



# **A-Level Biology**

## **Tissue Fluid Formation**

### **Mark Scheme**

**Time available: 58 minutes**

**Marks available: 48 marks**

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## Mark schemes

1.

- (a) 1. (Overall) outward pressure of 3.2 kPa;  
2. Forces small molecules out of capillary.
- (b) Loss of water / loss of fluid / friction (against capillary lining).
- (c) 1. High blood pressure = high hydrostatic pressure;  
2. Increases outward pressure from (arterial) end of capillary / reduces inward pressure at (venule) end of capillary;  
3. (So) more tissue fluid formed / less tissue fluid is reabsorbed.  
*Allow lymph system not able to drain tissues fast enough*
- (d) 1. Water has left the capillary;  
2. Proteins (in blood) too large to leave capillary;  
3. Increasing / giving higher concentration of blood proteins (and thus wp).

2

1

3

3

[9]

2.

(a)

	open	closed
Semi-lunar valves	2	3
Atrioventricular valves	4	1

*One mark for each correct column*

*General marker*

2

- (b) (Acceptable range is) 6315.79 to 6400;

*Allow one mark for (SV = 120 - 40 =) 80 (cm<sup>3</sup>)*

**OR**

*(1 cycle = 1.24 - 0.48 =) 0.76 (s)*

**OR**

*79 / 80 (beats minute<sup>-1</sup>)*

2

- (c) 1. Contraction of ventricle(s) produces **high** blood / hydrostatic pressure;  
2. (This) forces water (and some dissolved substances) out (of blood capillaries);  
1. *Do not accept contraction / pumping of the heart*  
1. *Reject blood / plasma / tissue fluid forced out*

2

- (d) Excess tissue fluid cannot be (re)absorbed / builds up;

*The idea of excess is important*

*Accept 'drained' for absorbed*

1

[7]

- 3.** (a) (Blood) plasma; 1
- (b) More / larger proteins / less urea / carbon dioxide / more glucose / amino acids / fatty acids / oxygen / high(hydrostatic) pressure;  
*Q Reference to blood cells / water potential = neutral*  
*Q No Protein should not be credited* 1
- (c) (i) Contracts;  
*Q Do not accept pumping of heart / heart beating* 1
- (ii) Loss of fluid / volume;  
 Friction / resistance (of capillary wall);  
*Q Reference to a narrow lumen is not sufficient to gain a mark unless friction or resistance is mentioned.* 1 max
- (d) Water potential (in capillary) not as low / is higher / less negative / water potential gradient is reduced;  
 More tissue fluid formed (at arteriole end);  
 Less / no water absorbed (into blood capillary) by osmosis; (into blood capillary);  
*Q The last two marking points must be in context of movement into the blood capillary* 3
- [7]**
- 4.** (a) (i) plasma; 1
- (ii) tissue fluid; 1
- (b) fluid **Y** contains little / no protein; *reject blood cells* molecules too large (to pass through capillary wall);  
**OR**  
 fluid **Y** contains less glucose;  
 some will have entered tissue cells;  
 accept any other biologically correct difference marked in a similar way. 2 max
- (c) hydrostatic pressure / blood pressure / arterial pressure;  
 greater than osmotic effect which forces molecules / fluid out;  
*ignore references here to diffusion or osmosis.* 2
- [6]**

**5.**

(a)

	glucose	sodium ions	haemoglobin
Tissue fluid	✓	✓	✗;
Blood plasma	✓	✓	✗;

*Mark for each correct row*

2

- (b) Hydrostatic pressure higher than osmotic “effect”;  
Forces / squeezes / pushes out / water / small molecules / ions / examples;

2

**[4]****6.**

- (a)
1. permeable capillary wall / membrane;
  2. single cell thick / thin walls, reduces diffusion distance;
  3. flattened (endothelial) cells, reduces diffusion distance;
  4. fenestrations, allows large molecules through;
  5. small diameter / narrow, gives a large surface area to volume / short diffusion distance;
  6. narrow lumen, reduces flow rate giving more time for diffusion;
  7. red blood cells in contact with wall / pass singly, gives short diffusion distance / more time for diffusion;

*(allow 1 mark for 2 features with no explanation)*

4 max

- (b)
1. (hydrostatic) pressure of blood high at arterial end;
  2. fluid / water / soluble molecules pass out (*reject plasma*);
  3. proteins / large molecules remain;
  4. this lowers the water potential / water potential becomes more negative;
  5. water moves back into venous end of capillary (*reject tissue fluid*) by osmosis / diffusion;
  6. lymph system collects any excess tissue fluid which returns to blood / circulatory system / link with vena cava / returns tissue fluid to vein;

6

**[10]****QWC 1****7.**

- (a) High(er) affinity for oxygen / absorbs / loads more oxygen;

At lower partial pressure (of oxygen) / lower  $pO_2$ ;

*Accept: Loads oxygen ‘quicker’, ‘more readily’, ‘higher saturation’,  
use of figures from graph for first point.*

*Neutral: References to unloading.*

2

- (b) 1. (Hydrostatic) pressure lowerer in capillary / blood / higherer in tissues / tissue fluid;
2. Water (returns);
3. By osmosis;
4. Water potential lower / more negative in blood / capillary / higher / less negative water potential in tissues / via water potential gradient;
5. Due to protein (in blood);
6. (Returns) via lymph (system / vessels);

*First marking point must be in context of between blood and tissue fluid.*

*Neutral: References to hydrostatic pressure and water potential at arteriole end of capillary.*

**3 max**

**[5]**