

Communication & homeostasis

Model Answers 1

Time allowed: 46 minutes

Score: /34

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

Which of the options, **A** to **D**, correctly describes how an endotherm would respond to an increase in temperature?

- A. dilation of arterioles near the surface of the skin
- B. erector muscles contract, causing hairs to stand up
- C. rapid contractions of skeletal muscles
- D. sweat glands release less sweat

[1]

Increased blood flow to the skin increases heat loss

Question 2

Fig. 11.1 shows the heat flow through the skin of an athlete during vigorous exercise. Exercise starts at 400 seconds.

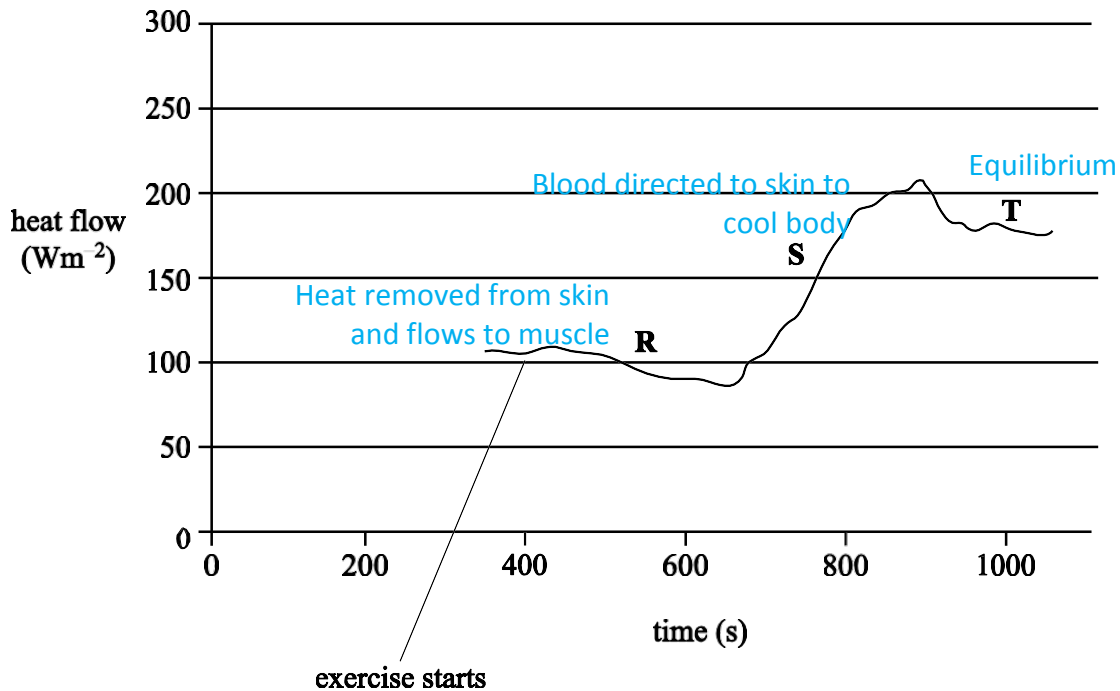


Fig. 11.1

Blood flow can be directed to those parts of the body that make the greatest demands.

Which row gives the best explanation of the stages in Fig. 11.1?

	R	S	T
A	Blood directed away from skin to avoid excess heat loss	Blood directed towards skin to release excess heat	Balance achieved between loss of excess heat and the need for oxygen in the muscles
B	Blood directed away from skin and towards the muscles to supply more oxygen for respiration	Blood directed towards skin to release excess heat	Balance achieved between heat loss and excess heat created in the muscles
C	Blood directed away from skin to avoid excess heat loss	Blood directed towards skin to gain heat from the environment	Balance achieved between heat loss and excess heat created in the muscles
D	Blood directed away from skin and towards the muscles to supply more oxygen for respiration	Blood directed towards skin to gain heat from the environment	Balance achieved between loss of excess heat and the need for oxygen in the muscles

[1]

Question 3

The maintenance of a stable body temperature is an important aspect of homeostasis in endotherms. This is known as thermoregulation.

(a) (i) State where the **core** body temperature is monitored. [1]

Core body temperature is monitored in the hypothalamus

(ii) Name the type of sensory cell in the skin that detects changes in environmental temperature. [1]

- Peripheral thermoreceptors are found in the skin

Peripheral thermoreceptors in the skin allow the thermoregulatory centre in the hypothalamus to regulate body temperature, they also allow a behavioural response to be made by the individual. This means core body temperature might not be affected if the response reduces the effect of the temperature change.

