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LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE

R072/02/RB How scientific ideas have developed

PRE-RELEASE RESOURCE BOOKLET

JUNE 2018



INSTRUCTIONS TO CANDIDATES

- This Pre-release Resource Booklet contains the case study required to answer Question 1. Question 1 accounts for 25% of the total marks.
- Take this Booklet away and read it through carefully.
- Spend some time looking up any technical terms or phrases you do not understand.
- For the examination on **11 June 2018** you will be given a fresh copy of this Booklet, together with a Question Paper.
- You will **not** be able to take your original copy into the examination with you.

INFORMATION FOR CANDIDATES

- This document consists of **8** pages. Any blank pages are indicated.

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The Polar Bear Plunge

The Polar Bear Plunge is a winter event in the United States where people plunge into freezing water (for example the sea) to raise money for charity. Organisers say that it is safe for healthy people to take a 'quick dip' into water below 0 °C. A scientist joked that 'you will be fine, as long as you get out fast and you are not a snake!'

Warm-blooded and cold-blooded animals

Mammals such as humans are warm-blooded animals. This means that their bodies have some control over their body temperature, independent of outside temperatures.

Reptiles such as snakes are cold-blooded animals. Although respiration causes a small increase in the body temperature of cold-blooded animals, their body temperature is closely linked to the outside temperature.

The graph in **Fig. 1** shows how the body temperature of a cat (a warm-blooded animal) and a snake (a cold-blooded animal) changes with the outside temperature.

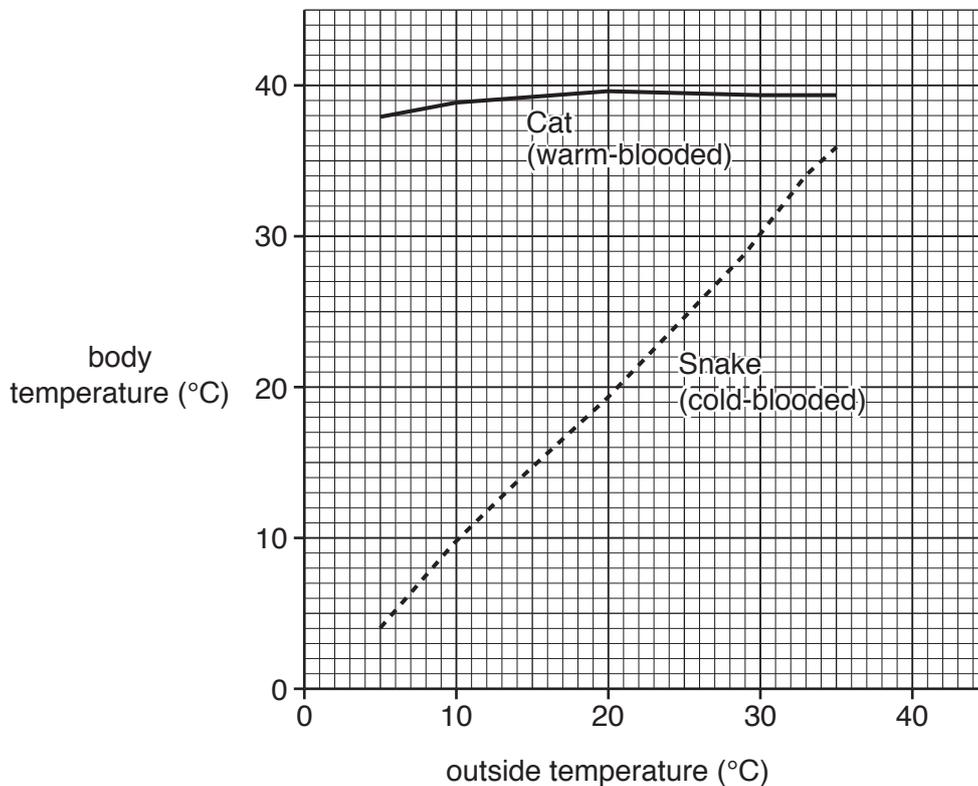


Fig. 1

The frill-necked lizard (**Fig. 2**) is a cold-blooded animal. Its temperature changes during the day. When the body temperature of the lizard decreases it cannot keep up normal activity, so it sleeps and rests. When its body temperature increases it becomes more active, for example it can begin mating, hunting and feeding.



