

The following statements refer to ectothermic and endothermic animals. If a statement is correct place a tick (✓) in the appropriate box and if it is incorrect place a cross (×) in the appropriate box.

Statement	Ectotherms	Endotherms
Require metabolic heat to keep warm		
Require external heat from the sun to keep warm		
Applies only to mammals		
All possess sweat glands		
All possess a thermoregulatory centre in the hypothalamus		

(a) Outline three methods by which mammals may increase heat loss from their bodies.

1. ....  
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.....  
..... [3]

2. ....  
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.....  
..... [3]

3. ....  
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..... [3]

(b) A hibernating mammal, such as a hedgehog, has a large reserve of brown fat. Explain why this is necessary.

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..... [3]

(c) Suggest why hibernation is a common strategy during adverse conditions.

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..... [3]

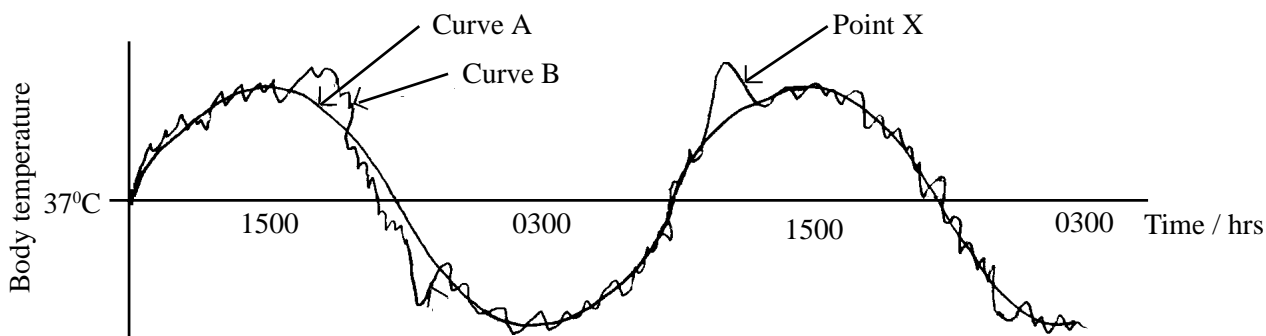
Explain the importance of the following in temperature regulation in mammals.

(a) The hypothalamus: .....  
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..... [3]

(b) The autonomic nervous system: .....  
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..... [3]

(c) Adipose tissue: .....  
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..... [4]

The following graph illustrates the Circadian (daily) biorhythm of body temperature in humans. Curve A shows the mean body temperature and curve B, variations from the mean.



(a)(i) What do you understand by the term ‘Circadian biorhythm’?

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

(ii) Name another biorhythm in humans which has a different time scale and state its time scale.

Name: .....  
 Time scale: .....  
 [2]

(iii) Explain the fluctuations in body temperature shown in curve A.

.....  
 .....  
 .....  
 .....  
 [3]

(b) With reference to curve B explain the changes that occur at point X.

X: .....  
 .....  
 .....  
 .....  
 [3]

(c) This is an endogenous rhythm. Explain the term ‘endogenous rhythm’.

.....  
 [1]

QUESTIONSHEET 5

Explain how the following adaptations can help in temperature regulation.

(a) The thick fur coat of an arctic mammal.

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.....

[2]

(b) The presence of sudorific (sweat) glands in some mammals.

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[2]

(c) The thick layer of subcutaneous fat in a marine mammal.

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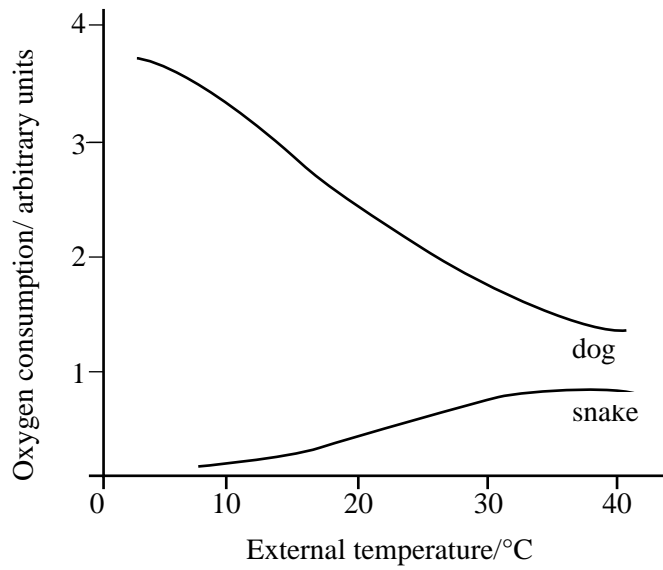
[2]

(d) The presence of arteriole shunts in the blood supply to the skin.