(iii) Name the corrective homeostatic mechanism that works to restore any changes in body temperature to the normal range. [1]

Negative feedback is responsible for the corrective mechanism

(b) Endotherms respond in different ways to changes in environmental temperature. Some of these responses are listed below:

J	secretion of adrenaline
K	sweating
L	shivering
M	contraction of erector pili muscles (attached to base of hairs)
N	curling up
O	finding shade
P	vasoconstriction of arterioles near to skin surface

Use the letters, **J** to **P**, to identify:

(i) the responses that conserve heat. **[1]**

- The responses that conserve heat are M,N and P.

That is contraction of erector pili muscles in the skin which trap a layer of insulating air.

Curling up reduces the surface area of the body to reduce heat loss. Vasoconstriction of arterioles near the surface of the skin reduces heat loss by radiation.

(ii) the responses that cool the body. **[1]**

- Responses that cool the body are K and O

Sweating cools the body as the water in sweat evaporates, it uses heat from the skin.

Finding shade is a behavioural response.

(iii) a physiological response that generates heat. **[1]**

- L is a physiological response that generates heat

Shivering involves rapid muscle contractions. The energy for this is provided by respiration which produces heat as a waste product

(iv) a behavioural (not physiological) response to a decrease in environmental temperature. **[1]**

N is a behavioural response to a decrease in environmental temperature

- (c) Different endotherms have evolved different physiological and behavioural adaptations to assist with temperature control.

Explain how each of the following adaptations help the animal to control its body temperature.

- (i) Elephants have large, thin ears that they move backwards and forwards when hot. **[2]**

- Large ears provide a large surface area to lose heat
- The ears are thin so that blood flow is close to the surface
- Moving the ears increases air movement over the skin

- (ii) Penguins living in cold climates have 'shunt' blood vessels. These shunt vessels link arterioles carrying blood towards their feet with small veins that carry blood away from their feet.

[1]

The feet of the penguin will lose less heat because less blood flows to them or warm

blood is diverted from arterioles to veins

[Total: 10]

Question 4

Coordination and control, using electrical and chemical methods, are vital in the correct functioning of multicellular organisms.

(a) Complete the following paragraphs by writing the **most suitable** word or term in each case.

Multicellular organisms need to monitor and **respond** to changes in both their external and internal environments. Organisms also need to co-ordinate the activities of different **organs / tissues** in the body. The way in which cells communicate with each other is known as **cell signalling** and this is achieved by the nervous and hormonal systems.

A regulatory mechanism known as **negative feedback** is used to maintain the internal environment at a relatively constant level despite changes in the environment. This maintenance of a stable internal environment is known as **homeostasis** [5]

(b) Identify the following:

(i) an organ that has both endocrine and exocrine functions. [1]

- **The pancreas has both exocrine and endocrine functions**

Exocrine glands secrete enzymes into a duct whereas endocrine glands secrete hormones into the bloodstream

(ii) the cells that form the myelin sheath around an axon. [1]

- **Schwann cells form the myelin sheath around the axon**

The gaps between Schwann cells are the Nodes of Ranvier which make the nerve impulse jump from node to node which speeds it up. This is known as saltatory conduction.

(iii) the hormone produced by the α -cells in the Islets of Langerhans. [1]

Glucagon is the hormone produced by the α cells of the Islets of Langerhans

(iv) the nerve that stimulates cardiac muscle and has the opposite effect to the accelerator nerve. [1]

- The vagus nerve or parasympathetic nerve

This has the opposite effect to the accelerator or sympathetic nerve

(v) an effector in the skin that is involved in temperature regulation. [1]

- Sweat gland
- Hair erector muscle
- Smooth muscle in wall of arteriole

[Total: 10]

Question 5

(a) The cells of the body need to communicate with one another.

State the name given to this process of communication.

[1]

Communication between cells is known as cell signalling

(b) Fig. 1.1 is an electron micrograph of the junction between two neurones.