Fig. 2

The graph in **Fig. 3** shows data collected about the body temperature of a frill-necked lizard between 07:00 and 19:00 during a day. The scientist who conducted the study measured the temperature of a single lizard during a single day.

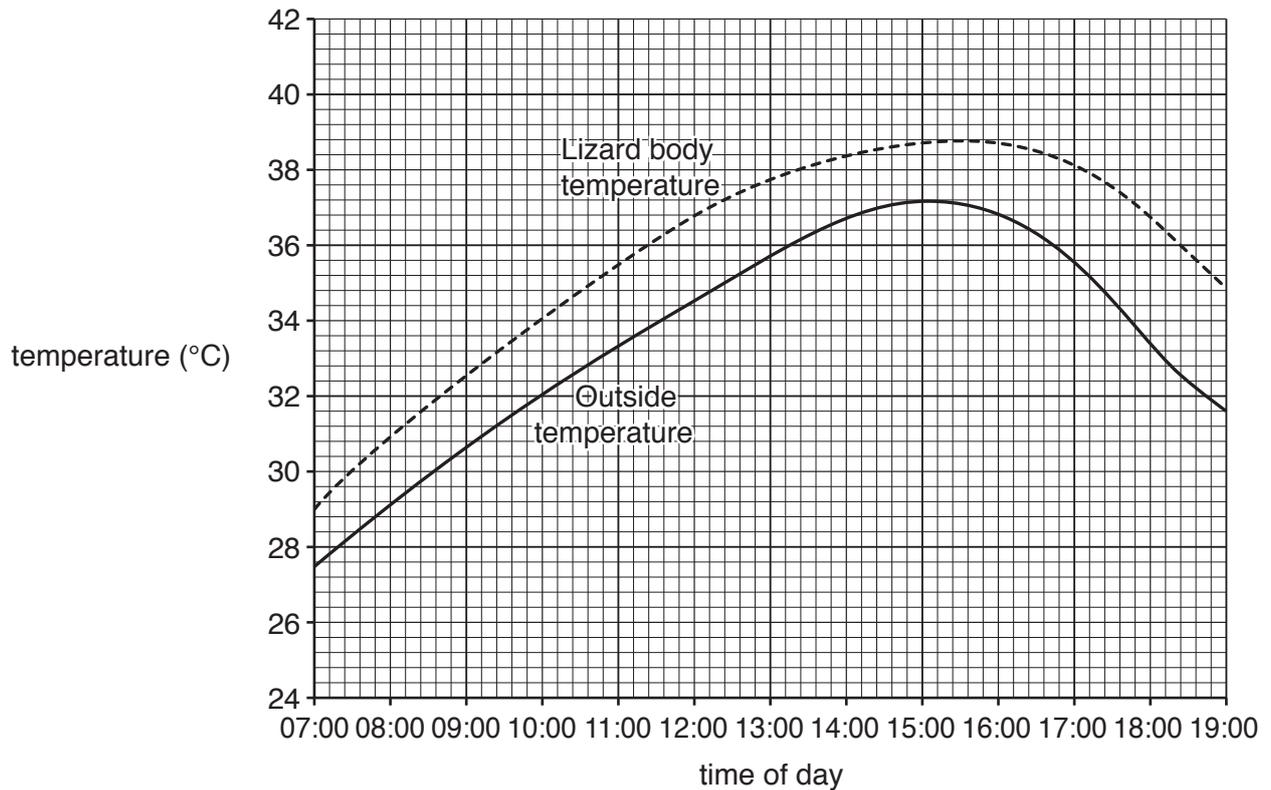


Fig. 3

Metabolic rate

Even when sleeping or resting, animals use a certain amount of energy for their body processes. The metabolic rate of an animal is a measure of how much energy the animal is using in a given time. When the metabolic rate is higher, the animal is using more energy. The basal metabolic rate is a measure of the amount of energy an animal uses when it is resting. Warm-blooded animals use energy to help to control their body temperature.

Warm-blooded animals operate best and are most comfortable in a narrow band of outside temperature. This is the 'critical temperature' range. In this temperature range, the animals can keep their normal body temperature without using any extra energy. When the outside temperature is higher or lower than this critical range, the body gets too hot or too cold and so reacts to bring its temperature back within the normal range. Warm-blooded animals can survive short periods at very extreme temperatures outside of this range.

Fig. 4 shows how the metabolic rate of a warm-blooded animal changes with outside temperature.

