

5: Coordination, responses and homeostasis – Topic questions**Paper 5**

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2016	June	53
1	2016	November	51

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

Read through all of the questions in this paper carefully before starting work.

- 1 Fig. 1.1 shows an elephant, *Loxodonta africana*. They have large ears which help them to control their body temperature.



Fig. 1.1

When the elephant is too hot, more blood is pumped into the blood vessels in the elephant's ears. Increasing blood flow to the surface of the skin helps the elephant to cool down.

You are going to set up a model of what happens in the elephant's ears as shown in Fig. 1.2.

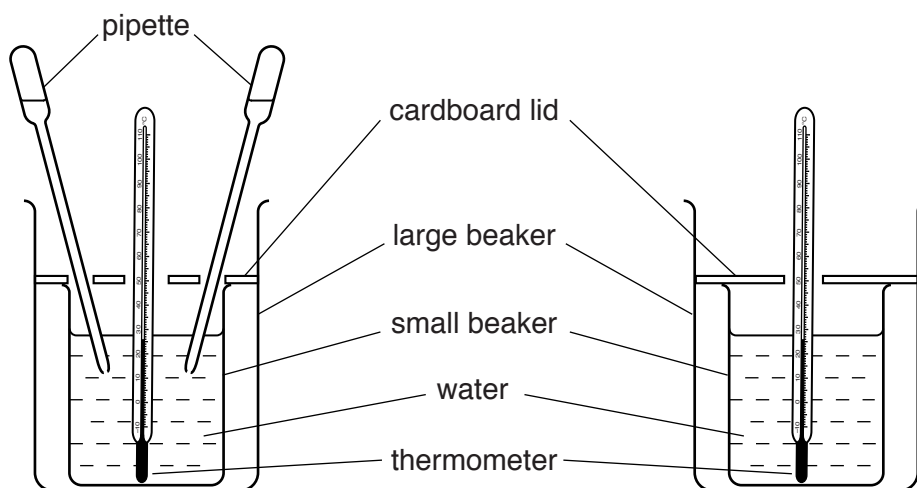


Fig. 1.2

You will place hot water into two small beakers and stand each one in a larger beaker. One of the small beakers will have 'ears' and the other will not.

The 'ears' will be represented by two plastic dropping pipettes. You will squeeze and release the pipette ears throughout the experiment so that water continuously moves out of and into the pipettes.

You will measure and record the starting temperature of the hot water in both small beakers and then record the temperature of the water every minute for a total of eight minutes.

- (a)** Before you start the practical work, prepare a table to record your observations in the space below.

[6]

- (b)** Suggest **one** safety precaution that you will take during this experiment.

.....
.....
.....[1]

- Step 1 Place one small beaker into each of the large beakers.
- Step 2 Cut two circles from the piece of cardboard. The circles should fit inside the large beakers and completely cover the top of the small beakers.
- Step 3 Make a small hole in each circle of cardboard for a thermometer to pass through and make two additional holes in **one** of the circles of cardboard for the pipette ears to pass through.
- Step 4 Carefully insert the thermometers and pipette ears through the holes in the circles of cardboard as shown in Fig. 1.2.
- Step 5 Raise your hand for hot water. The hot water will be poured into both of the small beakers.
- Step 6 **Immediately** and carefully place the circles of cardboard on top of the small beakers. Measure and record the starting temperature of the water in both beakers.
- Step 7 Start the timer.
- Step 8 Begin to squeeze and release the pipette ears so that they empty and fill with hot water. Continue doing this throughout the experiment.
- Step 9 Measure the temperature of the water in each small beaker every minute for a total of eight minutes.
- Step 10 Record your observations in the table in part **(a)**.

- (c) (i) A student repeated this experiment and calculated the change in temperature of the water each minute for eight minutes in both small beakers.

The change in temperature in the small beaker with pipette ears was 18 °C.

The change in temperature in the small beaker without pipette ears was 11 °C.

Explain why it is important to calculate the change in temperature in each beaker.

.....
.....
.....
.....
.....[2]

- (ii) Use the information in part (c)(i) to calculate the **rate** of temperature change in the small beaker with pipette ears for the student's experiment.

Show your working.

Give your answer to two significant figures.

rate of temperature change °C per min
[2]

- (d) (i) Suggest and explain **two** sources of error in your experiment.

1
.....
.....
.....
2
.....
.....
.....
[4]

- (ii) Suggest an improvement that will reduce one of the sources of error identified in (d)(i).

.....
.....[1]

- (e) Fig. 1.3 shows a different species of elephant, *Elephas maximus*, to the one shown in Fig. 1.1.



Fig. 1.3

- (i) State **one** visible difference between the ears of the elephant in Fig. 1.3 and those of the elephant shown in Fig. 1.1.

.....
.....[1]

- (ii) Based on this difference and the results of the student's experiment in part (c)(i), what can you conclude about the environmental conditions that the elephant shown in Fig. 1.3 lives in compared to the elephant in Fig. 1.1?

.....
.....
.....[1]

[Total: 18]

Read through all the questions on this paper carefully before starting work.

