

Question 30 (Answer: **A**)

- Tissue fluid is formed by filtration, and plasma proteins are too large to pass through the capillary wall.
- So the plasma keeps its proteins and the tissue fluid has very few.
- Red blood cells stay in the capillary too; only white cells can squeeze out.

Question 33 (Answer: **B**)

- Tissue fluid sits outside the capillary and plasma inside it.
- The molecule has to cross the endothelial cell: in through one membrane and out through the other.
- That is two cell surface membranes.

Question 32 (Answer: **D**)

- Blood pressure falls steadily as blood travels away from the heart.
- The vena cava is the last vessel before the blood returns to the heart.
- So it carries blood at the lowest pressure of the four.

Question 31 (Answer: **C**)

- Arteries carry blood at high pressure, veins at low pressure.
- During diastole the aorta still holds high pressure because of elastic recoil.
- The pulmonary artery is high but lower than the aorta, and veins are lowest.

Question 31 (Answer: **B**)

- A pulmonary artery carries blood only as far as the lungs, at a much lower pressure than the aorta.
- So its wall is thicker than any vein but thinner than the aorta.
- Look for the second-thickest wall among the four vessels.

6(a)	any two of these pairs, feature and explanation 1 thick wall of (left) ventricle ; R if right 2 pumps blood at high pressure to, reach (all of) systemic circulation / overcome resistance in systemic circulation / over a long distance / AW ; A if thick wall unqualified A generate high force R 'withstands high pressure' 3 thin wall of (left) atrium ; 4 pumps blood at low pressure, into ventricle / over a short distance ; either 5 (named) valves ; R tricuspid / pulmonary 6 prevent, backflow of blood / maintains one-way flow of blood (through heart) ; ecf if right atrioventricular / tricuspid or 5 (left) atrioventricular / mitral / bicuspid, valve ; R right 6 prevents, backflow of blood / blood flowing from ventricle to atrium ; A maintains one-way flow of blood (through heart) or 5 (left) semi-lunar, valve ; 6 prevents, backflow of blood / blood flowing from, aorta / artery, to ventricle ; A maintains one-way flow of blood (through heart) 7 chordae tendinae / tendons / tendinous cords / AW ; I ligaments 8 hold the valve in position, during systole / when ventricle contracts / AW ; A prevents blowback / turning inside out I high tensile strength unqualified 9,10 AVP ;; e.g. papillary muscle ; contracts to hold, tendons / valve, when heart contracts / during systole ; ora
6(b)	any four from: if AVN used penalise once and then use ECF 1 <u>sinoatrial node</u> releases, waves of excitation / waves of depolarisation / (electrical) impulses / action potential(s) ; AW 2 impulses / AW, stimulate, (both) atria to contract / atrial systole ; 3 impulses / AW, prevented from reaching ventricles by, fibrous ring / non-conducting tissue / insulating tissue / (between atria and ventricles) ; A annulus fibrosus 4 <u>atrioventricular node</u>, delays impulse (by 0.1 s) ; 5 atrioventricular node, sends impulse to, Purkyne tissue (in septum) ; A bundle of His allow ecf for abbreviating AVN 6 Purkyne tissue conducts impulse to, base of ventricles / apex of heart, so they contract ;
6(c)(i)	any two from: if transport is used in MP2 to MP8, penalise once and mark to a max of 1 for those MPs <i>provides, aqueous / watery, (external) environment / surroundings, for cells</i> 1 to maintain correct water potential to prevent, cell dehydration / excessive water loss from cells ; <i>idea that provides medium for exchange of substances</i> 2 supply of oxygen / oxygen diffuses from blood into tissue fluid ; 3 removal of carbon dioxide / carbon dioxide diffuses from tissue fluid into blood ; A exchange of (respiratory) gases as alternative to MP2 and MP3 4 supply of named nutrient e.g. glucose, amino acids, (named) ion(s) ; 5 removal of, metabolic / toxic, waste or urea ; 6 location / movement, of (tissue) macrophages / neutrophils / phagocytes (for defence) ; I white blood cell 7 allows movement of / medium for passage of, (named) cell signalling molecules / hormones / ligands ; A ref. to cells signalling nearby cells / paracrine signalling 8 AVP ; e.g. contributes to formation of lymph / contains antibodies e.g. allows movement of lymphocytes into lymph

