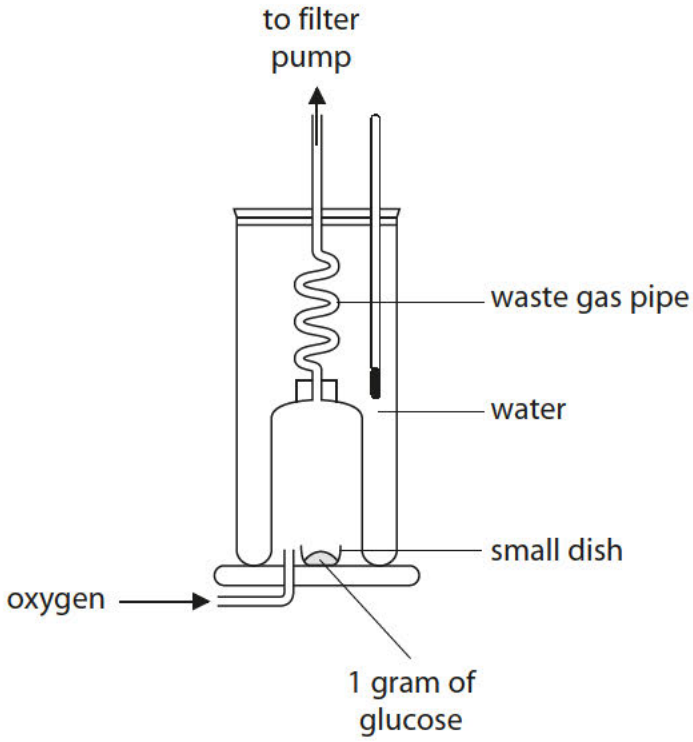
1 (a) The diagram shows a piece of apparatus called a calorimeter.



The calorimeter is used to investigate the energy content of one gram of glucose. The glucose burns in the calorimeter and the energy released heats the water.

(i) Suggest why oxygen gas is passed into the calorimeter.

(1)

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(ii) Suggest why the waste gas pipe is coiled.

(2)

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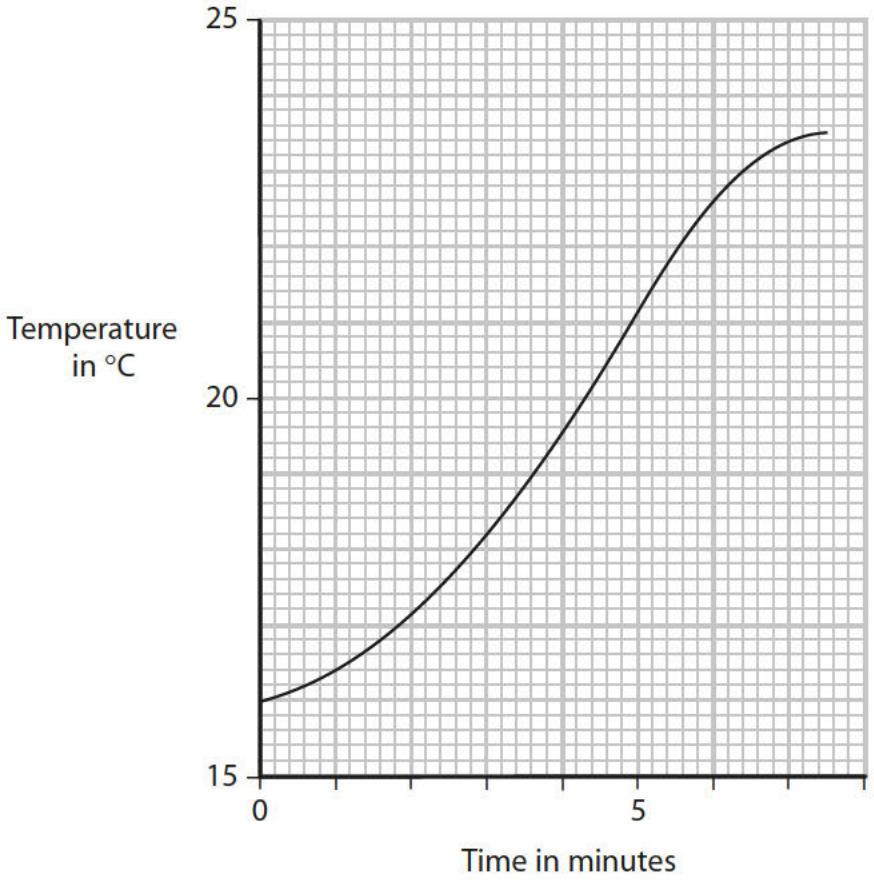
(iii) Suggest why stirring the water will improve the data collected.

(1)

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.....

