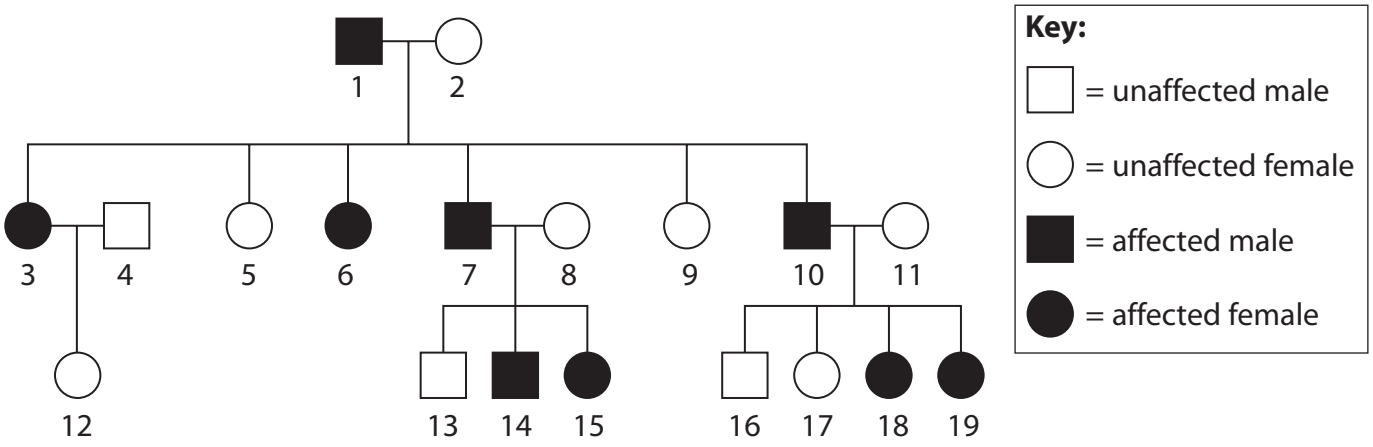
1 Moyamoya is a **rare** disorder caused by a dominant allele. This disorder progressively damages the arteries supplying the brain.

(a) Inherited factors may contribute to the development of moyamoya.

The pedigree diagram below shows a family affected by moyamoya.



(i) Explain how the information in the pedigree diagram suggests that this disorder is due to a dominant allele.

(3)

(ii) Using a genetic diagram, find the probability that the next child born to parents 3 and 4 would be affected by moyamoya.

(3)

Probability.....

(b) One way of treating moyamoya is to transplant an artery from a suitable donor to bypass the affected arteries supplying the brain.

Explain how the structure of an artery is adapted for its function.

(4)

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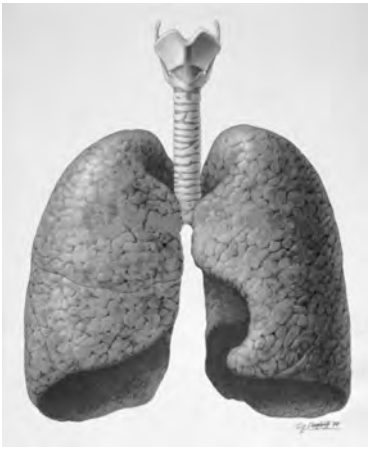
(Total for Question 1 = 10 marks)

2 Many animals have specialised organs for gas exchange and transport.

*(a) The diagram below shows the lungs of a mammal.

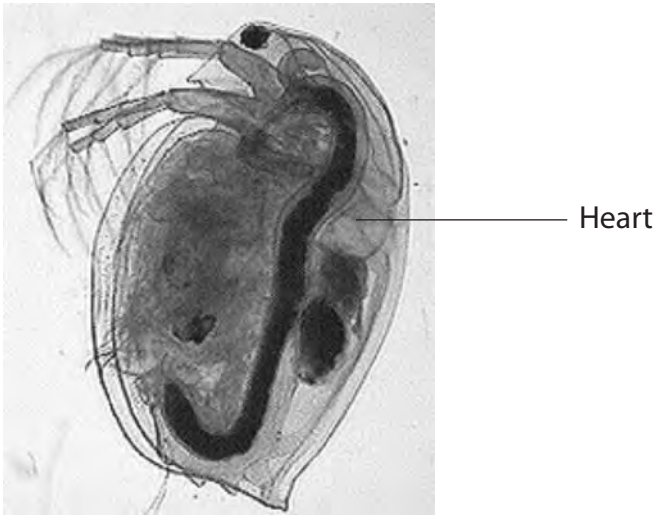


Describe and explain how the lungs of a mammal are adapted for rapid gas exchange.

(5)

(b) *Daphnia* have a circulatory system with a heart that pumps blood into cavities surrounding their organs.

The photograph below shows the location of the heart in a *Daphnia*.



Magnification ×25

(i) Suggest how the heart of a *Daphnia* enables organs to carry out effective gas exchange.

(2)

(ii) In mammals, blood passes through the heart twice for each circulation of the body.

Suggest how this type of circulation enables mammals to carry out effective gas exchange.

