lesson description

Starter Activity (30 minutes)

Pupils should be familiar with the concept of a Mole and Molarity.

Pupils begin by taking the stock solution and diluting it to produce the different molarities needed.

To use the burette with precision the meniscus should be discussed and pupils should be required to describe what they will do before they start to produce the different molarities.

Main Activity (70 minutes)

Work sheets are provided

Teacher may wish to demonstrate each step to pupils or for more advanced pupils they may be asked to provide a possible plan themselves.

Pupils begin by noting the reaction which they will observe $2\text{HCl} + \text{Mg} = \text{MgCl}_2 + \text{H}_2$.

The amount of gas produced in a period of time allows us to describe a rate.

Pupils then carry out the experiment with the different molarities of acid they have produced; a stock of pre prepared molarities acid should be kept on hand as a control.

Pupils record their results as they proceed. The teacher should circulate throughout this element of the lesson checking on the pupil's activities and their understanding of what they are observing.

Results should be plotted on a large sheet of graph paper.

More able pupils should pick attempt to calculate the rate of reaction unaided.

Plenary Activity (20 minutes)

Pupils are asked to report on their experiment and the class results are analysed. Any anomalous results should be examined and if possible explained.

Questions about the relative shapes of the graphs should be explored. The

abstract concept of number and concentration of reactants should also be discussed and pupils should be free to express their ideas and misconceptions.

Finally pupils should be asked to consider the possible effects of changing the temperature, a demonstration with a chilled acid and a normal room temperature acid should allow the class to give a prediction with reasons.

Rates of Reaction work sheet 1

Introduction (What are you hoping to find out during this investigation?)

Equipment (list the equipment used, if more spaces are needed please extend the table)

	Equipment
1	
2	
3	
4	
5	
6	
7	

8	
9	
10	

Plan (step by step describe how you are going to carry out this experiment add additional rows if needed)

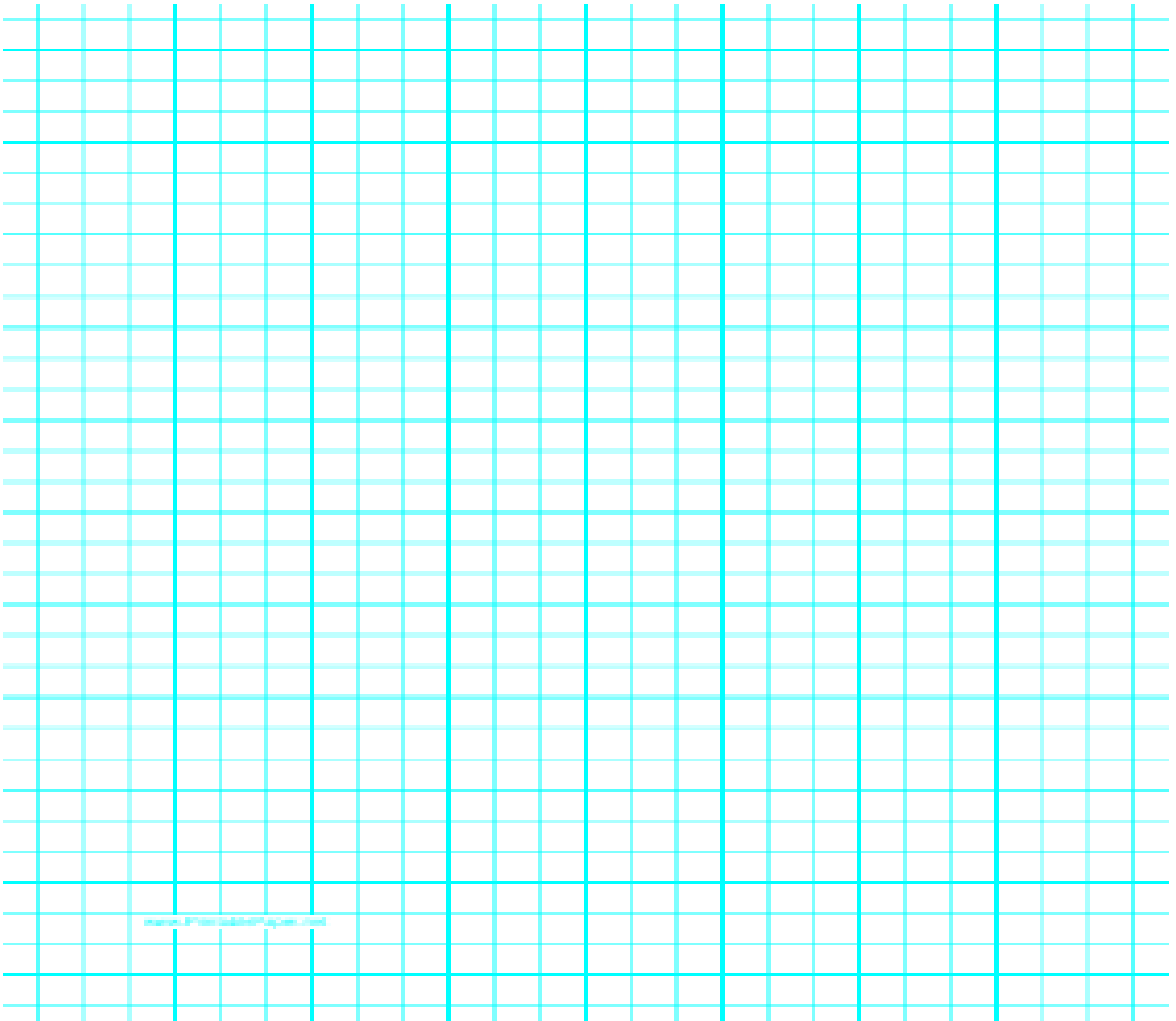
	Plan
1	
2	
3	
4	
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7	
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9	
10	

