

LIGHT - RATE OF REACTION

SENSOR(S)

- Internal Light
- External temperature (optional)

INVESTIGATE

- How to create and observe a chemical reaction
- How the rate of a reaction can be changed by chemical concentration or temperature
- How to analyse results and draw conclusions



INTRODUCTION TO THE INVESTIGATION

If, when two or more chemicals are brought together, their chemical properties are altered or a new substance is formed we say that a chemical reaction has taken place. During a chemical reaction, products are formed from reactants. An everyday example of this is if you placed an iron object in water, after a while rust forms on the object - in this case iron, water and oxygen from the air are the reactants and rust is the product.

The rusting of iron takes quite a while but there are chemicals which react much faster and so enable us to investigate how the speed at which a reaction takes place (the reaction rate) can be altered. Two such chemicals are sodium thiosulphate and hydrochloric acid (this is a common substance used to start a reaction - we call such chemicals reagents; it is also a reactant). When you mix the two chemicals together the solution gradually becomes cloudy as sulphur is produced. This cloudiness increases as the reaction progresses.

The aim of the investigation is to study whether the rate at which the liquid becomes cloudy can be affected by either the concentration of sodium thiosulphate that is used or by the temperature.

Note: Although this investigation is aimed at the upper end of the Explorer age range the idea of using the light sensor in a different way, in this case to measure the speed of a change, can be adapted for other pupil abilities and investigations e.g. using the light sensor with the optic attached to look at how fast algae forms in a pond.

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RESOURCES

- Explorer datalogger, datalogging software, computer, LogIT computer link cable, external temperature sensor if available.
- 100 ml beaker and small measuring cylinder
- Sodium thiosulphate solution (40g/l) and dilute hydrochloric acid
- Narrow light source e.g. very bright torch. A small tube to fit round the light sensor to block out background light if necessary. A ray box can be used to provide the light source and also a dark area into which the beaker can be placed.

WHAT TO DO

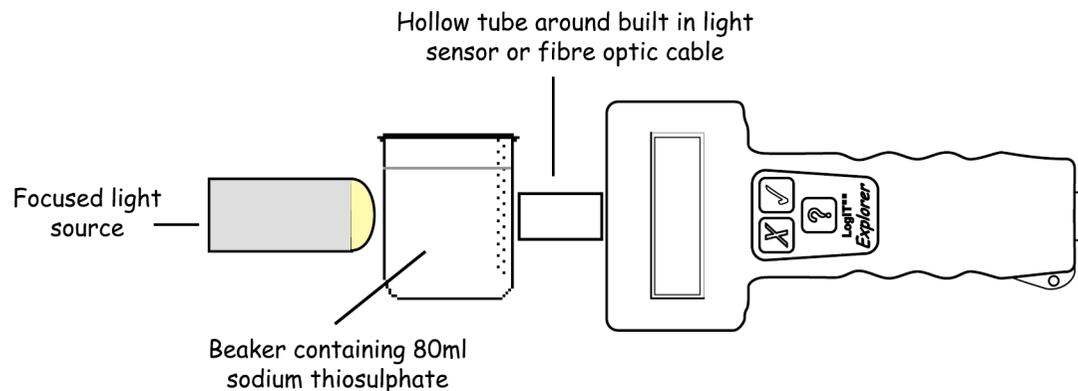
- Connect the Explorer to the computer and run the datalogging software.
- Set up the logging facility of the software (if necessary set the logging time span to between 5 and 15 minutes)
- Carefully measure out 80ml of the sodium thiosulphate into the beaker.
- Set up the light source on one side and the Explorer internal light sensor on the other (if investigating the effect of temperature put an external temperature sensor in the beaker).
- Start logging.
- After about 15 seconds carefully add 5 ml of the dilute hydrochloric acid (if your software has a mark facility use it to show on the graph when the acid was added) - give the mixture a stir.
- Keep collecting the readings until the mixture has gone very cloudy.
- Stop logging then repeat the experiment up to 4 times either altering the concentration of sodium thiosulphate OR the temperature (not too hot !). Ensure you clean the beaker out thoroughly each time.
- Between each run predict what will happen to the rate of reaction.
- At the end of the investigation print and save the results.
- Discuss and/or write up the findings and whether they matched the prediction.

If computers are limited the same investigation can be carried out using the Explorer's remote logging facility which is selected by using the blue button. Results can then be downloaded to a computer. Marks can be added by pressing the green button.

The concentration of sodium thiosulphate solution can be altered by mixing different amounts of the original solution with water e.g. 80 ml of thiosulphate + 0 ml of water then 60 ml of thiosulphate + 20 ml of water etc. If investigating how temperature changes the rate of reaction you may need a more dilute solution of sodium thiosulphate to start with as an increase in temperature will dramatically speed up the reaction.

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DIAGRAM



SAFETY



- Acids should always be used carefully and goggles worn. Small amounts of sulphur dioxide are produced but the amount involved should not be a problem but use in a well ventilated room.
- Liquids and electrical items do not mix so ensure that a tray is used to catch spillage and that paper towels are on hand to mop up accidents.

ABOUT THE RESULTS

- What do the results show about how the rate of reaction can be changed ?
- How did the pupils ensure it was a fair test ?
- Why was it important to ensure the beaker was thoroughly cleaned each time ?

EXTENSION ACTIVITIES

- Think about chemical reactions at home ?
- Which produces more lather - washing your hands in hot water or cold water ?
- Try an Alka-Seltzer® tablets in a glass of cold water and another in a glass of hot water.