

Aim: To find out how huddling, in penguins, affects heat loss and temperature.

Apparatus:

8 test-tubes or boiling tubes
stop clock
2 thermometers (-10 to 110 °C)
beaker to hold tubes
test-tube rack
measuring cylinder
container of hot water

Method:

- 1) Fill up one tube with cold water from the tap and use the measuring cylinder to work out its volume. Record this value, then tip the cold water away.
- 2) As accurately as you can, measure half the volume you have determined above of hot water into each of the 8 tubes.
- 3) Put one tube by itself, and the remaining 7 tubes into a bundle, held by the band.
- 4) Take the temperature of the water in the single test-tube, and write it down.
- 5) Take the temperature of the water in the centre test-tube of the bundle, and write it down.
- 6) Repeat stages 4 and 5 every 3 minutes for, say 24 minutes.
- 7) Record results in a tabular and a linear graph form. Think independently about the best way to do this.

Conclusion:

I noticed that the fastest rate of heat loss is directly after the water was poured into the test tubes. Afterwards, the rate of heat loss remains almost constant. The graph shows that the control test tube lost heat the quickest and fell to a final temperature of 56 after 7 minutes. From this you can conclude that a penguin

huddled up will loss heat slower than an isolated penguin. The reason is that the exposed surface area of a huddled penguin, to the cold, is less than an isolated one because of the fact the middle one is huddled. You'd expect the penguins at the edge to lose more heat than the one in the middle because it too has more surface area exposed, but it'd lose heat at a slower rate and end up with a higher temperature compared to the isolated one.