

Structured Questions

Transport

Blood Vessels / Identify Blood Vessels: Skills / Measuring Pulse Rate: Skills /
Coronary Heart Disease: Skills / The Transpiration Stream / Adaptations of Xylem
Vessels / Drawing Root & Stem Structure: Skills

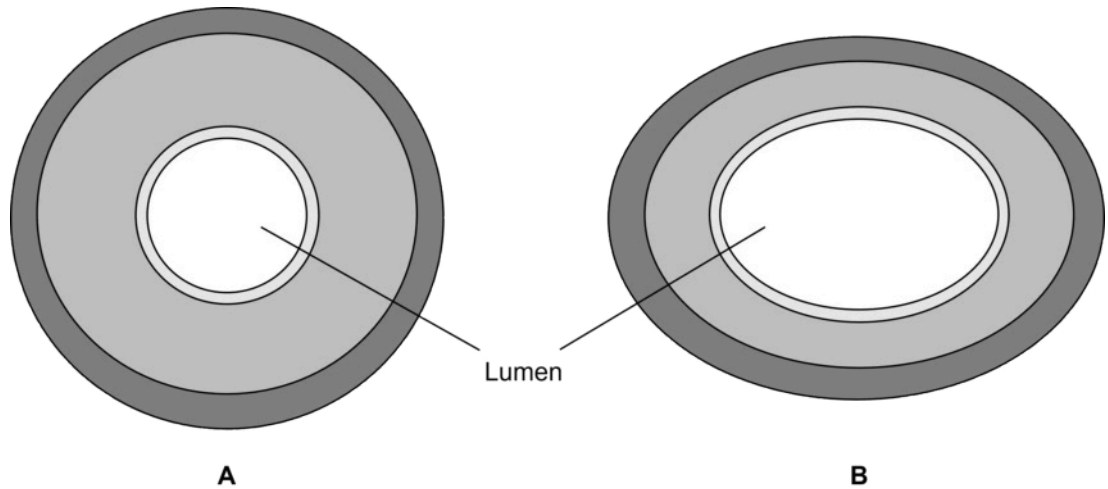
Easy (8 questions)	/35
Medium (7 questions)	/31
Hard (3 questions)	/26
Total Marks	/92

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Easy Questions

1 (a) The following diagram compares the structure of two main blood vessels in the body.



(i) Identify blood vessel **A**.

[1]

(ii) State a reason for your answer in part i).

[1]

(2 marks)

(b) Blood vessel **B** has a very large lumen.

(i) Identify blood vessel **B**.

[1]

(ii) State **one** reason for the presence of a large lumen in blood vessel **B**.

[1]

(2 marks)

- (c) The flow of blood in veins is not assisted by the pressure generated by the beating of the heart.

List **two** structures that assist with the flow of blood in veins.

(2 marks)

- (d) Systolic pressure is one of the measurements taken by a doctor to determine the blood pressure of a patient.

Define the term 'systolic pressure'.

(1 mark)

- 2 (a)** The following table shows the mean pressure (in mmHg) measured in different blood vessels of the body.

Blood vessel	Mean blood pressure / mmHg
Aorta	94
Arteries	90
Arterioles	68
Capillaries	24
Venules	10
Veins	3
Vena Cava	2

Calculate the percentage difference between the mean blood pressure of the aorta and vena cava. Show your working and give your answer to three significant figures.

