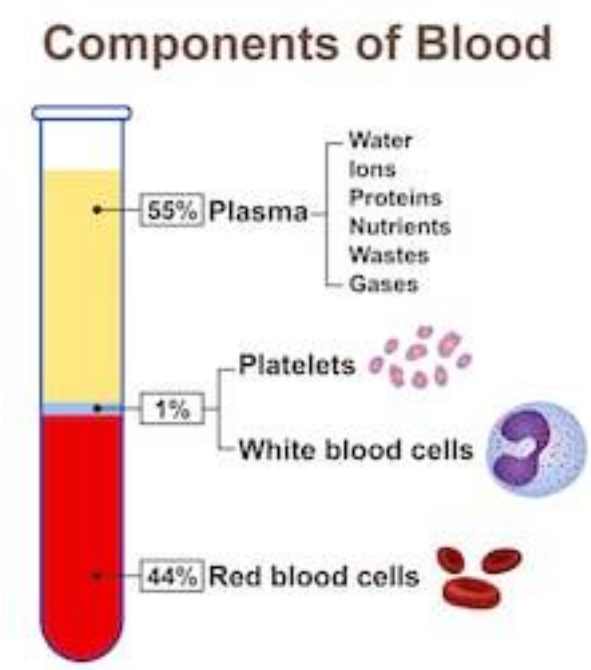
Lesson 7- Formation of tissue fluid 1



Components of the blood:

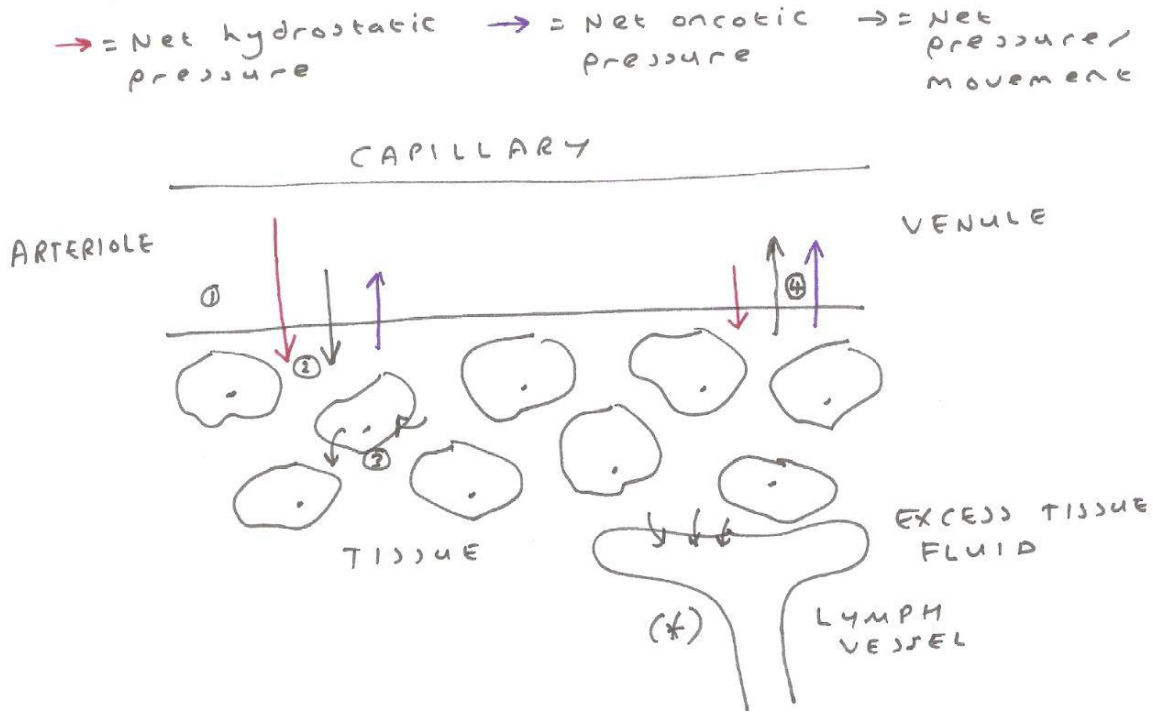
Plasma= dissolved glucose, amino acids, mineral ions, hormones, albumin and fibrinogen

Tissue fluid:
Tissue fluid is important for the exchange of substances between the blood and the cells Tissue fluid is formed from blood plasma leaking from the capillaries, but does not contain plasma proteins as these are too big to fit through the capillary wall.

