

OCR AS GCE Biology (23 pages)

F211 Cells, Transport and Exchange

Mark schemes from January 2009-June 2012

Topics:

1.2.2 Transport in Animals

Explain the need for transport systems in multicellular animals in terms of size, level of activity and surface area:volume ratio;

Explain the meaning of the terms *single circulatory system* and *double circulatory system*, with reference to the circulatory systems of fish and mammals;

Explain the meaning of the terms *open circulatory system* and *closed circulatory system*, with reference to the circulatory systems of insects and fish;

Describe, with the aid of diagrams and photographs, the external and internal structure of the mammalian heart;

Explain, with the aid of diagrams, the differences in the thickness of the walls of the different chambers of the heart in terms of their functions;

Describe the cardiac cycle, with reference to the action of the valves in the heart;

Describe how heart action is coordinated with reference to the sinoatrial node (SAN), the atrioventricular node (AVN) and the Purkyne tissue;

Interpret and explain electrocardiogram (ECG) traces, with reference to normal and abnormal heart activity;

Describe, with the aid of diagrams and photographs, the structures and functions of arteries, veins and capillaries;

Explain the differences between blood, tissue fluid and lymph;

Describe how tissue fluid is formed from plasma;

Describe the role of haemoglobin in carrying oxygen and carbon dioxide;

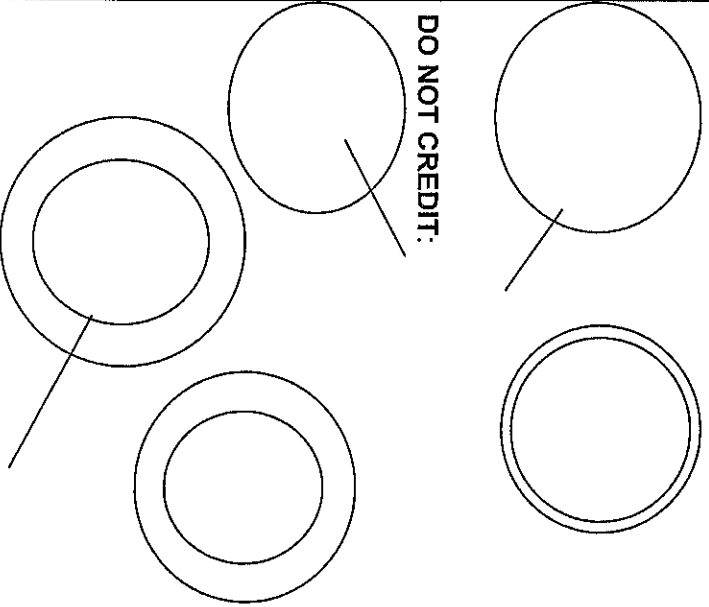
Describe and explain the significance of the dissociation curves of adult oxyhaemoglobin at different carbon dioxide levels (the Bohr effect);

Explain the significance of the different affinities of fetal haemoglobin and adult haemoglobin for oxygen

Question	Expected Answers	Marks	Additional Guidance
5	(a) <i>single circulatory system:</i> blood passes through the heart once for each, circulation / circuit / cycle, of the body ;	2	DO NOT ACCEPT ref to <u>cardiac cycle</u> DO NOT ACCEPT 'blood passes through heart once' - it must be clear there is a circuit / return to heart ACCEPT description e.g. heart to gills to body to heart ACCEPT ref to no separate pulmonary and systemic systems ACCEPT ref to lungs ACCEPT names of two types of vessel as alternative to 'vessels'
5	(b) (i) T SAN / sinoatrial node ; U AVN / atrioventricular node ; V bundle of His / Purkyne tissue ;	3	ACCEPT pacemaker DO NOT ACCEPT sinoatrial / atrial node DO NOT ACCEPT atrioventricular node ACCEPT Purkinje

Question	Expected Answers	Marks	Additional Guidance
5 (b)	(ii) T / SAN, creates / initiates / starts / originates, excitation ; wave (of excitation) spreads over atrial, <u>wall / muscle</u> ; ref to, AVN / U ; atria contract / atrial system ; contraction is synchronised / AW ; delay at AVN ; (excitation spreads) down septum ; ref to, bundle of His / Purkyne fibres ; ventricles contract / ventricular system, from, apex / bottom ; QWC – technical terms, spelled AND used in correct context	4 max 1	ACCEPT acts as pacemaker ACCEPT impulse / action potential / depolarisation DO NOT ACCEPT electricity / signal / message DO NOT ACCEPT if response suggests that brain needed to trigger SAN ACCEPT EITHER in context of both atria OR both ventricles contracting together ACCEPT Purkinje any three from: pacemaker, sinoatrial node, atrioventricular node, excitation, atrial / atrium / atria, septum, Purkyne, bundle of His, ventricle(s) / ventricular, apex, systole.
		[Total: 10]	