(b) The calorimeter contains 200 g of water. The graph shows the rise in temperature of the water in the calorimeter during the investigation.



(i) Use the graph to find out the **increase** in the temperature of the water during the investigation.

(1)

.....°C

(ii) Use the formula to calculate the energy content of the 1 g of glucose.

$$\text{energy content in J per g} = \frac{\text{mass of water in g} \times \text{temperature increase in °C} \times 4.2}{\text{mass of food in g}}$$

(1)

.....J

(Total for Question = 6 marks)

2 Pigeons are birds that eat seeds. They are hunted by predators called hawks.



(a) Use this information to draw a food chain in the space below.

(2)

(b) Pigeons often feed in small groups. The size of the group of pigeons affects the success rate of a hawk in catching a pigeon. Pigeons use their eyes to see an approaching hawk.

The table gives information about the success that a hawk has in catching pigeons when pigeons are in different group sizes.

Number of pigeons in group	Average distance when pigeons first see hawk (metres)	Success rate of hawk catching a pigeon (%)
1	3	80
2 to 10	16	58
11 to 50	30	17
more than 50	40	6

(i) Use the information in the table to describe and explain the relationship between the size of a group of pigeons and the success rate of the hawk.

(2)

(ii) Describe the changes that would take place in the eye of a pigeon to help it focus on an approaching hawk.

(4)

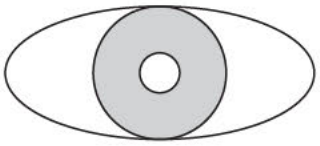
(iii) Describe what happens to protein from pigeon meat when it is in a hawk's stomach.

(3)

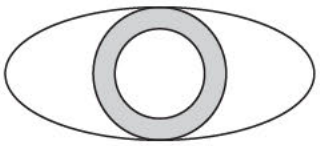
(Total for Question = 11 marks)

3 The eye can respond to changes in light intensity.

The diagram below shows how pupil size changes in different levels of light.



bright light



dark room

(a) Use a ruler to measure the change in pupil diameter between bright light and a dark room.

(1)

change in diameter = ... mm

(b) Where in the eye are the cells that detect the change in the stimulus to cause this response?

(1)

.....

(c) Explain the changes that take place in the pupil as a person moves from bright light into a dark room.

(3)

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(Total for Question = 5 marks)

4 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Conditioned Reflexes

Humans respond to stimuli such as sound, sight, smell and taste. Sometimes the response is a simple reflex. If we get a puff of air onto our eye, we blink. If we touch a hot object with our fingertips, we pull our hand away.

Another type of reflex is a conditioned reflex. These were first described around the beginning of the 20th century by the Russian physiologist Ivan Pavlov. Pavlov was studying digestive processes in dogs when he discovered that the dogs began to produce saliva before they received their food. In fact, after several occasions of the lab assistants bringing the food, the dogs started to produce saliva at the sight of the lab assistants. Pavlov called this 'psychic secretion'. He noted that dogs responded to a biological need (hunger) and also to a need developed by learning.



To experiment on conditioned reflexes, Pavlov used a tuning fork that produced a note of constant frequency. He hit the tuning fork and then gave the dog food. In the beginning the dog produced saliva only when given the food. After the combination of sound and then food were repeated, the dog produced saliva at the sound of the tuning fork. Even when Pavlov took away the food, the dog continued to produce saliva at the sound of the tuning fork alone. The dog had learned to associate one stimulus with another. The dog learned that the first stimulus is to be followed by the second stimulus. In Pavlov's experiments, the sound of the tuning fork informed the dogs that food was coming. The production of saliva was a conditioned reflex.

Pavlov then used a different tuning fork to produce a note of a different frequency. He measured the size of the dog's response to this note. He could then compare this response to the dog's response to the original tuning fork.

Many examples of conditioned reflexes exist in humans. Some psychologists believe that phobias, such as the fear of spiders, may develop by associating a neutral stimulus with a fearful one.

(a) Humans produce saliva when food is in their mouth.

Describe the function of saliva in humans.

(2)

(b) Complete the table by giving two sense organs that the dogs use to detect the arrival of food and the stimulus that each sense organ detects.

(2)

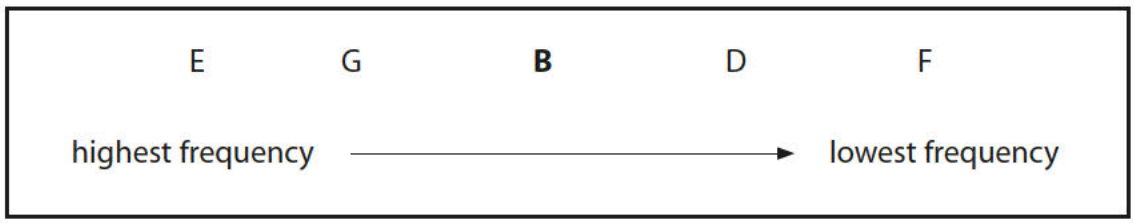
Sense organ	Stimulus

(c) Explain how reflex responses, such as blinking (line 2), differ from other nerve responses, such as picking up a pencil.