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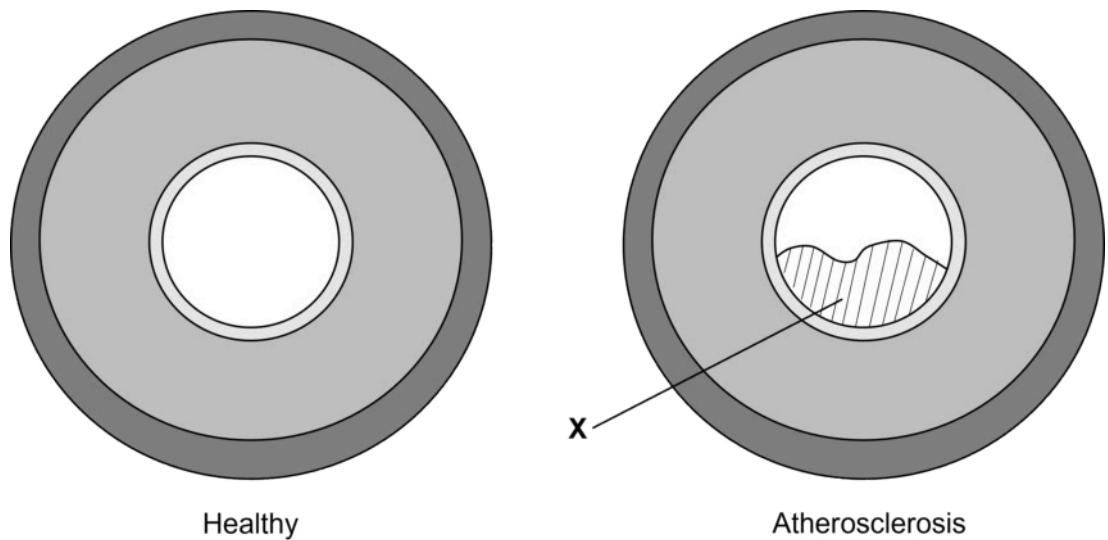
(2 marks)

- (b)** Using the table provided, identify the blood vessels where the greatest decrease in mean blood pressure occurs.

.....

(1 mark)

3 (a) The following diagram compares the structure of an artery of a healthy person with that of someone suffering from atherosclerosis.



Identify structure X.

.....
(1 mark)

(b) Atherosclerosis can lead to the occlusion of arteries over time.

Define the term 'occlusion'.

.....
(1 mark)

(c) Occlusion of the arteries can have a serious impact on cardiovascular health.

List **two** consequences of an occlusion of the arteries.

.....
.....
(2 marks)

(d) When blood flow to part of the heart muscle is restricted due to blockages in the coronary arteries, it will impair its ability to contract fully. This will reduce blood flow, and therefore oxygen flow, to the body tissues.

State **one** treatment option available to patients with blockages in their coronary arteries.

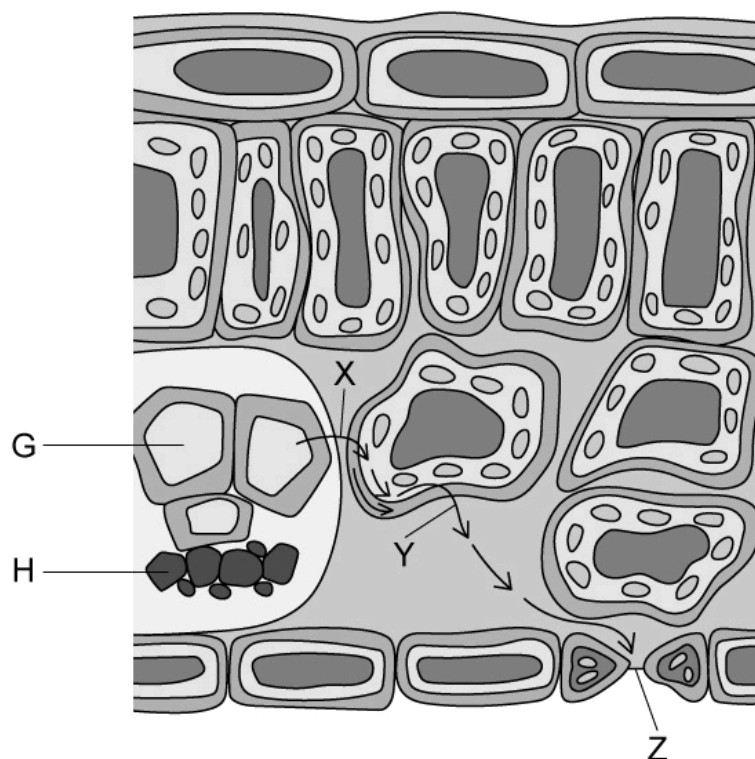
(1 mark)

4 Capillaries provide the exchange surface in the tissues of the body.

List **three** characteristics of capillaries.

(3 marks)

5 (a) The image shows the cross section of a leaf.



