

Shark attack!

How does water temperature affect the spread of blood through the water?

Notes

Resources needed

Beakers/Cups (100 mL or 500 mL)

Stopwatches.

Red food colouring. This is best to give to the students in small quantities pre set up

Plastic pipettes/Calpol syringes.

Ice.

Kettles

Thermometers.

Identifying variables

Independent (the one you change): The temperature of the water.

Dependent (the one you measure):: The time it takes for the food dye to spread through the water.

Control (the one you keep the same):: The volume of water.

The amount of food dye added.

Method

Students fill a beaker with water at different temperatures. They can use ice/boiled water/hot water from the tap to create a range of temperatures. They measure the temperature with a thermometer. They add 1 drop of food dye and time how long it takes for the dye to diffuse through the water.

You can give the students a choice of end points here. They can stop the timer either when the dye reaches the bottom of the beaker, or when they have judged it has spread and filled the whole beaker. The first suggestion is perhaps easier to measure, but happens faster and is affected by the height they drop the dye in from. The second is slower, but more subjective.

The disadvantage with this experiment is that the water cannot be reused and it is very difficult to do a repeat with the exact same temperature. This can be overcome if the students just describe the water as ice water/tap water/hot water and end up producing a bar graph. They can do repeats in this case, but there will be significant variation in their results.

What you can do is just have them record the temperature and do it once. They can vary the temperature by adding different ratios of hot/tap water or ice/tap water. They can get a range of readings. There will most likely be a general trend that diffusion increases as temperature increases, but there will also be outliers, which could be useful as an opportunity to introduce those.

Risk assessment

What is the hazard?	How could it be dangerous?	How will you reduce the risk?
Hot water	Causes burns	Be careful when handling hot water. Wear eye protection. Don't sit at the desk. Stools and bags placed under desks.

Collecting results

The students should collect a table of temperature against time. They should record a wide range of temperatures.

Presenting results

The results should be presented as a line graph of temperature versus time. A line of best fit can be drawn.

Interpreting data

The time should decrease as temperature increases. They can use their results to compare cold water with hot water.

Conclusions

Diffusion will proceed faster at higher temperatures as the water/dye particles are moving quicker as they have more energy.

I would award levels for:

Spreads faster. (level 3)

Spreads faster at higher temperature (Level 4)

Spreads faster at higher temperature, mentions one of *particles*, *diffusion* or *energy* in answer (Level 5)

Spreads faster at higher temperature, mentions two of either *particles*, *diffusion* or *energy* in answer (Level 6)

Spreads faster at higher temperature, mentions particles, diffusion and energy in answer (Level 7)

Improvements

A suitable improvement would be to repeat the experiment to make the results more reliable.

Or a suggestion for a way to define the end point more clearly. Perhaps do the experiment in a long measuring cylinder rather than a beaker and time how long it takes for the dye to reach the bottom.