(3)

(Total for Question 2 = 10 marks)

3 There is evidence for a causal relationship between blood cholesterol levels and cardiovascular disease (CVD).

(a) Explain the meaning of the term **causal relationship**.

(1)

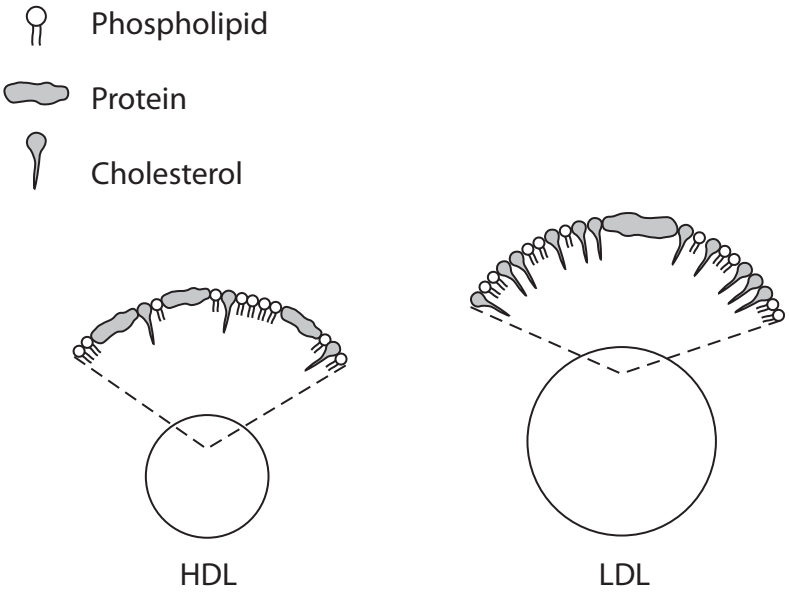
(b) Lipoproteins are composed of phospholipids, cholesterol and proteins.

(i) Proteins are made up of amino acids.

Describe how amino acids join together to form the three-dimensional structure of a protein.

(4)

(ii) The diagrams below show part of the structure of the surface of high-density lipoprotein (HDL) and low-density lipoprotein (LDL).



Using the information in the diagram, describe the differences between the structure of HDL and the structure of LDL.

(2)

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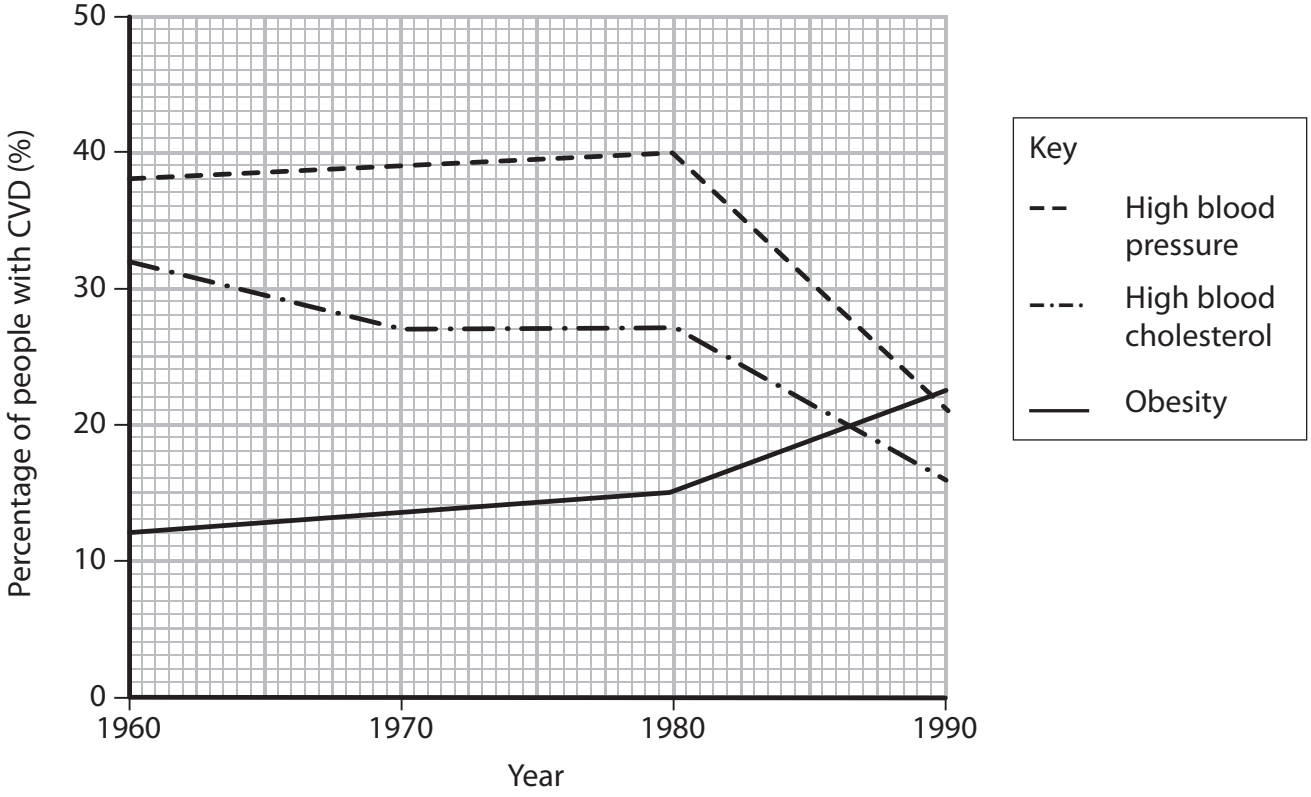
(c) Obesity and high blood pressure are also factors that increase the risk of CVD.