Identify the substance which is represented by the arrows in the diagram.

(1 mark)

(b) Draw three lines to correctly identify the method of particle movement shown in the diagram from part a).

X

Y

Z

Osmosis

Diffusion

Active transport

Evaporation

Cohesion

(3 marks)

(c) (i) Identify the letters from the diagram in part a) that represents the xylem.

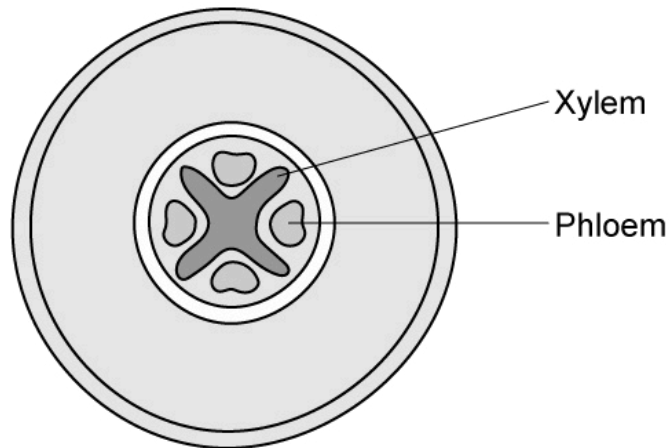
[1]

(ii) Describe **one** adaptation of the xylem which makes it suitable for its function.

[1]

(2 marks)

(d) The diagram below represents a plant organ.



State the name of this organ.

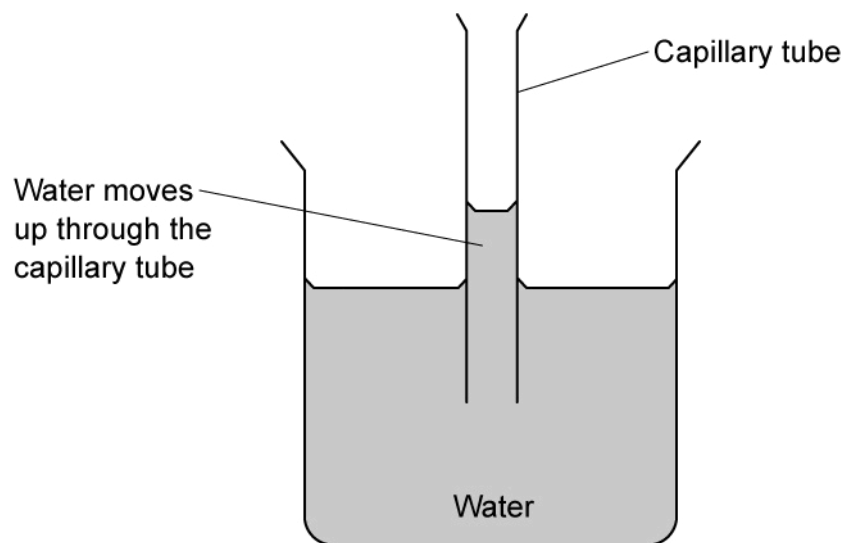
(1 mark)

- 6 (a) The transpiration stream relies on cohesion to maintain a continuous column of water in the xylem.

Define the meaning of the term 'cohesion'.

(1 mark)

- (b) Capillarity is a term used to describe the movement of water through narrow diameter tubing, called capillary tubing, against the force of gravity. This phenomenon is represented by the image in the diagram.



In combination with the cohesion described at part a), identify **one** other property of water which allows transport through the capillary tube.

(1 mark)

- 7 Draw a labelled diagram of the vascular system seen in the cross section of a plant stem.

(4 marks)

- 8 (a)** A traditional practice used in forestry to manage tree growth is called girdling. This involves removing a complete ring of bark, as shown in the image below. The tree dies over a period of time, allowing forests to be thinned out as required.



State how girdling may kill a tree over time.

.....

.....

(2 marks)

- (b)** State the role of the parenchyma in phloem tissue.

.....

