**Thermoregulation**

45 min

38 marks

**1.** (a) The blood vessels in the skin play an important part in allowing a mammal to conserve heat. Describe how.

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(2)

(b) Sea lions and iguanas feed in the sea around the tropical Galapagos Islands. Sea lions are mammals and iguanas are reptiles. Both species spend some time on land. The graphs show the core body temperature and the oxygen consumption of an iguana and a sea lion at different external temperatures.



Using information from the graphs, answer the following questions.

(i) The mean temperature of the sea surrounding the Galapagos Islands is 21 °C while the mean air temperature during the day is higher than this. Suggest why the iguana feeds for only short periods of time in the water before returning to the land.

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**S** (ii) Explain the link between core body temperature and rate of oxygen consumption in the sea lion between the external temperatures of 10 °C and 30 °C.

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(Total 6 marks)

**2.** Some organisms are adapted for living in hot, dry environments.

Explain what causes the activity of reptiles living in a desert to vary greatly over a twenty-four hour period.

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(Total 5 marks)

**3.** (a) Humans are able to maintain a constant core temperature when exposed to cold external temperatures.

**S** Suggest

(i) **one** advantage of this;

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(1)

(ii) **one** disadvantage of this.

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(1)

(b) The graphs show data collected from a volunteer who ate several ice cubes.



(i) Explain the relationship between the rate of sweating and the temperature of the skin.

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(ii) Use information in the graphs to explain the part played by negative feedback in the control of core temperature.

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(Total 6 marks)

**4.** Size matters for marathon runners. Big athletes produce more heat and find it harder to keep cool. Shape matters too - a tall, thin runner has fewer problems keeping cool than a short, tubby runner of the same body mass. A 65 kg athlete running a marathon in 2 hours 10 minutes in reasonably dry conditions can avoid overheating at air temperatures up to 37 °C, but in humid conditions the same level of performance is possible only at temperatures below about 17 °C.

(a) Explain how athletes produce heat when they run.

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(b) Why does a ‘tall, thin runner have fewer problems keeping cool than a short, tubby runner of the same body mass’?

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(c) Explain why runners are more likely to overheat in humid conditions.

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(d) Describe how the body responds to a rise in core body temperature.

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(Total 12 marks)

**5.** The graph shows the effect of increasing the environmental temperature on the metabolic rate of a small mammal.



(a) Suggest **one** way of measuring the metabolic rate.

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(1)

(b) The small mammal has ears which are usually pink, but they appear pale when the environmental temperature is low. Explain the pale appearance of the mammal’s ears when the environmental temperature is low.

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(c) Use your knowledge of thermoregulation to explain

(i) the change in metabolic rate of the mammal when the environmental temperature increases from 5°C to 40°C;

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(ii) the increase in metabolic rate after 40°C.

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(2)

(Total 9 marks)