Clothing for keeping warm

Overview:
Latent heat is the heat absorbed or released by a substance as it changes state ie. liquid to gas at a constant temperature and pressure. The latent heat needed for evaporation is taken from the liquid itself which subsequently cools and as a result cools its surroundings. This is why we feel cold when we get out of the sea or a swimming pool. The water evaporating reduces the temperature on the surface of the skin which feels cold. This resource is designed to show this cooling in action, and to allow the design of beach or swim clothing which might reduce this effect.

Aim:
To investigate the cooling effect of a liquid evaporating and to see how this can be used in the design of comfortable clothing to minimise the effect.

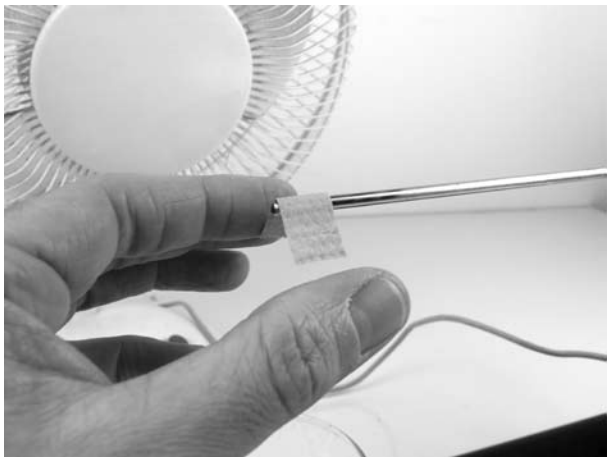
Equipment required: uLog Temperature sensor
Clamp stand or similar
Paper towels, pipettes drip tray or mat
Different materials for clothing eg. felt, T-shirt material etc
Tap water
Electric fan or similar

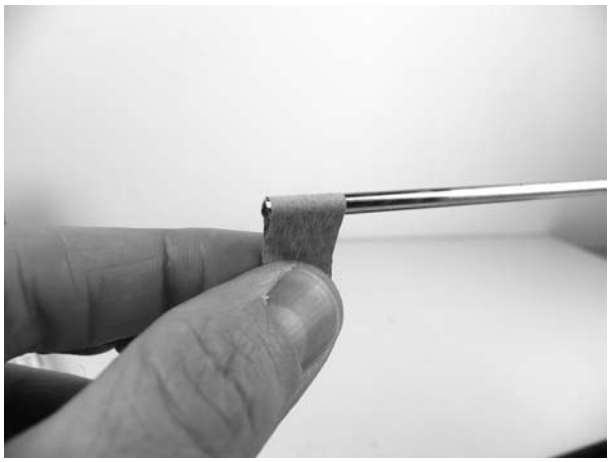
Hazards:
Always check your local regulations or the school advisory service for guidance on the use of laboratory equipment. Students should be supervised at all times.

Method:

1. Connect the uLog temperature sensor to the computer and mount it on the clamp stand as shown.

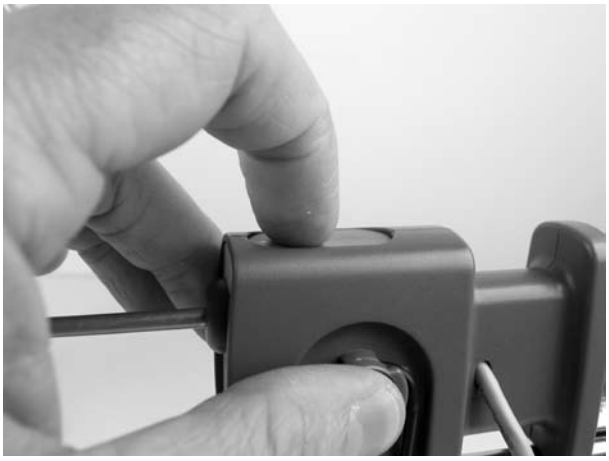
2. Place the fan close to the probe and place a small folded piece of paper towel (about 1 x 4cm) on the tip as shown.