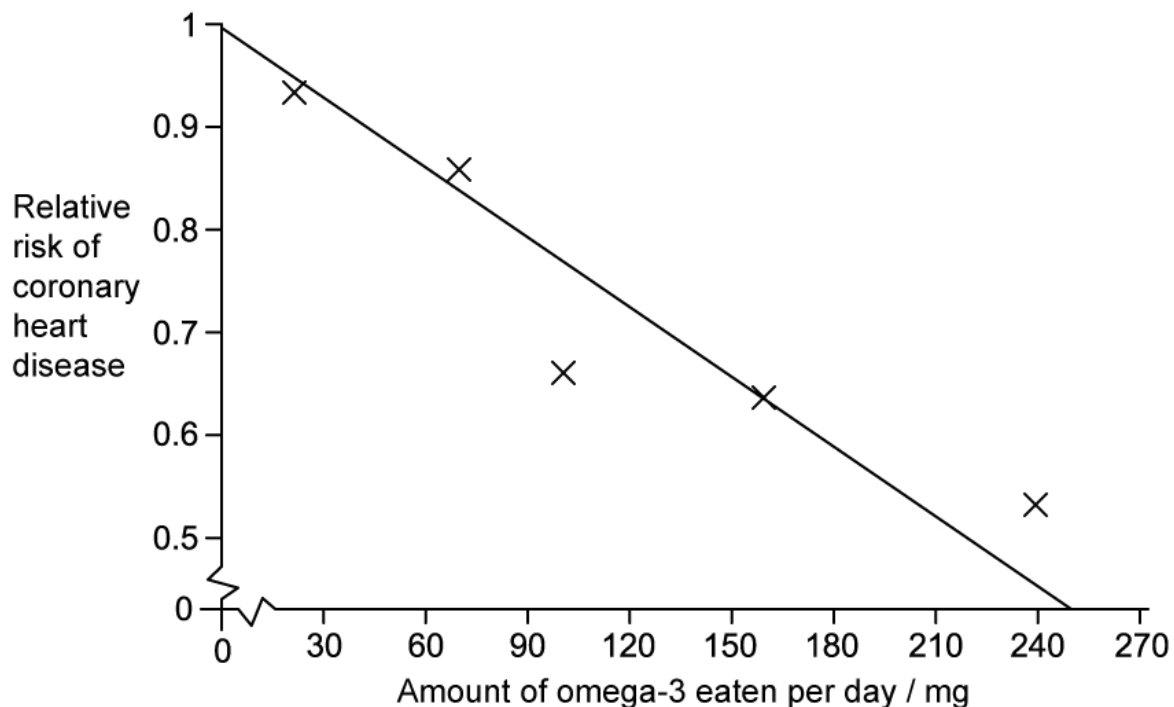
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(2 marks)

Medium Questions

- 1 (a) The graph below shows the data obtained by scientists investigating the effect of omega-3 fatty acid consumption on the relative risk of coronary heart disease in humans.

Figure 1



Using the data in the graph, evaluate whether coronary heart disease can be prevented by increasing omega-3 intake.

(3 marks)

- (b) Using the graph in part (a), deduce the approximate daily mass of omega-3 required to reduce the risk of coronary heart disease by 40%

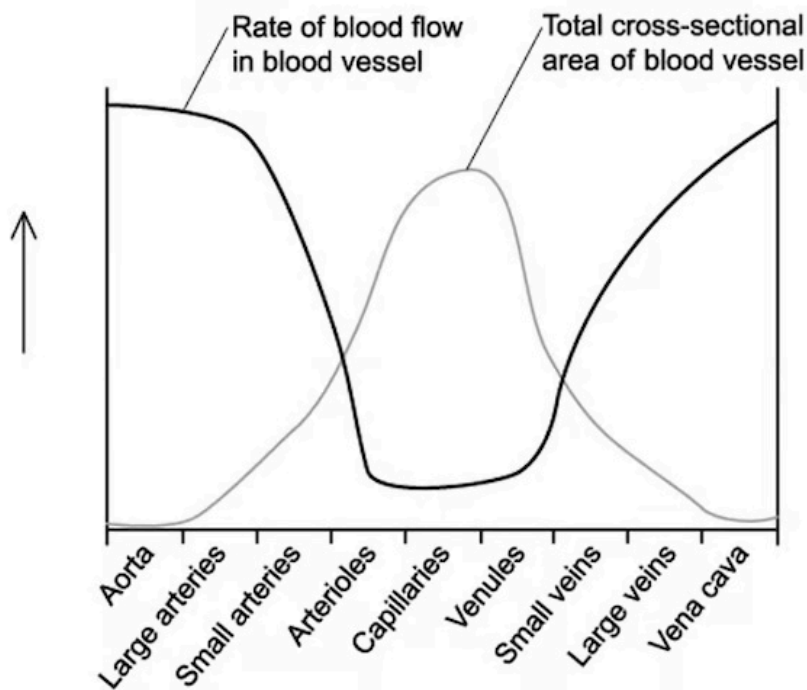
(2 marks)