- 1** Some animals have a body temperature that is higher than the temperature of the environment.

As a result these animals lose heat to the environment, causing their body temperature to fall.

You are going to investigate the effect of the volume of the body on the loss of heat to the environment.

The volume of the body of an animal and its temperature can be represented by hot water.

Complete question **1(a)** before starting the investigation.

Step 1 Label two beakers, one beaker **A** and another beaker **B**.

Step 2 Draw a line on beaker **A**, 6cm up from the bottom of the beaker.

Step 3 Raise your hand when you are ready for hot water to be added to the container labelled **hot water**.

Step 4 Add hot water to beaker **A** up to the 6cm mark.

Step 5 Place the thermometer in the water in beaker **A** and start the timer.
Immediately measure the temperature of the water and record it in your results table.
Leave the thermometer in the water throughout the investigation.

Step 6 After 1 minute, measure the temperature of the water in beaker **A** and record it in your results table.

Step 7 Repeat step 6 after 2, 3, 4 and 5 minutes and record these results.

Step 8 Raise your hand to get the container labelled **hot water** refilled with hot water.

Step 9 Draw a line on beaker **B**, 3cm up from the bottom of the beaker.

Step 10 Add hot water to beaker **B** up to the 3cm mark.

Step 11 Repeat steps 5 to 7 for beaker **B**.

(a) Prepare a table to record your results in the space below.

[6]

(b) (i) The rate of heat loss is the fall in temperature per minute.

Calculate the rate of heat loss between 0 and 5 minutes for both beakers.
Include the units.

Show your working.

beaker **A**

.....

beaker **B**

.....

[4]

(ii) Using your results, suggest a relationship between the volume of the body and heat loss.

.....

.....

.....

.....[2]

(c) (i) State **two** variables in this investigation that have been controlled.

1

2 [2]

(ii) Suggest why the thermometer must be left in the water throughout the investigation.

.....

.....[1]

(iii) There is a possible source of error in step 2 and step 9 of this investigation.

Identify the source of error and describe how to modify steps 2 and 9 to improve this investigation.

.....

.....

.....

.....[2]

(d) Some students were asked to test the hypothesis:

The colder the surroundings, the faster a small mammal's temperature will drop.

Describe how the students could modify the investigation you have carried out to test this hypothesis.

Do **not** carry out this experiment.

[6]

- (e) Humans sweat when they get too hot.

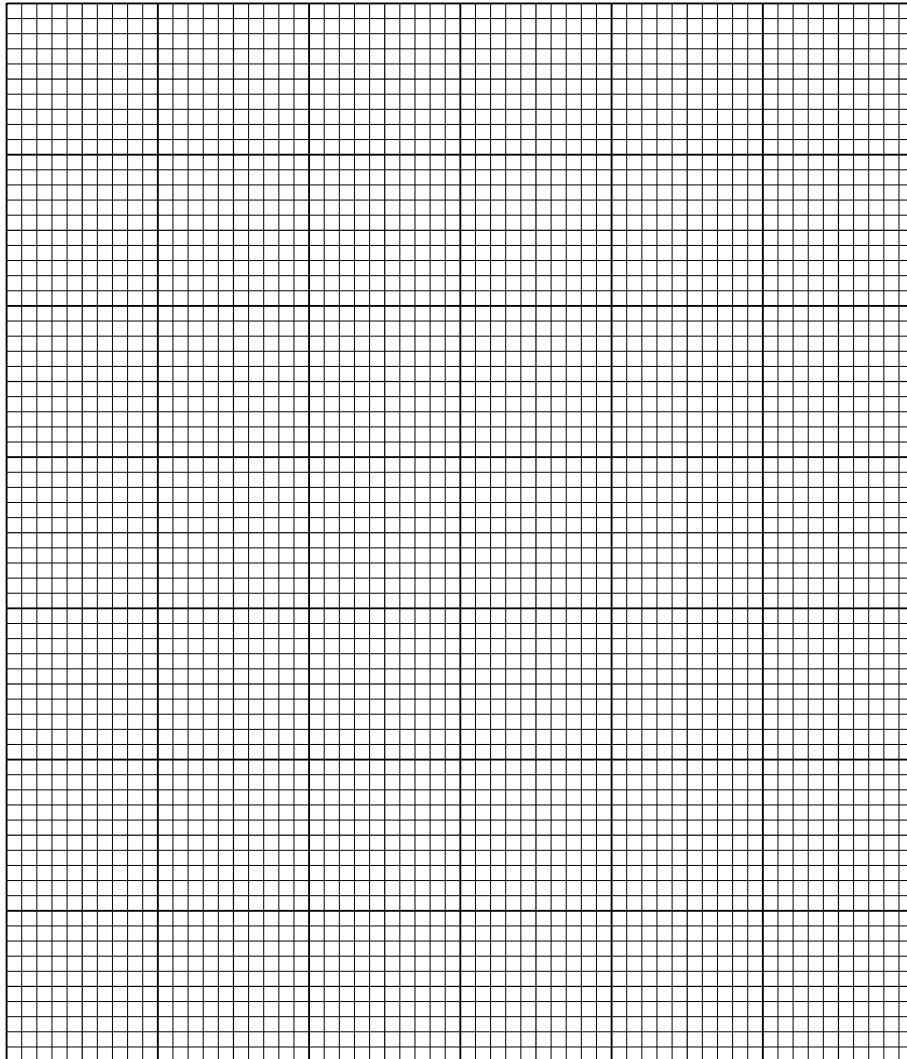
The effect of the temperature of the room on the average rate of sweating was investigated.