Results

Molarities of HCl	Gas produced after 10 seconds	Gas produced after 20 seconds	Gas produced after 30 seconds	Gas produced after 40 seconds	Gas produced after 50 seconds	Gas produced after 60 seconds	Rate of reaction
1.0M							

0.8M							
0.6M							
0.4M							
0.2M							

Graph (describe your results graphically)



Conclusions (explain what you have found out, remember to reflect upon your results?).

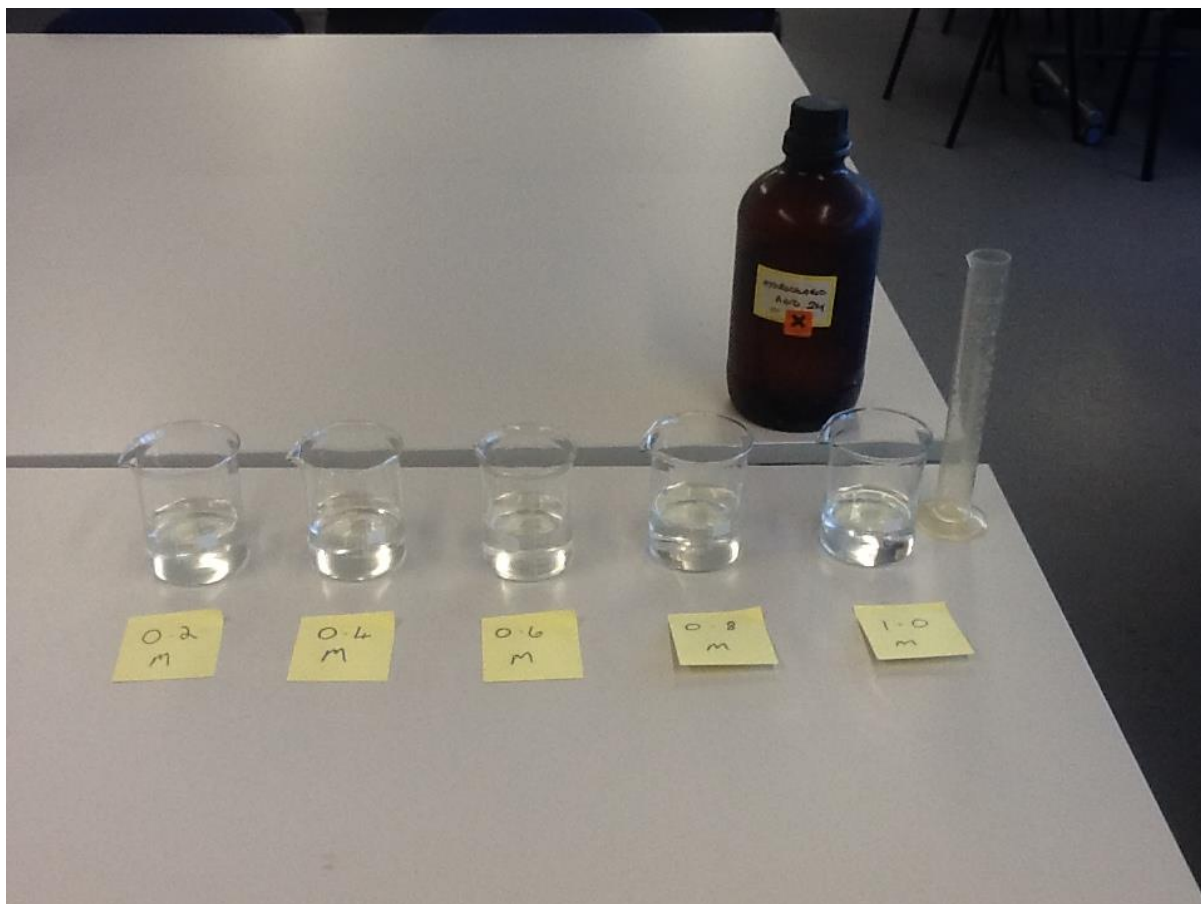
Evaluation (explain what you could do to improve your experiment).

