

GCSE Physics - Huddling Heat Investigation and Surface Area Coursework

Aim: The aim of this experiment is to investigate how groups of animals conserve heat in cold climates.

Hypothesis: I hypothesise that a huddled group will lose less heat than an isolated animal. This is because the exposed surface area of a group of animals is less for each animal than an isolated animal (as shown below).

S. area of 1: $10 + 10 + 10 + 10 = 40$ cm

S. area of 4: $40 \times 4 = 160$ cm

However...

S. area of 4 huddled: $20 + 20 + 20 + 20 = 80$

As you can see the surface area doesn't increase as much when the animals are huddled.

Plan: We will use the same amount of water (35ml) and take the temperature at regular intervals. All water will start at the same temperature. We will continue the experiment for 5 minutes.

Apparatus: This is how the boiling tubes (used to represent the animals) will be set up.

Other apparatus: kettle, stop clock, measuring cylinder.

Method: Collect all equipment and boil the kettle. Assemble huddle and pour water in all of the tubes on the outside. When ready, start the clock and pour water into the centre of the huddle and into the isolated tube. Take the temperature of the isolated tube and the tube at the centre of the huddle every minute until the desired time is up. Record results.

Results:

Temp. Isolated Huddle

00:00 37 37

01:00 38 38

02:00 36 38

03:00 36 37

04:00 36 37

05:00 35 37

06:00 34 37

07:00 34 36

08:00 33 36

09:00 32 36

10:00 32 36

11:00 32 35

12:00 32 35

13:00 32 35

14:00 31 35

15:00 30 35

16:00 30 35

17:00 30 35

18:00 30 35

19:00 30 34

20:00 30 34

Conclusion: The results show that an isolated animal will lose heat faster than an animal in the middle of a huddle. As I predicted, a huddled animal will conserve more heat than an isolated animal. The exposed surface area of a huddled animal is less than an isolated one.

Evaluation: I felt the results weren't very convincing but do show a pattern. At first we would take the temperature every 30 seconds but our results weren't changing enough so we took the temperature every minute. Originally, we were going to continue the experiment for 10 minutes but the results were quite inconclusive so the experiment ran on for 20 minutes. Next time we could use a different number of test tubes or vary the starting temperature of the water. A different amount of water will also be a variable we could change.