Questions

Q1.

The table shows two differences between blood plasma and tissue fluid.

Blood plasma	Tissue fluid
Has a higher protein content	Has a lower protein content
Contains more dissolved oxygen	Contains less dissolved oxygen

Explain the differences between blood plasma and tissue fluids shown in the table.

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(Total for question = 2 marks)

Q2.

The table shows two differences between blood plasma and tissue fluid.

Blood plasma	Tissue fluid
Has a higher protein content	Has a lower protein content
Contains more dissolved oxygen	Contains less dissolved oxygen

State how tissue fluid is formed.

(1)

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(Total for question = 1 mark)

Q3.

The production of tissue fluid is vital for cells in the human body.

In some parts of the world, mosquito bites can infect people with roundworms called *Wuchereria bancrofti*.

The roundworms block lymph vessels and prevent proteins in tissue fluid entering the lymph vessels.

This causes a disease called lymphatic filariasis (LF). One symptom of LF is swelling of the legs.

Which of the following explains why someone with LF has swollen legs?

(1)

☒ **A** turgor pressure in blood is higher than in tissues

☒ **B** turgor pressure in blood is lower than in tissues

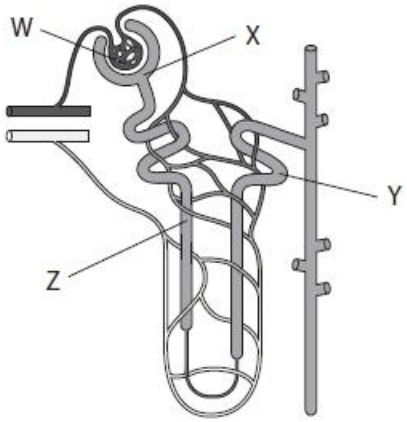
☒ **C** oncotic pressure in blood is higher than in tissues

☒ **D** oncotic pressure in blood is lower than in tissues

(Total for question = 1 mark)

Q4.

The diagram shows a nephron.



Oedema is an accumulation of tissue fluid. This is due to less tissue fluid being returned to the blood capillaries.

(i) Explain how tissue fluid is returned to capillaries.

(3)

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(ii) Furosemides are drugs that are used to reduce oedema. They are diuretics that increase urine production.

Furosemides reduce the active transport of sodium ions by the loop of Henle.

Explain how furosemides cause an increase in urine production.

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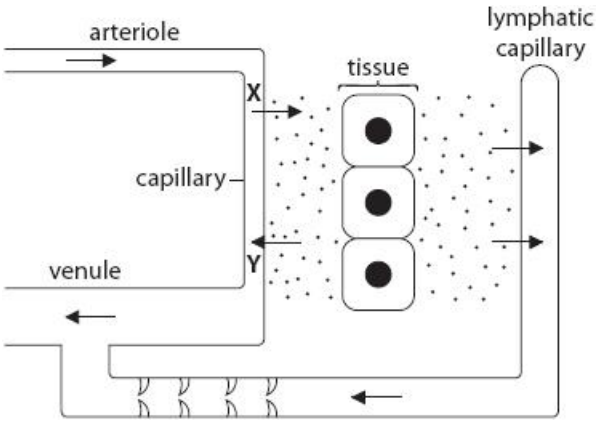
(Total for question = 7 marks)

Q5.

The production of tissue fluid is vital for cells in the human body.

The diagram shows the production and circulation of tissue fluid.



(i) Which of the following describes the pressures at **X** and **Y** in the diagram?

(1)

	Blood hydrostatic pressure / kPa		Plasma oncotic pressure / kPa	
	At X	At Y	At X	At Y
☒ A	3.3	2.0	3.3	2.0
☒ B	3.3	3.3	4.7	2.0
☒ C	4.7	2.0	3.3	3.3
☒ D	4.7	3.3	2.0	3.3

(ii) Compare and contrast the transport of fluid in a vein with its transport in a lymph vessel.

(2)

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(Total for question = 3 marks)

Q6.

The production of tissue fluid is vital for cells in the human body.

(i) Explain why the production of tissue fluid is vital for cells in the human body.

(2)

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(ii) Tissue fluid makes up 16% of the mass of a human body.

Calculate the mass of tissue fluid, in grams, that would be found in a person with a mass of 80 kg.