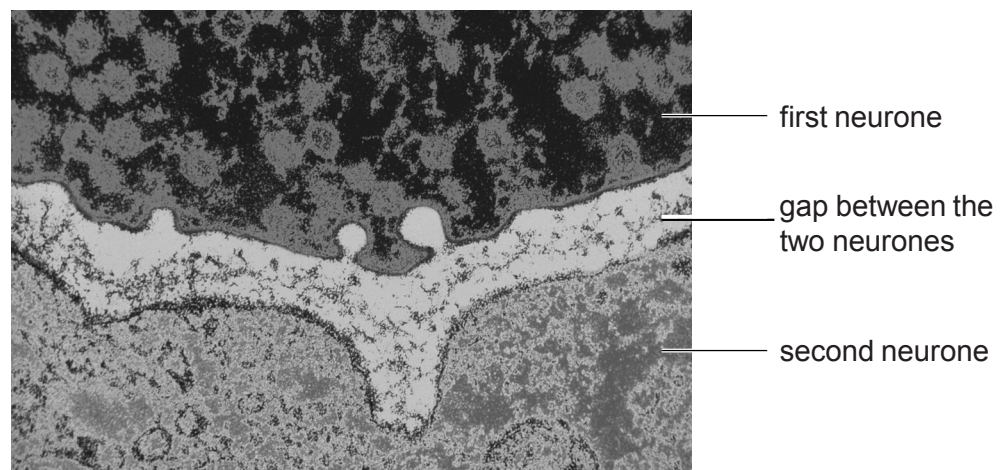



Fig. 1.1

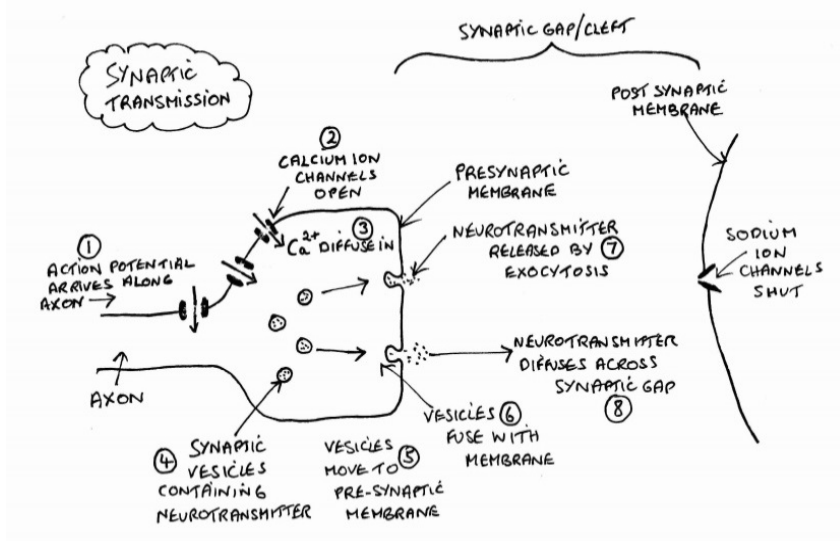
(i) State the name given to the gap between the two neurones at this junction. [1]

Gaps between neurones are called synapses

(ii) Outline how the first neurone communicates with the second neurone across the gap.

 In your answer, you should use appropriate technical terms, spelt correctly. [3]

- A neurotransmitter such as acetylcholine is released from the presynaptic membrane
- The neurotransmitter diffuses across the synaptic cleft
- The transmitter attaches to receptors attached to sodium ion channels on the postsynaptic membrane
- Following this the neurotransmitter is broken down by enzymes in the cleft



(iii) Outline the importance of the junctions between neurones in the functioning of the nervous system. [3]

The nervous system and the hormonal system are involved in the maintenance of core body temperature.

- Synapses make sure that action potentials only occur in one direction
- One neurone can connect to many different neurons to have a wider effect
- Summation can take place if several neurones converge onto one neurone
- Communication between synapses is the basis of memory and learning
- There are also two types of synapses known as excitatory and inhibitory

If a stimulus is repeated then the re-formation of neurotransmitter will not keep up with the continued stimulus. As a result the synapse will filter out any low level of background stimuli

(c) Give the **most suitable** word or term that has the same meaning as each of the following descriptions:

(i) animals that are able to regulate and maintain their core body temperature within narrow limits; [1]

Animals that can maintain a constant body temperature are endotherms

(ii) the increase in the diameter of the lumen of an arteriole to allow more blood to flow through. [1]

An increase in the diameter of the lumen of an arteriole is known as vasodilation

(d) (i) Name a hormone that increases the metabolic rate and so generates heat. [1]

A hormone that increases the metabolic rate and generates heat could be adrenalin or thyroxine

(ii) Name the part of the brain where the thermoregulatory centre is located. [1]

The thermoregulatory centre is in the hypothalamus

[Total: 12]