Question	Expected Answers	Marks	Additional Guidance
6 (a) (i)	cardiac ;	1	ACCEPT myogenic
6 (a) (ii)	(muscle) contraction / systole ;	1	ACCEPT atrial or ventricular systole DO NOT ACCEPT atrial or systolic pressure
6 (b) (i)	correct answer = two marks 75 ; ; <i>if answer incorrect ALLOW one mark for correct working</i>	2	
6 (b) (ii)	pressure in ventricle is below (pressure in) atrium ; bicuspid / atrioventricular valve, open(s) ; blood flows into (atrium and) ventricle ; QWC - technical terms used appropriately and spelt correctly ; max 3	4	ORA ACCEPT mitral DO NOT ACCEPT pushed or pumped DO NOT ACCEPT arterioventricular Use three terms in correct biological context from: ventricle / ventricular, atrium / atrial, bicuspid, mitral, atrioventricular, diastole
Total		8	
Paper Total		60	

Question	Expected Answers	Marks	Additional Guidance
5 (a) (i)	vein with thinner wall than artery ;	1	<p>CREDIT: Correct position of endothelium as indicated by circle or label line Must be clearly thinner than shown on artery</p>  <p>DO NOT CREDIT:</p>

Question		Expected Answers	Mark	Additional Guidance
5	(a) (ii)	<p>Arteries have:</p> <p>no valves ;</p> <p>endothelium / tunica intima, folded / AW ;</p> <p>more / thicker, muscle / elastic tissue / tunica media ;</p> <p>more / thicker, collagen / tunica externa ;</p>	2 max	<p>Assume answer refers to wall of artery.</p> <p>IGNORE any ref to artery wall being thicker, unqualified, as this has already been stated in the question</p> <p>IGNORE reasons for differences</p> <p>ACCEPT ORA if stated - 'vein is.....'</p> <p>Look for comparative statements</p> <p>ACCEPT tunica adventitia for tunica externa</p>
5	(b) (i)	contraction of <u>ventricle</u> , wall / muscle ;	1	<p>ACCEPT ventricular systole</p> <p>DO NOT CREDIT heart muscle unqualified</p> <p>DO NOT CREDIT contraction of atria and ventricles</p> <p>DO NOT CREDIT pump / squeeze / push / beat without ref to contraction</p>

Marks	Expected Answers	Mark	Additional Guidance
5 (b)	(ii) more, (smaller) vessels / named vessels ; (vessels) have larger, total lumen / cross sectional area ; reduced resistance to blood flow ; arteries, stretch / expand ; loss of, fluid / plasma, from capillaries ;		ACCEPT divides into smaller vessels (implies more of them) ACCEPT larger total surface area DO NOT CREDIT further from the heart
5 (b)	(iii) 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 ;	2 max	DO NOT CREDIT loss of, blood / water DO NOT CREDIT loss of fluid / plasma, unqualified or from other vessels Assume 'it' refers to plasma: DO NOT CREDIT water / diffuses out ACCEPT filters out
5 (b)		3 max	DO NOT CREDIT ref to osmosis

Marks	Expected Answers	Marks	Additional Guidance
5 (c)	X = carbonic anhydrase ;	3	ACCEPT correct phonetic spelling DO NOT ACCEPT anahydrase
	Y = carbonic acid / H ₂ CO ₃ ;		If formula only given, it must be correct. Incorrect formula can be ignored if correct name given.
	Z = hydrogen (ion) / H ⁺ ;		DO NOT CREDIT H alone
	Total	12	