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[2]

The graph below shows the oxygen consumption in arbitrary units of a snake (ectothermic) and a dog (endothermic) at different external temperatures.



Comment on the relationship between external temperature and oxygen consumption in:

(a) the dog.

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.....

.....

.....

[4]

(b) the snake.

.....

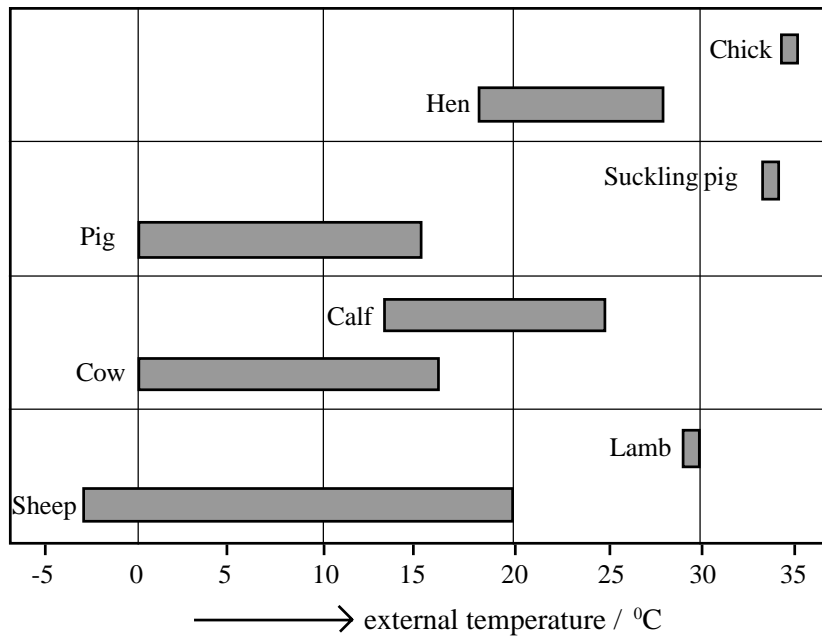
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[3]

The figure shows the range of external temperatures (comfort zone) within which livestock can make homeostatic adjustments to maintain their own body temperature with minimal changes to their metabolic rate.



(a) Suggest why it is economically sensible for farmers to maintain the external temperatures approximately the same as the blood temperatures of their livestock.

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[3]

(b) Suggest an explanation for the difference in the comfort zone of sheep and lambs.

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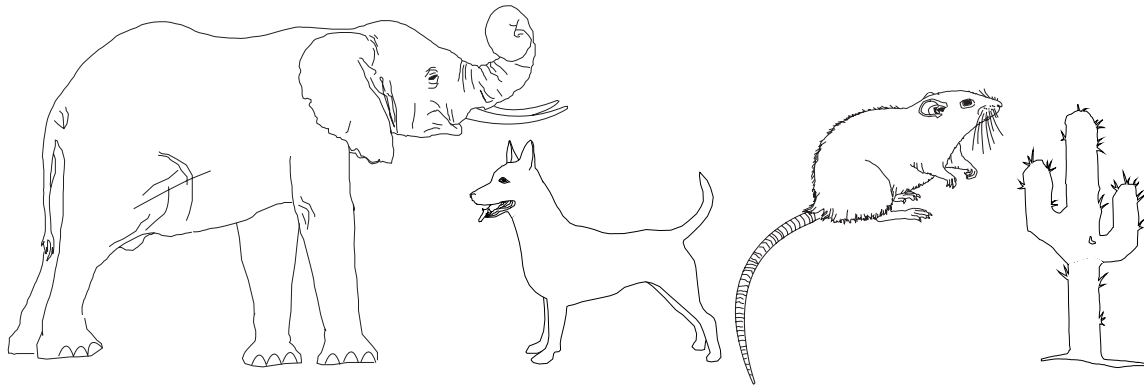
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[4]

Humans have sweat glands in order to lose heat by using up latent heat of vaporisation of water. Elephants, dogs, rats and cactus plants do not have sweat glands and so must lose heat by alternative methods. For each of the following organisms describe their main method of losing heat.