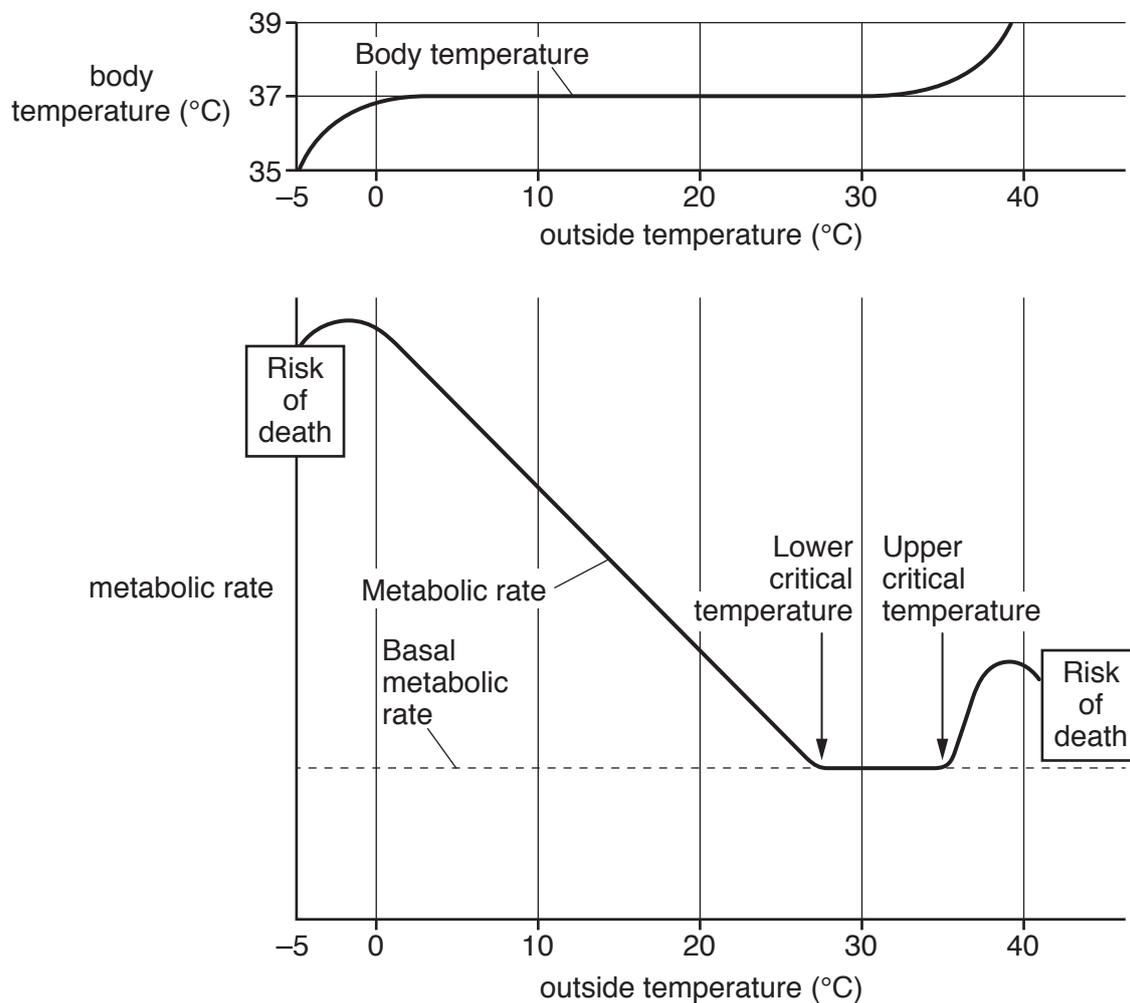


Fig. 4

Differences between warm-blooded and cold-blooded animals

The basal metabolic rate of a warm-blooded animal is about six times that of a cold-blooded animal at the same outside temperature. This energy is needed to help control their body temperature. During the winter, when food is scarce and the temperature is too low for normal activity, cold-blooded animals often hibernate (sleep) for long periods. Both types of animals have different features that enhance their chances of survival.

Some features of warm-blooded animals are summarised in **Table 1**.

Warm-blooded animals
Keep a constant internal temperature within their optimum temperature range.
Enzymes and body processes work to full capacity all of the time.
Can withstand extreme heat or cold for short periods of time.

Table 1

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