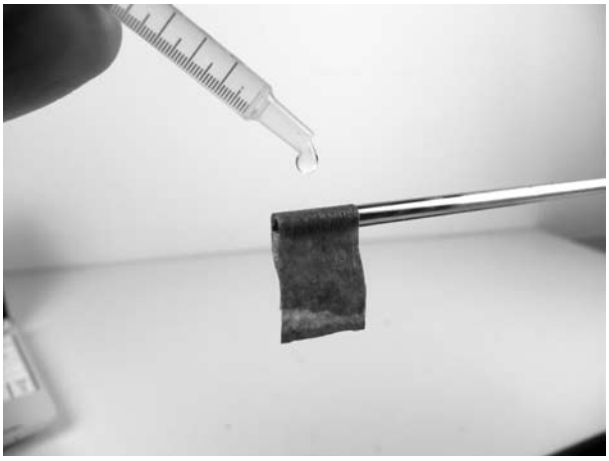




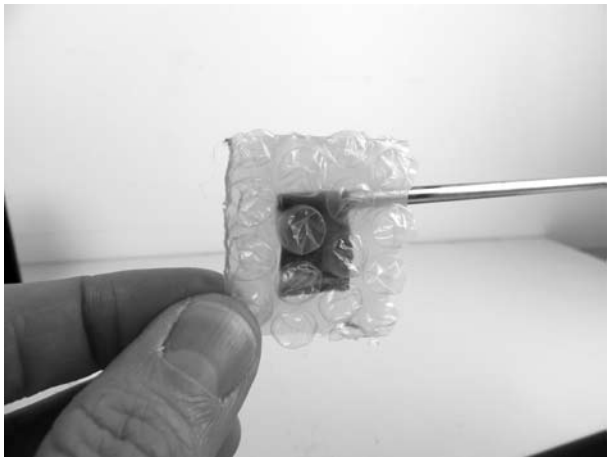
Clothing for keeping warm - continued

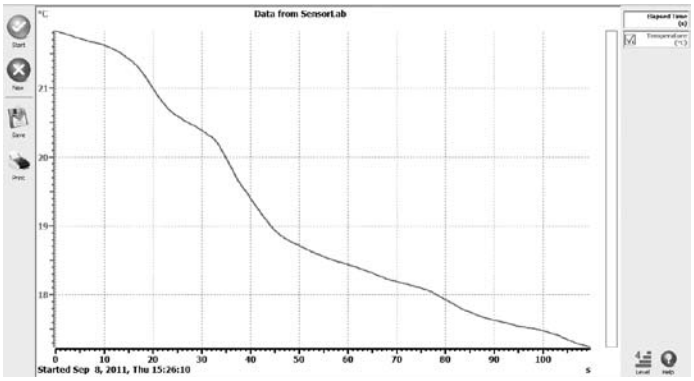
3. Start logging by pressing the uLog button, then saturate the paper using the dropper and start the fan.





4. Once the temperature no longer falls, stop logging, reset the experiment performing steps 2 and 3 only this time, once the paper has been saturated, place a material sample over the paper as shown. For clarity we have used transparent bubble wrap.





Note: You can produce separate graphs, but for easier analysis you can overlay each set of readings by simply pressing the uLog button each time you are ready to start, with a new material. Don't forget to allow the probe to reach normal room temperature each time by drying the tip using another paper towel.

Results:

What do the graphs tell you about heat loss?
How does the fan effect this heat loss? Why does this happen?

Going further:

From your data, which material might be the best solution for preventing heat loss?
Why might this material not be the most suitable for designing beach clothing?
What factors do you think are the most important for designing this type of specialist clothing?

Investigate 'breathable' material. Why is this a good type of material for this application? Think about drying and keeping warm at the same time.