(2)

(d) Pavlov originally conditioned the dogs with a tuning fork of note B. The dogs would then produce saliva when the tuning fork was hit.

Different tuning forks produce notes of different frequencies as shown in the box.



(i) Suggest why notes G and D produce a greater response in the dogs than notes E and F.

(1)

(ii) Suggest how Pavlov might have measured the size of the conditioned response.

(2)

(e) Scientists make conclusions about humans from studying animal behaviour.
Suggest two reasons why these conclusions may **not** be valid.

(2)

1

2

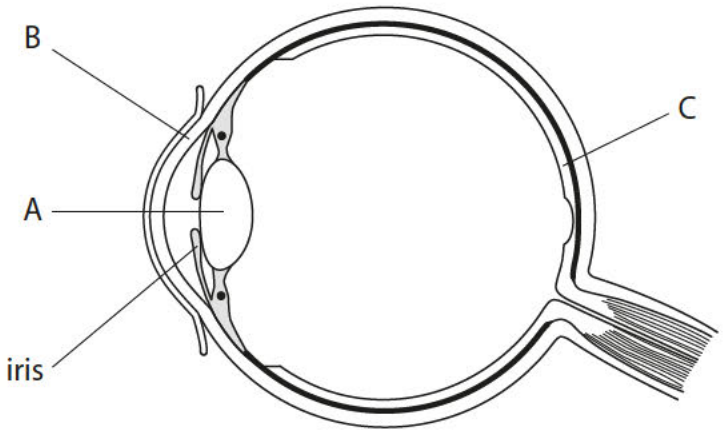
(f) Simple reflexes are responses to stimuli.

Explain the structure and functioning of a simple reflex arc, using the example of the withdrawal of a finger from a hot object.

(5)

(Total for Question = 16 marks)

5 The diagram shows a section through an eye with the iris and parts A, B and C labelled.



(a) Name parts A, B and C.

(3)

A .....

B .....

C .....

(b) When you move from a bright room into a dark room you cannot see very well for a while. After a brief time, a change in the iris helps you to see more clearly.

(i) The iris contains muscle tissue.

What is meant by the term **tissue**?

(1)

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(ii) Describe the changes that take place in the iris when moving into the dark room and explain how they help you to see more clearly.

(3)

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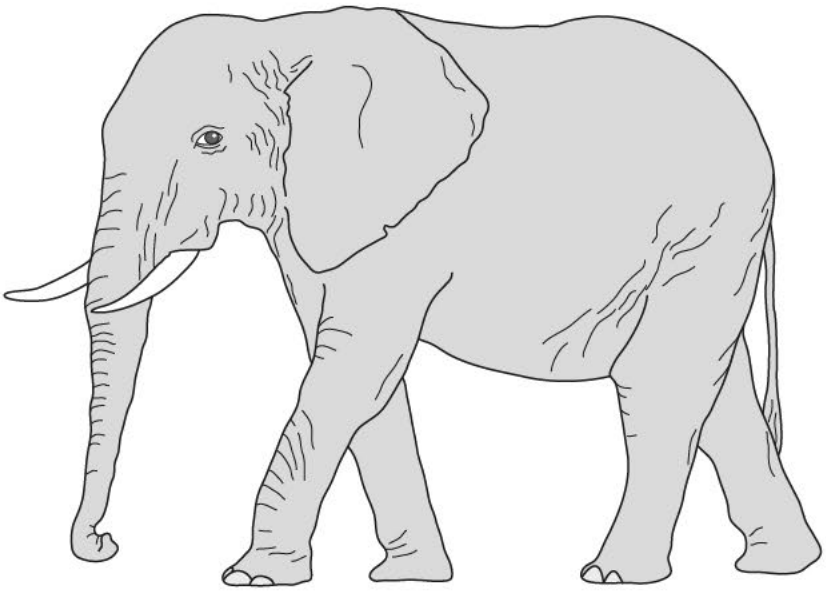
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(Total for Question = 7 marks)

6 The drawing shows an elephant. Elephants live in Africa where it is hot.



(a) The elephant is adapted to live in a hot environment by having large ears.

Suggest how having large ears helps prevent the body temperature of the elephant from rising too high.

(3)

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(b) Explain why the elephant may die if its body temperature rises too high.

(2)

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(Total for Question = 5 marks)