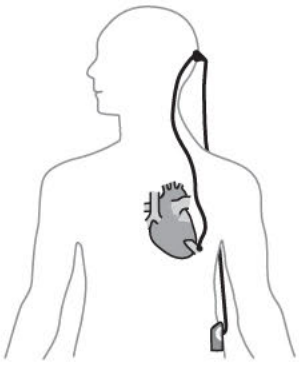
1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Artificial heart pump gives life to dying patients

In June 2000, a 61-year-old man in the United Kingdom became the first person to have a permanent artificial heart pump fitted. Before the pump was fitted, the man was told that he had only a few weeks left to live. However, the pump has taken on the work of his heart: taking blood from the heart and delivering it to the rest of the body. Pumps like these could be a possible alternative to heart transplants, which are usually performed on patients whose heart has begun to fail.

The operation to insert the pump took several hours but the surgeons were very pleased with the speed of the man's recovery. During the operation, the pump was fitted into the left ventricle of the man's heart. This heart chamber provides much of the pumping power of the heart when it contracts.



The pump is powered by batteries, which are usually carried around the patient's waist. The batteries are connected to the pump by wires which enter the body at the back of the skull. The wires then pass down through the neck, into the chest cavity and connect to the pump in the heart. The batteries are rechargeable and need changing every eight hours.

The surgeon who performed this operation wrote about it in a medical journal. He said that the pump had helped to lower the patient's blood pressure and had done no damage to his red blood cells. He also reported that, six weeks after the operation, the patient's heart and liver were working much better than before the procedure and that the man was able to take exercise. As the patient takes exercise, he can change the speed of the pump.

The important medical advance with this pump is that it is fitted permanently. Previous artificial heart pumps had to be replaced every few months and were also much larger and noisier. The new pumps give doctors hope that this treatment could solve the problem of a shortage of hearts available for transplants. The heart surgeon said, 'Currently, the outlook for patients who are not able to have a transplant is poor. Our laboratory experience and the result from this first operation with a small, silent intraventricular device suggests a potential alternative for many patients.'

(a) Name **two** of the blood vessels that carry blood away from the heart.

(2)

1 .....

2 .....

(b) Suggest why the batteries for the heart pump are placed outside the body (lines 12 and 13).

(1)

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(c) Describe how the blood in the left side of the heart differs from the blood in the right side of the heart.

(2)

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(d) Explain why the patient might need to change the speed of the pump (line 22).

(2)

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(e) Explain why some patients are 'not able to have a transplant' (line 28).

(1)

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(f) Suggest what is meant by the term **intraventricular** (line 29).

(1)

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(g) Suggest **two** advantages of using the new artificial heart pump compared to previous artificial heart pumps.

(2)

1 .....

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2 .....

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(Total for Question = 11 marks)

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

Therapeutic Cloning versus Reproductive Cloning

Some people find the idea of cloning frightening. They have an image of identical human beings being created by scientists. This is why some people were concerned when Dolly the sheep was created by reproductive cloning.

Therapeutic cloning is different as it could help to repair damaged tissue, for example in the treatment of diabetes, heart disease or the loss of photoreceptors in the eye that cause blindness.

The procedure involves putting an adult body cell nucleus into an enucleated egg cell. This egg cell is then stimulated to divide into an embryo. Some cells in this embryo are called stem cells. This means they have the ability to develop into many different cell types. The stem cells are removed and can be used to treat diseases in any body organ or tissue by replacing the damaged cells.

This type of therapy reduces the risk of rejection by the immune system. Cells from another person would be recognised as being foreign and would be attacked by the immune system. This rejection of foreign tissue is a major challenge of organ transplants, alongside the fact that there is a huge shortage of available organs for donation.

Some scientists hope that the stem cells created by therapeutic cloning might be useful in the treatment of heart disease. Heart disease is a major cause of death in the UK. It reduces the transport of oxygen to heart muscle cells and eventually kills them. The remaining living cells attempt to keep the heart pumping but heart failure may occur. Replacing damaged heart muscle tissue using stem cells, created by therapeutic cloning, may offer people a chance to survive heart failure. Studies show that stem cells injected directly into damaged heart tissue improve heart function and help with the formation of new capillaries.

Therapeutic cloning does result in the destruction of an embryo after the stem cells are removed and this destruction has caused concern over the morality of the procedure. Also, because therapeutic cloning uses a body cell nucleus, there is still concern that a scientist may attempt to move beyond therapeutic cloning and create a cloned human being.

(a) In cloning, an adult body cell nucleus is put into an enucleated egg cell.