(a) Elephants: .....

..... [2]

(b) Dogs: .....

..... [2]

(c) Rats: .....

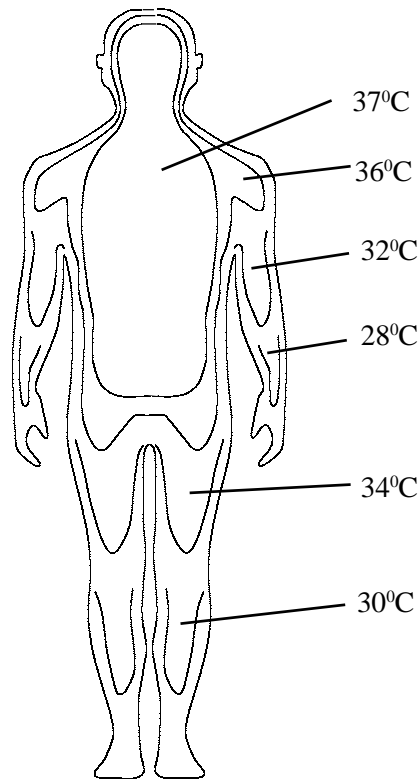
..... [2]

(d) Cactus: .....

..... [2]



The diagram shows the temperatures of regions of a human body exposed to a cold environment.



(a) (i) Which cells of the body are responsible for monitoring body temperature?

..... [2]

(ii) Which part of the body is responsible for controlling core temperature?

..... [1]

(b) Explain the significance of the temperature pattern shown.

.....  
.....  
..... [3]

(c) Suggest an explanation for each of the following responses:

(i) Upon initial exposure to a cold environment, a person's face appears pale in colour.

..... [1]

(ii) Following prolonged exposure to the cold a person's face becomes ruddy i.e. they develop a red-faced complexion.

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..... [1]

By reference to the physiological mechanisms involved give an explanation for each of the following:

(a) eating an ice cream on a hot day may actually cause the skin temperature to rise.

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..... [5]

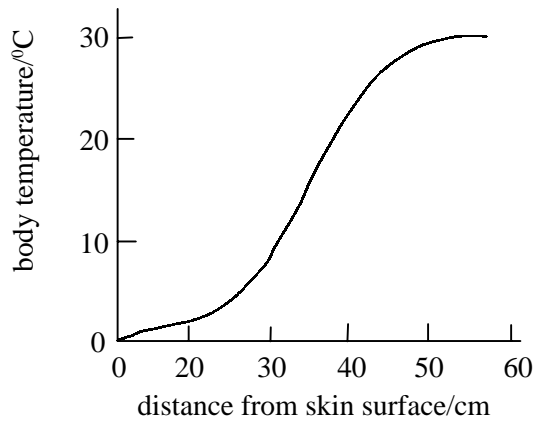
(b) on awaking from hibernation a hedgehog's reduced temperature rises back to normal very quickly (within half an hour);

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..... [5]

(c) crocodiles tend to bask in the sun with their mouths gaping open.

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..... [4]

Seals, whales and polar bears characteristically develop thick layers of blubber in their superficial tissues. Polar bears, in addition, also have a very thick coat of white hair. The graph below shows the temperature of the surface layers of a seal when swimming in icy waters (around 0 - 4°C).



(a) (i) Explain the data shown in the graph.

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..... [4]

(ii) How would the seal lose heat if its core temperature became too high?

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..... [4]

(b) Explain why polar bears have a thick coat of white fur as well as a layer of blubber.

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.....  
..... [4]

Suggest explanations for the following observations:

(a) In a dehydrated camel the body temperature fluctuates between 34.5°C and 40.5°C but in a well-watered camel the body temperature only fluctuates between 36°C and 39°C.

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..... [5]

(b) In proportion to body mass, the length and breadth of the ears of the Arizona Jack-rabbit (a species of hare) are twice as large as the ears of the Arctic hare.

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.....  
..... [3]

(c) Modern elephants and rhinoceros species have virtually no hair but their prehistoric relatives, the mammoth and woolly rhinoceros were covered with thick hair.

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.....  
..... [3]