Rates of Reaction Step by step

Step 1

You will be given a stock of Hydrochloric acid from your teacher.

Carefully follow the instructions on how to dilute it to the concentrations you need.



Make sure you clearly label the different concentrations produced.

Step 2

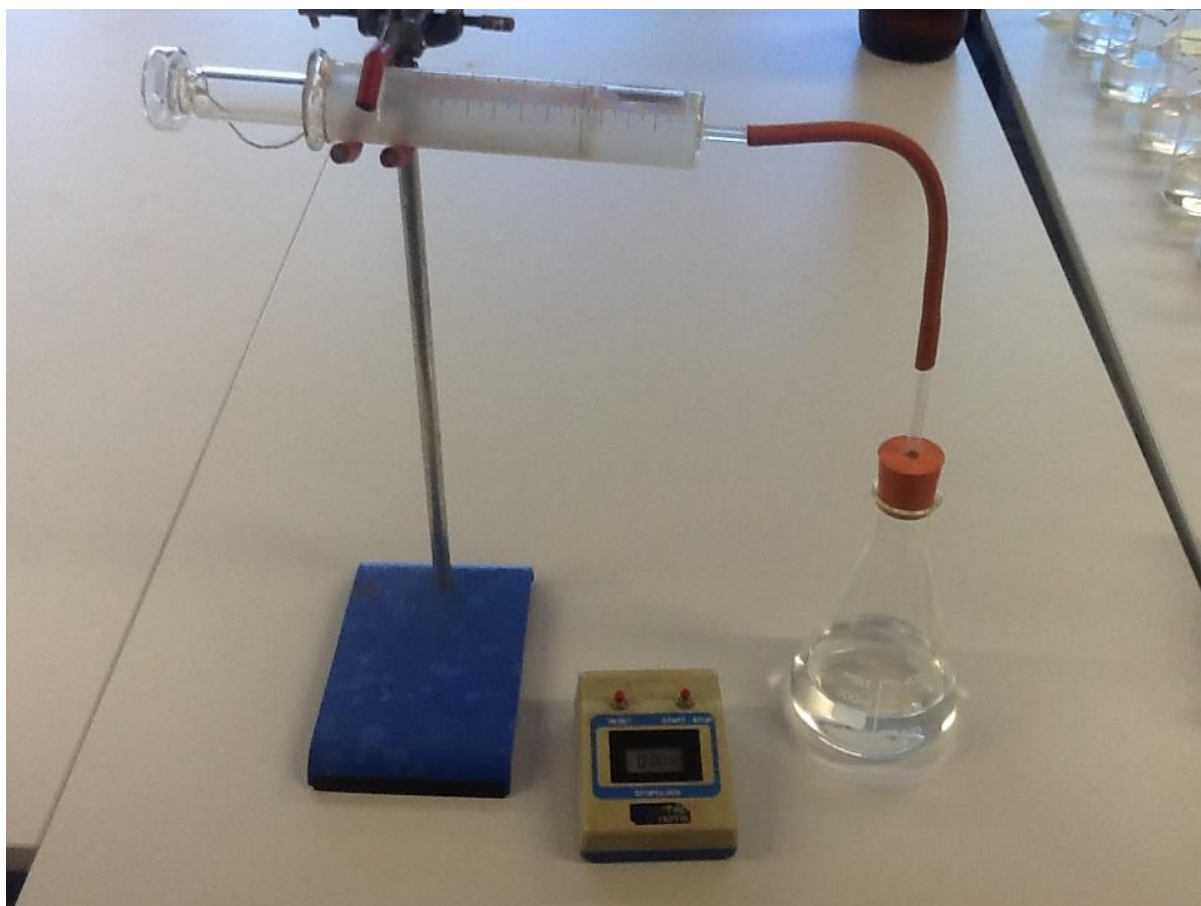
Cut the magnesium ribbon into uniform lengths, you might be able to check how well you can do this using a digital balance.



Step 3

Place your magnesium and acid into the flask and put the lid on quickly and start your timer.

Record your results as best you can.



Now repeat for each of your concentrations.