6(c)(ii)	any three from: 1 (at arteriole end of capillary) high, hydrostatic / blood, pressure ; 2 (ultra)filtration / described ; e.g. fluid / plasma / water <u>and</u> solutes, forced / comes, out of, capillaries / blood 3 glucose / amino acids / ions, leave blood R if stated, red blood cells / platelets, leave or (large) plasma proteins remain in blood ; 4 through, fenestrations / fenestrae / endothelial pores or through, pores / gaps / spaces, in, capillary wall / endothelium / between cells ; 5 AVP ; e.g. <i>ref. to</i> hydrostatic pressure gradient hydrostatic pressure of blood is greater than hydrostatic pressure of tissue fluid
6(d)(i)	I pathogen A epitope for antigen any two from: some (T-lymphocyte) have (T-cell) receptors, specific / complementary, to a particular antigen ; ora antigen (in vaccine) binds to these T-lymphocytes ; <i>idea that</i> only these T-lymphocytes are, activated / stimulated / selected ; I respond AVP ; e.g. some T-lymphocytes do not become exposed to limited quantity of antigen in vaccine

6(d)(ii)	max four if no correct ref. within response to, memory cells / immunological memory any five from: <i>context of primary immune response</i> 1 antigen presentation by macrophages ; 2 (T- / B-) lymphocyte, binding / recognition / clonal selection / activation / described in terms of receptor ; 3 clonal expansion / cell divides by mitosis many times (to produce a clone) / AW ; 4 cytokines released by T-helper, cells / lymphocytes ; 5 (stimulate) formation of memory, (T- / B-) lymphocytes / cells ; 6 (memory cells) remain in, circulation / body, for a long time / AW ; A remain in lymph nodes or memory cells are long-lived ; <i>context of secondary immune response</i> 7 large numbers of (specific), memory cells / lymphocytes ; I more memory cells A memory cells have a higher chance of encountering antigen
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5(a)(i)	microtubules ;
5(a)(ii)	<i>any two from:</i> <i>ref. to</i> (daughter) chromosomes at poles ; R move to poles I ends A (sister) chromatids at poles A two separate groups of (daughter) chromosomes A two nuclei form (enclosing chromosomes) I there are two nuclei R if in context of cell dividing <i>in context of at each pole, so R if context implies only a single nucleus</i> nuclear envelope, reassembles / (re-)forms / AW (around chromosomes) ; A nuclear membranes reassemble nucleolus / nucleoli, reappear(s) / re-form(s) ; (daughter) chromosomes, become diffuse / become long and thin / decondense / uncoil ; A become chromatin I chromosomes disappear spindle, disassembles / AW ; A spindle breaks down <i>accept ref. to microtubules in a correct context</i>
5(b)	<i>any three from:</i> two structural features named ; valves <i>do not count as a feature if described as semilunar</i> tunica, externa / adventitia A outer layer with collagen tunica media A middle layer with smooth muscle and elastic tissue thin wall large lumen (relative to wall thickness) <i>feature matched to function</i> valve I semilunar to, prevent backflow / help blood move back towards the heart / help move blood in one direction ; <i>tunica, externa / adventitia</i> contains collagen / thick(est) layer / outer layer, to protect / prevents collapse (from external forces) / helps to maintain shape ; AW <i>tunica media</i> smooth muscle, for (mechanical) support / to change diameter of lumen / to help move (low / zero, pressure) blood back towards heart ; elastic fibres to accommodate changes in, blood volume / lumen diameter ; A allows, vein / blood vessel, to, stretch / recoil R stretch and recoil to prevent bursting <i>thin walls with large lumen</i> holds large(r), volume / quantity / amount, of (low / zero, pressure) blood I more blood or (large lumen) <i>ref. to</i> minimises / reduces, resistance (from walls) ;