2 Valves are important structures found in the heart and veins.

Explain how valves work.

(2 marks)

- 3 (a) The graph below shows the rate of blood flow in various blood vessels in the body. It also shows the total cross-sectional area of the vessels.



Suggest why the rate of blood flow increases from the venules to the vena cava despite a large decrease in the total cross-sectional area.

(1 mark)

- (b) The relative thickness of layers in the wall of an artery and a vein are shown in the table below.

Layer in wall	Thickness / μm	
	Artery	Vein
Endothelium	25	25
Smooth muscle	495	245
Elastic tissue	375	245
Connective tissue	125	125

Explain the difference in the thickness of elastic tissue for the artery versus the vein.

(2 marks)

(c) The external diameter of a vein was measured at 1.5 mm.

Calculate the diameter of the lumen of the vein.

(2 marks)

(d) Explain how the structure of capillaries enable them to function efficiently as exchange surfaces.

(3 marks)

- 4 (a) Plant sterols and plant stanols are found in a range of food, including vegetables, cereals, seeds and nuts. Plant sterols and stanols have a similar structure to cholesterol and reduce the absorption of cholesterol in the small intestine, so more cholesterol is lost in the faeces. This helps to lower the levels of cholesterol in the blood and in turn, reduce the risk of coronary heart disease (CHD).

A group of scientists wanted to investigate the effects of eating plant sterols and stanols on the risk of CHD. The scientists randomly divided healthy volunteers into two groups. Every day for eight weeks, one group was given plant sterols and stanols to eat. The other group acted as a control.

Each week, the scientists measured the diameter of the lumen of the main artery in the arm of the volunteers.

State how the control group should have been treated.

(2 marks)

- (b) The results of the experiment in part (a) are shown in the table below.

	Mean maximum diameter of lumen of main artery in the arm (mm)	
	Experimental group (\pm standard deviation)	Control group (\pm standard deviation)
Before experiment	0.69 (\pm 0.02)	0.71 (\pm 0.02)
After 8 weeks	0.74 (\pm 0.03)	0.72 (\pm 0.05)

A student reading the results concluded that there was sufficient evidence to assume a causal relationship between plant sterols and stanols, and a reduced risk of CHD.

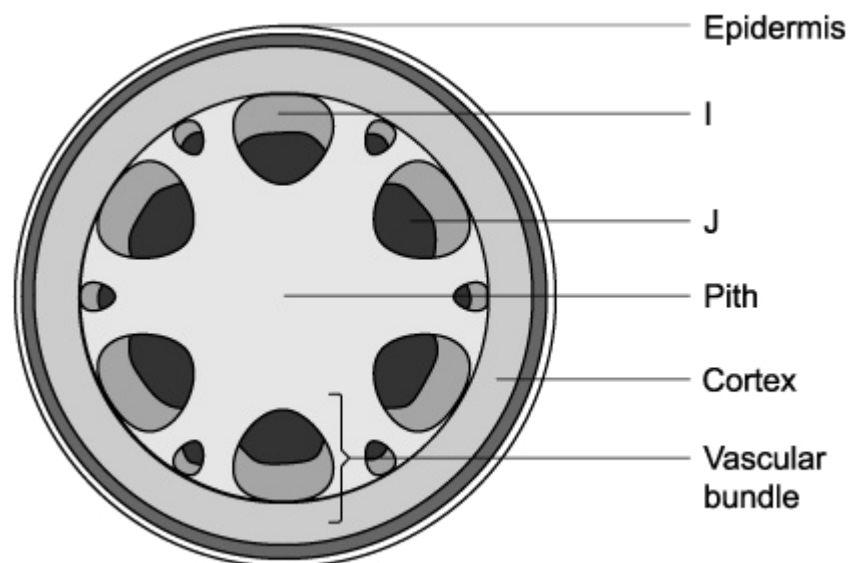
Evaluate the student's conclusion.

