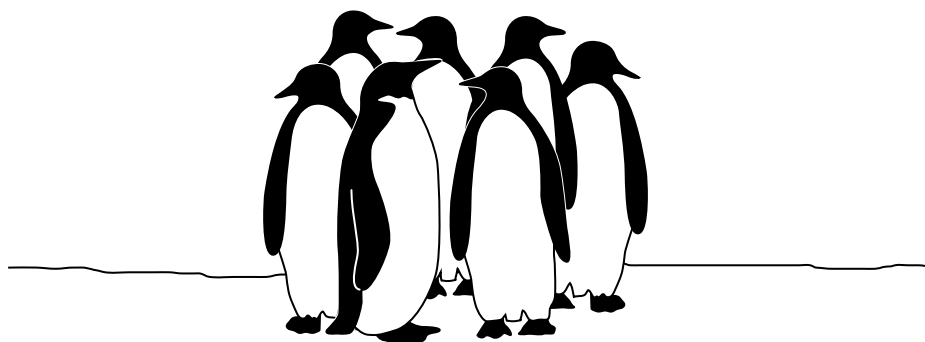


12 Penguins are adapted to survive in cold conditions.

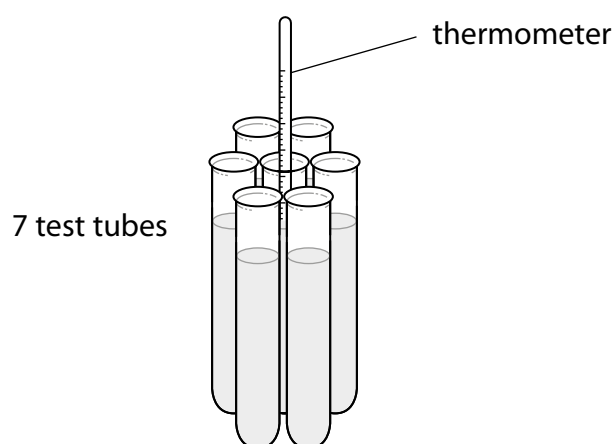
The adaptations help them to maintain a constant body temperature of 39°C .
Penguins also crowd together in groups of many penguins.



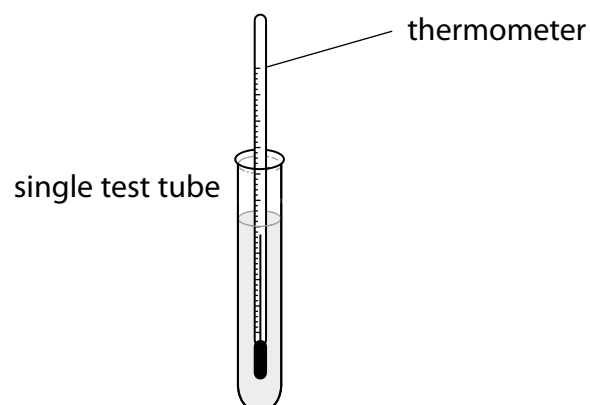
- (a) A student wants to investigate how the temperature of a penguin is affected when they crowd together in groups.

She uses this apparatus.

Each test tube represents a penguin.



represents a huddle of
7 penguins



represents a single
penguin

- (i) These statements describe the method she should use.

The statements are in the wrong order.

Put them into the correct order by numbering the boxes.

Some have been done for you.

(3)

Statements	Order
record the data in a table	8
take the temperature of the two test tubes	
tie 7 test tubes together	1
heat the water to 90 °C	2
take the temperatures every minute	
place equal volumes of water in all test tubes	
put thermometers into the middle test tube and single test tube	
record data for 15 minutes	

- (ii) The student draws a table to record her results.

Add suitable headings to her table.

(2)

Time/	

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(iii) Predict how the temperature change for the single test tube will differ from the temperature change for the group of test tubes.

(1)

(iv) Draw a sketch graph of the results you predict the student will obtain.

Label and use the axes below.

(4)



(v) Explain your prediction using ideas about thermal energy transfer.

(3)

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(b) Here are two adaptations that help penguins to maintain a constant body temperature.

- Most of their bodies are covered with layers of fat.
- They have flat overlapping feathers.

Explain why these features help penguins to maintain a constant body temperature.

(3)

Layers of fat.....

Flat overlapping feathers.....

(Total for Question 12 = 16 marks)

TOTAL FOR PAPER = 110 MARKS