(2)

Answer ..... g

(Total for question = 4 marks)

Q7.

The table shows two differences between blood plasma and tissue fluid.

Blood plasma	Tissue fluid
Has a higher protein content	Has a lower protein content
Contains more dissolved oxygen	Contains less dissolved oxygen

Some of the tissue fluid is not reabsorbed into the blood capillary.

Describe what happens to the tissue fluid that is not reabsorbed into the blood capillary.

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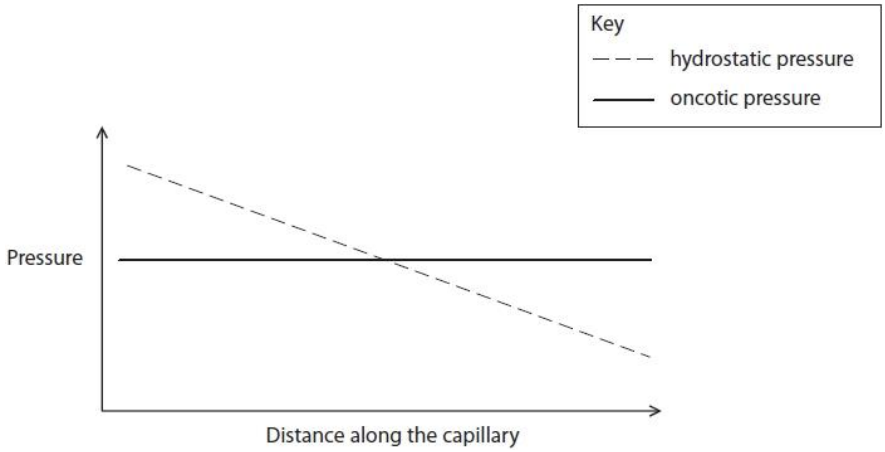
(Total for question = 2 marks)

Q8.

Lymphoedema is a condition that causes severe swelling of body tissues due to the accumulation of tissue fluid.

This occurs when lymphatic ducts are blocked.

The diagram shows how the hydrostatic blood pressure and oncotic plasma pressure vary along the length of a capillary.



(i) With reference to the diagram, explain how tissue fluid is produced and reabsorbed by the capillaries.

(4)

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(ii) Lymphatic ducts remove proteins that are secreted by cells.

Explain how a blockage of a lymphatic duct could lead to lymphoedema.

(2)

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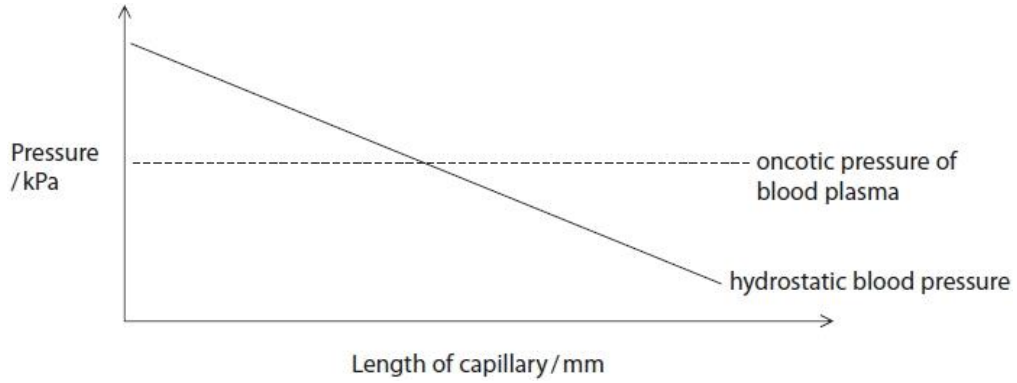
(Total for question = 6 marks)

Q9.

The graph shows the hydrostatic pressure and oncotic pressure of the blood along a capillary.



(i) Explain how tissue fluid is formed by the capillary. Use the information in the graph to help your answer.

(3)

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(ii) Kwashiorkor is a condition caused by a lack of dietary protein. One symptom is accumulation of tissue fluid.

Explain why children suffering from kwashiorkor often suffer from an excess of tissue fluid. Use the graph to support your answer.