(3 marks)

5 Describe how blood returns to the heart from the legs.

(4 marks)

6 (a) The diagram below shows a transverse section (TS) of a plant stem.



Identify the structure found at **J** and state its function.

.....
.....

(2 marks)

(b) In xylem vessels, hydrogen bonds form between polar water molecules.

Describe the role that hydrogen bonding plays in the cohesion-tension theory of water transport in the xylem of plants.

.....
.....
.....

(3 marks)

7 Explain a property of water that allows it to flow as mass transport in the transpiration stream.

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(2 marks)

Hard Questions

- 1 (a)** Carnitine is a chemical that plays an essential role in energy metabolism by transporting long-chain fatty acids into mitochondria in cells where they are then oxidised. It is often used as a supplement by athletes to enhance their athletic performance and to aid in weight loss.

Recent studies have linked the prolonged use of carnitine supplements with increased levels of trimethylamine N-oxide (TMAO) in the bloodstream. TMAOs can trigger inflammatory and immune responses in the body, as well as elevated blood glucose levels.

Based on the information provided, explain why increased TMAO levels could increase the risk of suffering a heart attack.

(2 marks)

- (b)** Scientists investigated the effect of carnitine in the diet on the plasma concentration of TMAO in mice. Four groups, consisting of ten mice each, were fed one of four possible diets.

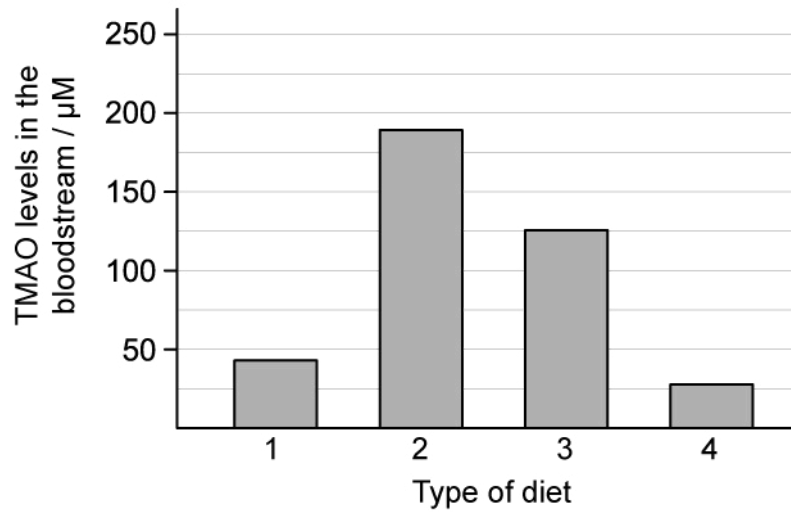
- Diet 1 - a normal mouse diet with natural carnitine levels
- Diet 2 - a normal mouse diet with added carnitine
- Diet 3 - a low carnitine mouse diet
- Diet 4 - a normal mouse diet with added carnitine and antibiotics

The TMAO levels in the bloodstream of the mice were measured over time and a mean for each group was calculated.

Suggest a possible hypothesis for this investigation.

(1 mark)

- (c)** The results of the investigation described at part b) are shown in the following graph.



Key: 1 - normal 3 - carnitine poor
 2 - carnitine rich 4 - carnitine + antibiotics

Explain the results from the group that followed diet 4.

