

Investigation finding whether sweating increases the rate at which the body cools

Planning

I am trying to find out if the body cools quicker by sweating skin or dry skin. My input variable, the factor I am changing, is the moisture of the material wrapping the evaporating water.

Prediction

I predict that the temperature of the wet material will fall twice as fast as the dry material. This is, if the wet material tube falls 2 °c in a minute, the dry will fall 1 °c in a minute.

Scientific Reasoning

I believe that the wet tube will reduce temperature quicker because our body has several mechanisms to change our body temperature. When the thermoreceptors in the blood detect a high temperature, impulses are sent to the effectors in the skin so that the temperature is regulated. When we are hot, our body has to try to cool down and so sweat is produced and evaporates. This effectively allows heat to be released easily, cooling the body back to the average temperature of 37 °c.

Method

I am using wet and dry paper towels to imitate dry skin and sweating skin. I will wrap the paper towels around two test tubes, both of 70 °c water. This will be imitating the fluids in the body.

Double headed clamp

Test tubes

Thermometers

Paper towels

Stopwatch

Water

The experiment should be carried out carefully using the following procedure:

- Set up apparatus in a dry, clean space.
- Prepare two paper towels. Soak one thoroughly in cold water so it is dripping then wrap it around one of the test tubes. Wrap the dry towel, ensuring it does not get wet, around the other test tube.
- Add 20ml of 70°C water into each test tube. Beware, this water is hot and may burn. If heating using a kettle, use kettle safety instructions. Do not allow any internal electrical devices to have contact with water. Keep away from kettle as it boils as the water vapour may burn. Use a thermometer to check the water is cooled to 70°C. If it is still too hot, let it cool further.
- Start timing once both test tubes have the correct amount of water in them.
- Every minute, place a thermometer into the liquid and measure the temperature to the nearest °C. Record the results in a table.
- Keep recording until the stopwatch reaches 10 minutes; at which time the water should have almost reached room temperature.
- Repeat this experiment 3 times with the same equipment and measurements but new paper towels.
- When removing equipment, be careful that the test tubes do not burn when picking them up, as they may still be hot.

Collecting Evidence

I am observing the temperature of the water in the wet and the dry test tubes. I will measure to the nearest °C on the thermometer. I will use a stopwatch to know at what point to take the reading, every minute.

To ensure my results are reliable, I will repeat the experiment 3 times so that any obvious mistakes can be recognised and corrected.

I will ensure my results are precise by making sure that the test tube that is supposed to be dry is not wet at all. If it is, I shall dry the equipment and use a new dry paper towel. By allowing the 'wet' paper towel to soak, it will absorb as much water as possible.

I will ensure that the temperature of the water is 70°C in both test tubes. If one test tube has hotter water, it is sure to evaporate quicker. This is a factor I can control to make the experiment fair.

I cannot control the room temperature where the experiment is taking place. If the temperature increases as the experiment progresses, it may cause the water to evaporate faster making it an unfair test. I will reduce the risk of this by doing the experiments close to the same time, so that the chance of the temperature suddenly reducing is lowered.

Stopwatches measure to the nearest 100th of a second. Readings are taken close to the minute as possible. It takes more than one second to take each reading of the thermometer so readings are not taken at exactly the minute. As this incident occurs for every reading, the results

are fair, as they are all taken within a couple of seconds after the minute.

The scale of the thermometer is every 2 °c. Results are read to the nearest °c. The results may not be completely accurate, as the reading would have been taken between the scale.

I have decided to measure every minute as in my quantitative prediction I have said how the temperature will change over a period of one minute. I estimated that the temperatures would be at nearly room temperature after 10 minutes. I have therefore decided to measure every minute, for 10 minutes.

Preliminary experiment

Time/ minutes	Wet test tube temperature/ °c	Dry test tube temperature/ °c
0	45	45
1	41	42
2	38	40
3	36	39
4	34	38
5	33	37
6	31	36
7	30	35
8	30	35

I have taken preliminaries to see if my method of working is successful. I did not take results until the water reached room temperature as this was unnecessary and would take too long. I did not start at 70 °c, only at 45 °c so I know that the water would evaporate slower than that of higher starting temperature. I found my method successful. It is already apparent that the wet material allows cooling quicker.