The graph below shows the percentage of people with CVD who have high blood pressure or have high blood cholesterol or are obese for the period 1960 to 1990.



(i) Using the information in the graph, describe the overall changes that have occurred in these risk factors during this period.

(3)

(ii) Suggest **two** reasons for the overall change in high blood cholesterol as a risk factor.

(2)

1 .....

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2 .....

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(iii) State **two** factors, other than obesity, high blood pressure and high blood cholesterol, that increase the risk of CVD.

(1)

1 .....

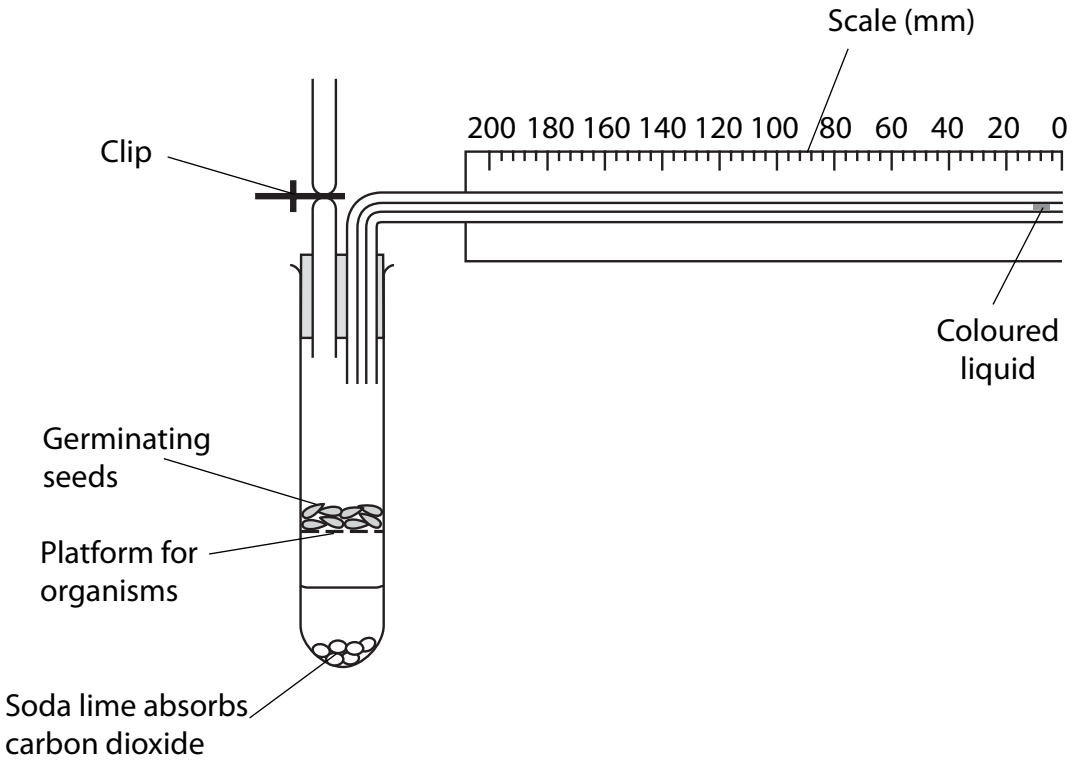
2 .....

(Total for Question 3 = 13 marks)

4 The apparatus shown in the diagram below was used to measure the rate of respiration of germinating seeds in air. The distance moved by the coloured liquid was measured at 15-minute intervals for one hour.

This was repeated with the air replaced by nitrogen gas.

The rate of respiration of small insects in air was measured using the same apparatus.



(a) Suggest reasons for absorbing carbon dioxide in this apparatus.

(2)

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(b) The table below shows results recorded by a student using this apparatus.

Organism	Distance moved by liquid in 15-minute intervals / mm				Mean rate of respiration / mm min^{-1}
Germinating seeds	7	6	5	6	0.4
Germinating seeds in nitrogen gas	0	0	0	0	0
Insects	12	11	13	12	

(i) In the space below, calculate the mean rate of respiration for the insects, expressed as movement of liquid in millimetres per minute.
Show your working.

(2)

Answer ..... mm min^{-1}

(ii) The seeds in the experiment with nitrogen gas continued to germinate.
Suggest an explanation for the lack of movement of the liquid.

(2)

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(iii) Suggest **two** reasons why a valid comparison cannot be made between the mean rates of respiration of the germinating seeds in air and the insects. For each reason, suggest a modification that would allow a valid comparison.

(4)

(Total for Question 4 = 10 marks)