Key terms:
Hydrostatic pressure- the pressure a fluid exerts when pushing against the sides of a vessel (force which pushes fluid out/into the capillary)
Oncotic pressure- the pull of fluid into and out of the capillary by osmosis because of the presence of plasma proteins.

https://www.youtube.com/watch?v=CTcnQ3a45KA y***ou may need to watch this again after writing the notes***

How it is formed:



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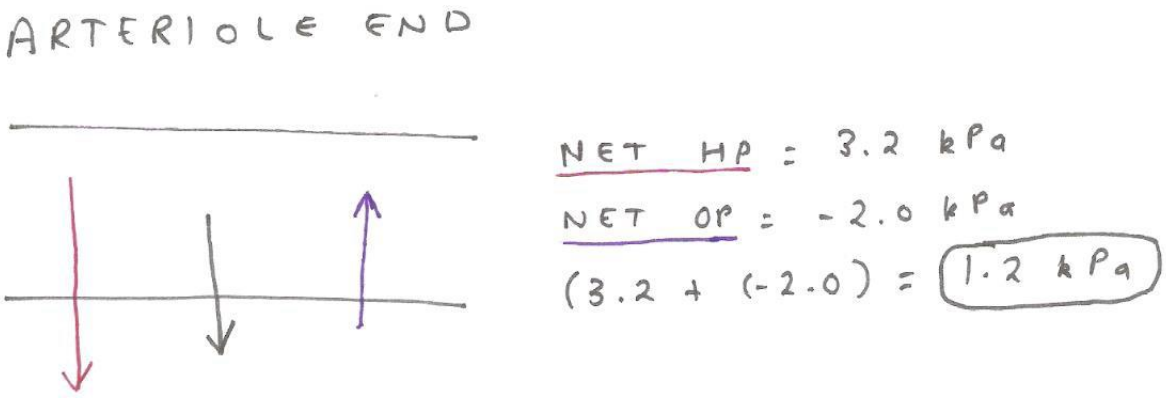
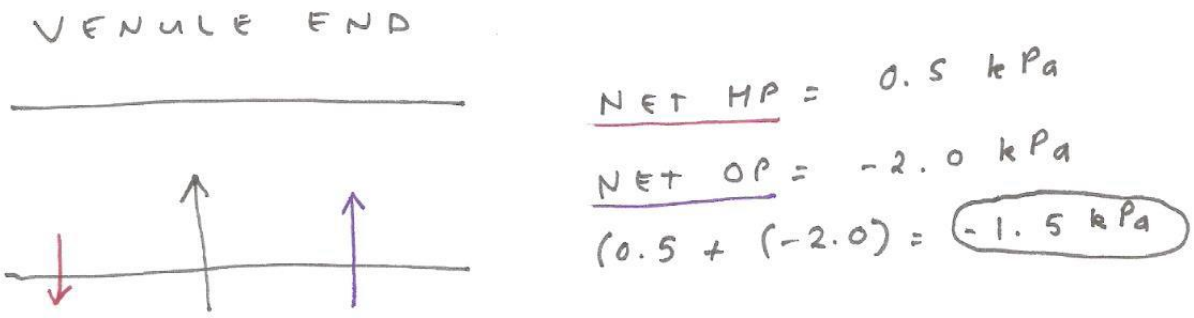
1. When an artery reaches the tissues it branches into an arteriole. This blood is under high net hydrostatic pressure as a result of ventricular systole
2. At this end of the capillary water and dissolved substances is forced out of the blood across the capillary forming tissue fluid because of this high net hydrostatic pressure. Other substances such as erythrocytes and plasma proteins are too large to pass and remain in the capillary
3. Exchange of substances between tissue fluid and tissues occur.
4. At the venule end of the capillary there is a high net oncotic pressure which means tissue fluid returns back to the capillary returning waste products back to the blood.



Arteriole end:
The net hydrostatic pressure is higher than the net oncotic pressure. This means the overall net pressure forces plasma OUT of the capillary.



Venule end :
The net hydrostatic pressure is lower than the net oncotic pressure. This means the overall net pressure forces fluid back INTO the capillary.

Lymph:
Any excess tissue fluid which does not return to the capillary enters the lymphatic system forming lymph. The lymphatic system is a network of vessels in the body containing the fluid lymph. This is the same as tissue fluid but also contains lymphocytes which are produced in lymph nodes found along the system.

1. Which of the options, **A to D**, is a correct statement about tissue fluid?

A Tissue fluid carries carbon dioxide to muscle cells.

B Oncotic pressure in the capillary causes tissue fluid formation from plasma.

C Hydrostatic pressure in the capillary causes tissue fluid formation from plasma.

D Tissue fluid is reabsorbed into the capillary by active transport.

Your answer ☐ **[1]**

2. Dissolved ions diffuse between blood plasma and tissue fluid.

Pressure differences at the arterial and venous ends of capillaries are responsible for the formation of tissue fluid. The following measurements were made in one capillary:

- Net hydrostatic pressure at the arterial end was 4.6 KPa
- Net oncotic pressure was -3.0 KPa
- Net hydrostatic pressure at the venous end was 2.3 KPa.