.....
(1 mark)

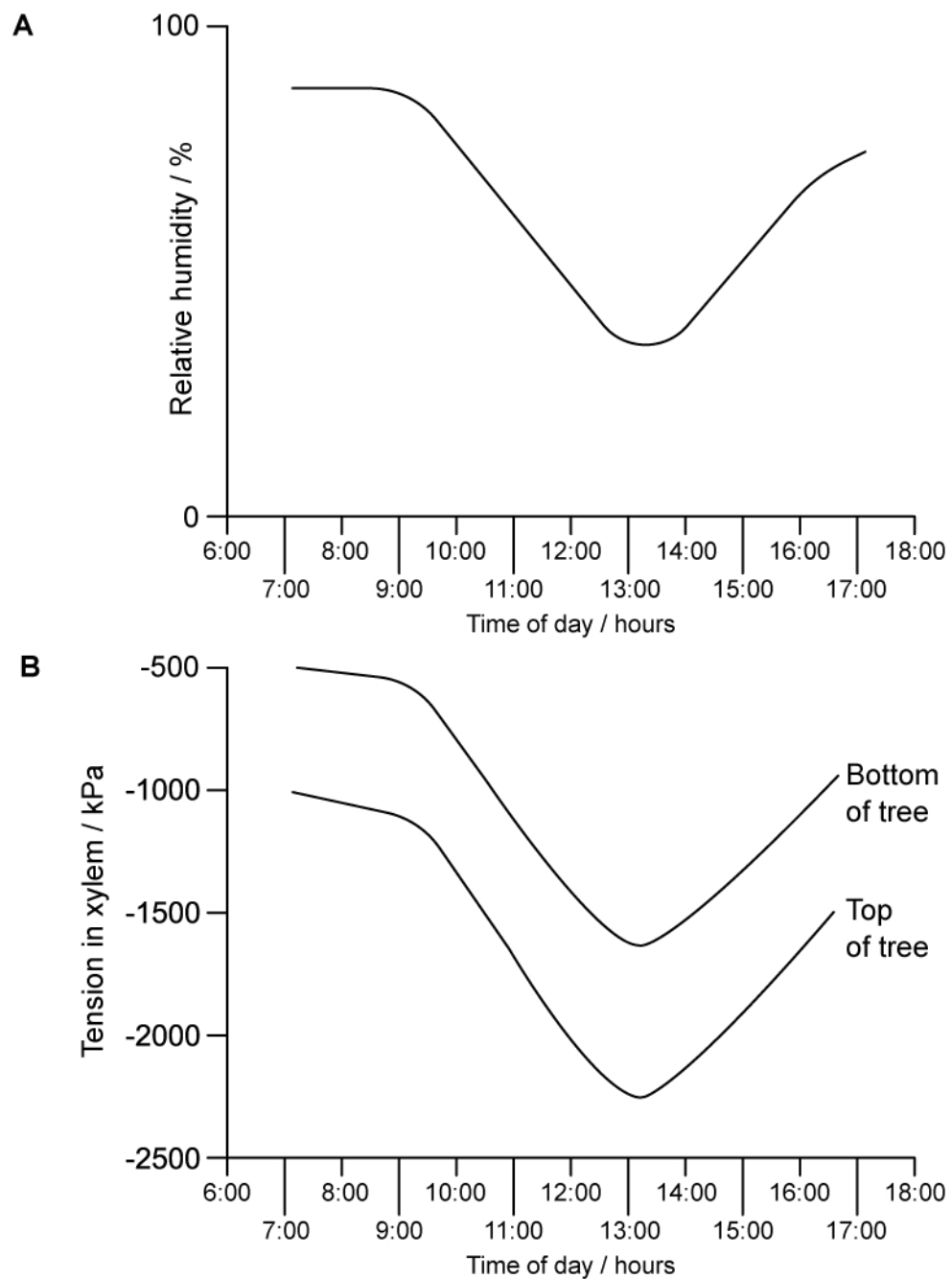
(d) The scientists concluded that a diet high in carnitine will increase levels of TMAO in the bloodstream in humans.

Evaluate this conclusion.

.....

(3 marks)

2 (a) The effect of humidity on the transpiration stream within the xylem of an oak tree was investigated, the results are displayed in the graphs below.



Describe how the trends shown in graph **A** compare with the trends shown in graph **B**.

.....

.....

.....

(4 marks)

- (b) Outline how the changes in humidity lead to the changes in water tension measured in the xylem at the top of the tree.