(2)

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(Total for question = 5 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • blood plasma has higher protein content as the {plasma proteins / named plasma protein / some proteins} are too large to pass out of {capillary / blood} (1) • tissue fluid has less (dissolved) oxygen as it has {diffused into / respired by} the {cells / tissues} (1)	**ACCEPT** converse for tissue fluid **ACCEPT** converse for plasma	(2)

Q2.

Question Number	Answer	Additional Guidance	Mark
	• (high) hydrostatic pressure forces {fluid / plasma} out of the capillaries (at the arteriole end) (1)		(1)

Q3.

Question number	Answer	Mark
	The only correct answer is D A is not correct because blood does not have turgor B is not correct because blood does not have turgor C is not correct because if true water would not leave the blood	**(1)**

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following points: • there is more protein in plasma than tissue fluid (1) • because plasma proteins are too large to pass out of the capillary (1) • and **oncotic** pressure generated by (plasma) proteins (1) • (so fluid moves in) as {oncotic / osmotic} pressure is greater than hydrostatic pressure (1)	**Accept** converse **Accept** converse	3 exp

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to four of the following points: • sodium ions are not removed from the **ascending** limb (1) • so the water potential of medullary fluid is higher (1) • therefore less water is removed from the **descending** limb (1) • and less water is removed from the {collecting duct / distal tubule} (1) • (a higher volume of) {dilute / low concentration} urine is produced (1)	**Accept** less negative water potential **Accept** water potential gradient is lower **Accept** osmotic gradient is lower	4 exp

Q5.

Question number	Answer	Mark
(i)	The only correct answer is C A is not correct because the oncotic pressure cannot be lower at Y than it is at X B is not correct because the hydrostatic pressures are not the same at X and Y D is not correct because the hydrostatic and oncotic pressure at Y cannot be the same	(1)

Question Number	Answer	Additional guidance	Mark
(ii)	An answer that makes reference to the following: <u>One similarity from:</u> • both have low pressure (1) • both have valves (1) • both use muscle squeezing to move fluid (1) <u>One difference from:</u> • faster flow in vein (1) • heart causes {mass flow / movement} in vein (1) • flow to heart in vein but to {glands / neck} in lymph (1)	Allow converse where appropriate	(2)

Q6.

Question Number	Answer	Additional guidance	Mark
(i)	An explanation that makes reference to the following: One from: • supplies {oxygen / glucose / amino acids / fatty acids / salts / hormones} (1) • removes {carbon dioxide / urea} (1) One from: • therefore {respiration / growth / protein synthesis} can occur (1) • therefore {pH controlled / cells not poisoned} (1)	Ignore waste	(2)

Question Number	Answer	Additional guidance	Mark
(ii)	• calculates 12.8 as 16 percent of 80 (1) • multiplies by 1000 (1)	<u>Example of calculation</u> 16 ÷ 100 x 80 = 12.8 x 1000 = 12 800 Correct answer gains full marks, with no working shown.	(2)

Q7.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • tissue fluid enters the lymphatic (vessels / system) (1) • lymph returns to {the (subclavian) veins / blood} (1)		(2)

Q8.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • oncotic pressure is caused by (plasma) proteins (1) • hydrostatic pressure is due to heart pumping / contraction (1) • therefore when hydrostatic pressure is **higher** (than oncotic), fluid is forced out (1) • therefore when hydrostatic pressure is **lower**, fluid is drawn in (1)	ALLOW converse statement ALLOW converse statement	**(4)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to two of the following: • proteins accumulate in tissue fluid (1) • therefore oncotic pressure changes (1) • therefore less {fluid / water} removed by {blood / capillary} (1)	ACCEPT water potential decreases ACCEPT more {fluid / water} is drawn out of {blood / capillary}	**(2)**

Q9.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of thefollowing: • tissue fluid leaves the capillary through pores (1) • because the hydrostatic pressure is greater than the oncotic pressure (1) • plasma proteins are present in the blood but not intissue fluid / more protein in blood plasma (1) • plasma proteins are too large to leave capillary (1)	**Allow** fenestrations / other termsfor pore **Allow** oncotic pressure is lower thanhydrostatic pressure	**3**
(ii)	An explanation that makes reference to two from: • there is less protein in the blood plasma (1) • so that less tissue {fluid / water} enters blood (1) • because the oncotic pressure is less / there is lesscapillary length where oncotic pressure is greater than hydrostatic pressure (1)	**Allow** more fluid leaves than enters	**2**