Use this information to explain the movement of fluid in and out of a capillary.

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3.

(iii) Capillaries have walls that are one cell thick.

Fig. 5.2 shows how the hydrostatic pressure of the blood changes as it moves through a capillary.

Fig. 5.2 also shows the water potential of the blood, due largely to the plasma proteins, which tends to move water into the blood.

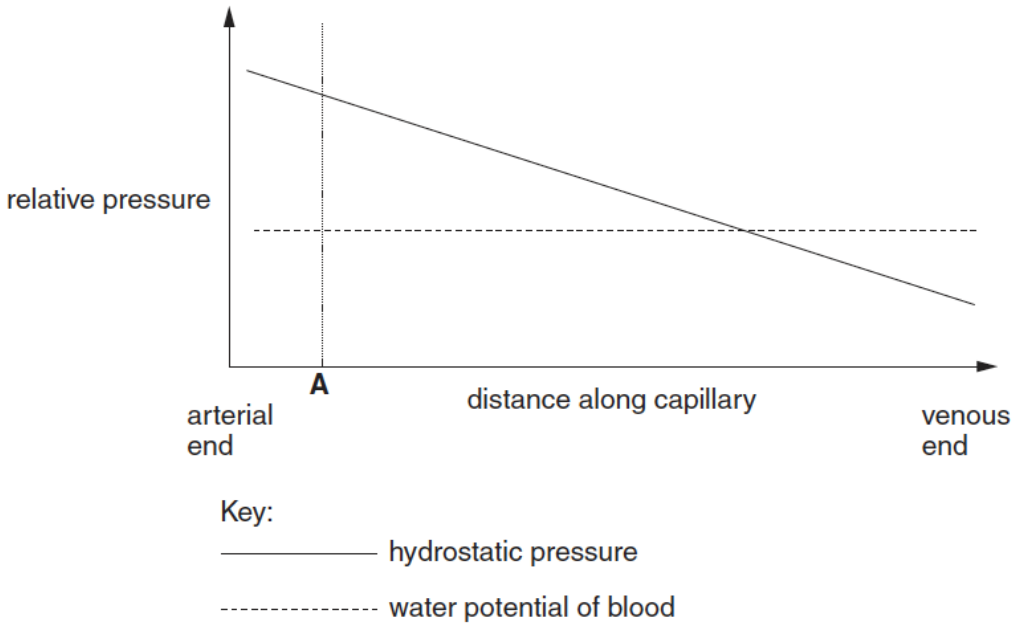

Fig. 5.2

Describe **and** explain what happens to the blood plasma at point **A** along the capillary in Fig. 5.2.

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Question		Answer/Indicative content	Marks	Guidance
1		**C** ✔	**1**	**Examiner's Comments** This was answered quite well. Option **B** was a common incorrect suggestion.
2		at arterial end **AND** hydrostatic / 4.6, is great**er** than, oncotic / −3 **AND** (fluid / plasma) moves, **out** / from, (capillary) ✓ at venous end **AND** hydrostatic / 2.3, is low**er** than, oncotic / −3 **AND** (tissue fluid) moves **into** (capillary) ✓	2	Statements must: • **name the end** of the capillary • make a **comparative** statement about the two pressures in the capillary (using name or number) • state the **direction of movement** of fluid. **ALLOW** bigger / higher / more, for 'greater' **ALLOW** ORA oncotic / −3, less than hydrostatic / 4.6 **ALLOW** ORA fluid moves into tissues **IGNORE** osmosis **ALLOW** smaller / less, for 'lower' **ALLOW** ORA oncotic / −3, more than hydrostatic / 2.3 **ALLOW** ORA fluid moves, out of / from, tissues **IGNORE** osmosis **Examiner's Comments** This question targeted a quantitative understanding of a theoretical process. Candidates needed to present an analysis of the figures in the question to explain why fluid moves out of the capillary at the arterial end and back in at the venous end. Memorised answers that not fully explain the net effect of the two opposing pressures did not score. Lower scoring answers ignored oncotic pressure and just discussed the difference between hydrostatic pressure at both ends of capillary.
3		plasma / fluid, moves out of, capillary / blood ; enters / forms, tissue fluid ; (plasma) proteins, remain in capillary / too large to pass through capillary wall / AW ; (fluid moves) down pressure gradient ; hydrostatic pressure greater than, water potential / Ψ;	3 max	Assume 'it' refers to plasma: DO NOT CREDIT water / diffuses out ACCEPT filters out DO NOT CREDIT ref to osmosis