(4 marks)

- (c) During the investigation, the scientist also measured the diameter of the tree trunk, the results can be seen in the table below:

Time	Circumference of the trunk (cm)
7:00	97.5
9:00	97.4
11:00	96.5
13:00	95.7
15:00	95.7
17:00	96.3
19:00	97.3
21:00	97.4
23:00	97.5

Explain how this data and the data in the graphs from part **a)** support the cohesion-tension theory.

(4 marks)

- (d)** The scientist who carried out the investigation in part **a)** concluded from his data that water moves through the xylem through the cohesion tension mechanism.

Evaluate his conclusion based on the validity of the evidence provided by the results of this investigation.

(5 marks)

- 3** The microscope image below shows a cross section of part of a stem of a herbaceous (non-woody) plant.

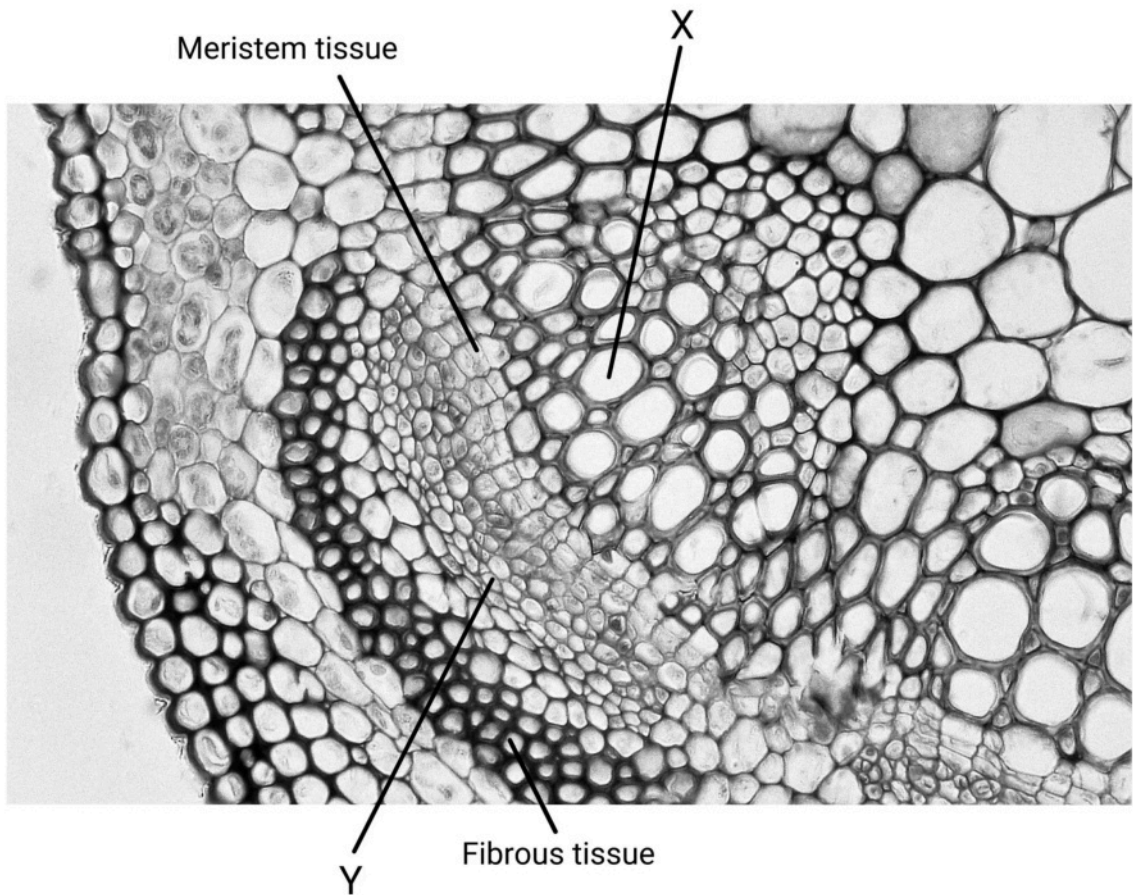


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Identify tissue types **X** and **Y** in the image.

(2 marks)