The results are shown in Table 1.1.

Table 1.1

temperature of room/°C	average rate of sweating /cm ³ per hour
13	10
22	40
30	320
36	740
40	1180

- (i) Plot a graph, using the data in Table 1.1, on the grid.



[4]

- (ii) Describe the effect of the temperature of the room on the average rate of sweating.

.....

.....

.....

.....[2]

[Total: 29]

Abbreviations used in the Mark Scheme:

;	separates marking points
/	alternatives
I	ignore
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
AW	alternative wording (where responses vary more than usual)
AVP	any valid point
ecf	credit a correct statement / calculation that follows a previous wrong response
ora	or reverse argument
()	the word / phrase in brackets is not required, but sets the context
<u>underline</u>	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given

Question	Answer	Marks
1 (a)	one table drawn with rows and (3) columns ; appropriate column headings with units (°C and min) ; table shows starting temperatures ; correct completion of the table ; temperature in both beakers decreases with time ; faster rate of temperature decrease in the beaker with 'ears' ;	[6]
1 (b)	wear goggles / gloves / method to reduce spillages / stand up when working ;	[1]
1 (c) (i)	may have different starting temperatures ; enables results to be compared / AW ; allows calculation of rate ;	[2]
1 (c) (ii)	2.3 ; working $18 \div 8$	[2]
1 (d) (i)	suggest do not fit snugly on the beaker / holes made in the cardboard/more holes in the lid with the ears ; water volume not measured ; squeeze rate not consistent / defined ; difficult to measure both times simultaneously ; explain heat may be lost through gaps / more holes so greater heat loss ; different volumes cool at different rates ;	[4]

Question	Answer	Marks
1 (d) (ii)	improve insulation of beaker ; start temperatures the same ; measure volume of water in beakers ; squeezing regularly / force of squeezing ; stir water ; use digital thermometer ; tape holes ; sequential experiments ;	[1]
1 (e) (i)	smaller ears	[1]
1 (e) (ii)	cooler temperature	[1]
[Total: 18]		
1 (a)	one table drawn with lines ; column / row headings (time and temperature); appropriate units ($^{\circ}\text{C}$ and minutes) in the header only; temperatures recorded for beaker A ; temperatures recorded for beaker B ; appropriate trend;	[6]
1 (b) (i)	temperature fall correct for beaker A and B (with units) ; divide both temperature differences by 5 (minutes) ; correct answer obtained; correct units ($^{\circ}\text{C} / \text{min}$) ;	[4]
1 (b) (ii)	the greater the volume of the body, the smaller the rate of heart loss / ref to speed (e.g. slower) / ora ; rate of heat loss in A is less than beaker B / ora ; appropriate data quote comparing A and B ; the greater the volume of the body, the greater the (total) heat loss / ora ;	[2]
1 (c) (i)	<i>any 2 from:</i> temperature of environment; size / volume of beaker; starting temperature of water; time intervals / 1 minute to record temperature ; total time / 5 minutes for investigation;	[2]
1 (c) (ii)	<i>idea</i> of time taken for the thermometer to reach the water temperature is longer;	[1]
1 (c) (iii)	<i>error:</i> drawing the line accurately / judging the water level against the line / measuring height (rather than volume); <i>improvement:</i> measure the volumes of water / AW ;	[2]

Question	Answer	Marks
1 (d)	<p><i>any 6 from:</i></p> <p>1 identical containers / containers of equal volume / containers of equal size;</p> <p>2 same volume of water in each container;</p> <p>3 same starting temperature for the water;</p> <p>4 idea of placing (containers) in 2 or more different temperatures; 5 detail of method to keep external temperature constant, e.g. use of water-bath or a fridge and explanation;</p> <p>6 measure temperature in each container for the same time / measure temperature in each container at set intervals;</p> <p>7 repeat and calculate an average / mean;</p> <p>8 calculate / compare rate of heat loss (for each temperature);</p>	[6]
1 (e) (i)	<p>A(xes) – labelled with units;</p> <p>S(cale) – even scale and plots to fill half or more of the printed grid ;</p> <p>P(lot) – all points plotted accurately $\pm \frac{1}{2}$ square ;</p> <p>L(ine) – line joining all the points $\pm \frac{1}{2}$ square ;</p>	[4]
1 (e) (ii)	<p>as temperature increases (rate of) sweating increases / ora;</p> <p>idea of increasing rate of increase as temperature rises / not a linear relationship / not directly proportional;</p>	[2]
[Total: 29]		