What is meant by the term **enucleated** (line 7)?

(1)

(b) Name the part of the eye that contains photoreceptors (line 5).

(1)

(c) Explain why reducing the transport of oxygen to heart muscle cells will make them contract less efficiently and may kill these cells (lines 19 and 20).

(4)

(d) The formation of new capillaries helps to improve heart function (line 24).

Explain how the structure of a capillary is adapted to help improve heart function.

(2)

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(e) Give two advantages of using organs produced by therapeutic cloning compared to using donated organs.

(2)

1 .....

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2 .....

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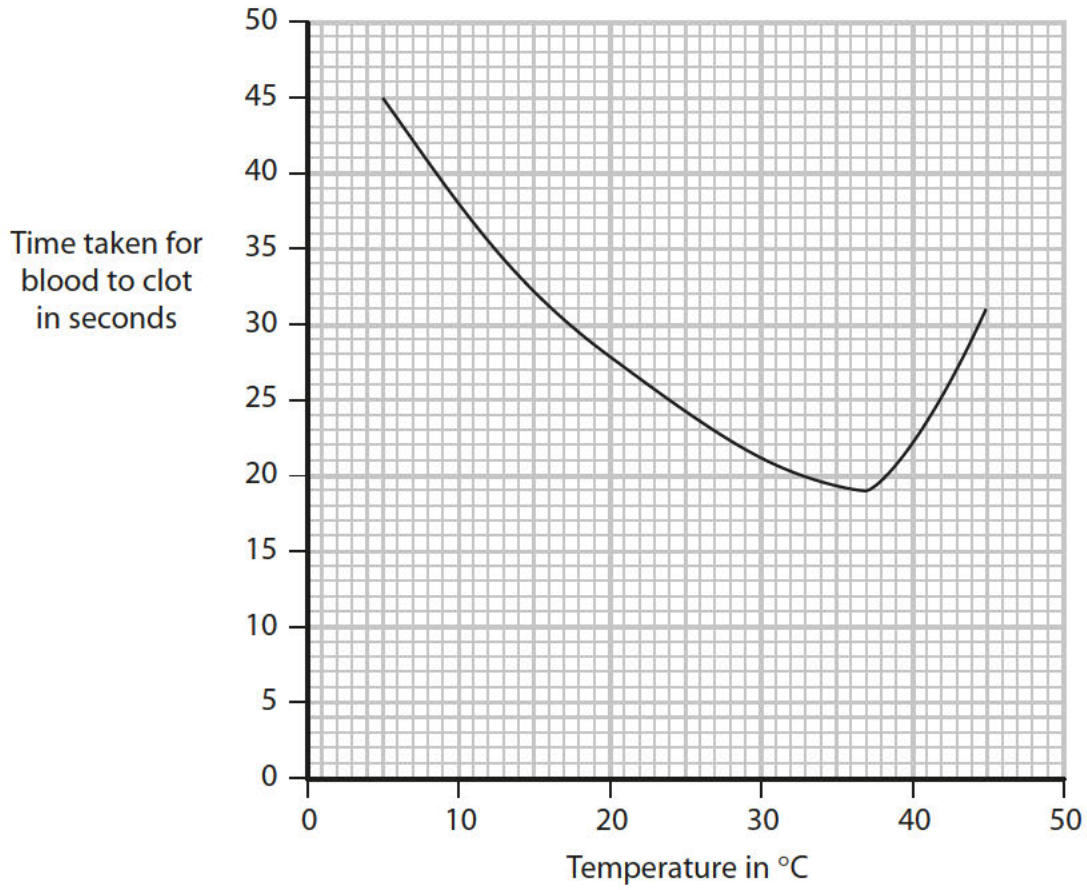
(f) Dolly the sheep was created by reproductive cloning (line 3).

Explain how a mammal such as Dolly the sheep has been cloned.

(5)

(Total for Question = 15 marks)

3 The graph shows the time taken for samples of blood to clot at different temperatures.



(a) When blood clots, an enzyme converts a soluble plasma protein into an insoluble plasma protein.

Use the information in the graph to suggest the optimum temperature for this enzyme.

(1)

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(b) Explain why blood takes longer to clot at 20 °C than it does at 30 °C.

(2)

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(c) Use your knowledge of enzymes to explain why blood is slow to clot at 45 °C.

(2)

(d) The coronary artery supplies blood to heart muscle cells. A heart attack may occur if the coronary artery is blocked by a blood clot.

Suggest what happens in heart muscle cells when the coronary artery is blocked.

(4)

(Total for Question = 9 marks)