Question	Expected Answers	Marks	Additional Guidance
2 (a)	visible / can be seen / increase contrast ; named example of what is now visible (after staining) ;	2	<p><i>First mark is for 'seeing' and the second mark is for 'recognising' what can now be seen.</i></p> <p>ACCEPT see detail IGNORE ref to resolution</p> <p>ACCEPT recognise different types of white blood cell ACCEPT can (now) see, nucleus / organelles / named organelles IGNORE recognise parts inside red blood cell IGNORE can now see red blood cells (already visible)</p> <p>'can now see red and white blood cells' = 2 marks</p>
2 (b)	(i) 3D shape can be seen / greater depth of field ; can see, surface features / detail ;	max 1	<p>DO NOT CREDIT shape alone</p> <p>ACCEPT 'you can see what is on the surface' IGNORE 'you see the surface better' because this needs further clarification i.e. features, shape, named structure</p>
(ii)	smaller / named, organelle (becomes visible) ; shapes / details of organelles ;	max 1	<p>ACCEPT named structure(s) such as lysosome, RER, mitochondrion, ribosome, Golgi, vesicle, nucleolus DO NOT CREDIT nucleus or chloroplast (already visible)</p>

Question	Expected Answers	Marks	Additional Guidance
2 (c)	<p><i>This is a QWC question</i></p> <p>1 fetal <u>haemoglobin</u> has a higher <u>affinity</u> (for oxygen) (than adult haemoglobin) ;</p> <p>2 (fetal Hb) takes up oxygen in low(er) <u>partial pressure</u> of oxygen ;</p> <p>3 <u>placenta</u> has low partial pressure of oxygen ;</p> <p>4 at low partial pressure of oxygen / in placenta, adult (oxy)haemoglobin will <u>dissociate</u> / AWV ;</p> <p>QWC (two terms used in correct context and spelt correctly);</p>	max 3	<p>IGNORE oxyhaemoglobin for haemoglobin</p> <p>ACCEPT Hb for <u>haemoglobin</u> (but not HbO)</p> <p>ACCEPT fetal Hb becomes <i>more</i> saturated at a <i>low(er)</i> partial pressure of oxygen</p> <p>ACCEPT ppO_2 / pO_2 / oxygen tension / O_2 concentration, for partial pressure of oxygen</p> <p>ACCEPT in placenta mother's haemoglobin, releases its oxygen / saturation drops</p> <p>Any two terms from the following: affinity, dissociate / dissociation, placenta, partial pressure / oxygen tension, saturation / saturated</p>
		max 1	

Question	Expected Answers	Marks	Additional Guidance
2 (d)	(i) curve to right of curve A ; appropriate sigmoid shape ;	2	Curve should start at 0% on y axis and reach at least 80% on y axis
2 (d)	(ii) 1 (actively respiring tissue) needs / requires, <i>more oxygen</i> ; 2 for aerobic respiration / to release <i>more energy</i> ; 3 (actively respiring tissue produces) <i>more CO₂</i> ; 4 haemoglobin involved in transport of CO ₂ ; 5 less haemoglobin available to combine with O ₂ ; 6 (Bohr shift) causes <i>more oxygen</i> to be released ;	max 2	<i>idea of 'more'</i> should be clear as shown (MP 1,2,3,6) ACCEPT make <i>more</i> ATP ACCEPT produces a <i>lot</i> of CO ₂ / as CO ₂ levels rise CREDIT detail to include carbonic acid dissociation / formation of haemoglobinic acid / HHb etc DO NOT CREDIT oxygen released <i>more</i> quickly / quicker ACCEPT oxygen released <i>more</i> , readily / easily 'More CO ₂ produced so more O ₂ released' = 2 marks
Total		12	

Question	Expected Answers	Marks	Additional Guidance
6 (a)	a single value between 67 and 80 ; ;	max 2	two marks for correct answer If answer incorrect, allow one mark for appropriate working i.e. 60 divided by time from trace selected by candidate
6 (b)	heart rate, slower / lower / reduced / 60 – 63 beats per minute ; rest period / diastole longer ; ventricle takes longer to contract / ventricular systole longer ;	max 2	<i>Mark first point on each numbered line</i> ACCEPT length of one beat is longer DO NOT CREDIT 'slows heart's activity' ACCEPT T wave elongated / increases from 0.24s to 0.32s / increases by 0.1 s IGNORE name of chamber ACCEPT R wave slightly elongated / increases from 0.07s to 0.12s / increases by 0.05 s
6 (c)	SAN, is pacemaker / initiates heart beat ; (SAN sends) impulse / wave of excitation, over atria (walls) ; AVN delays impulse ; (AVN) sends impulse down, septum / bundle of His / Purkyne fibres ;	max 3	ACCEPT starts, wave of excitation / action potential / electrical impulse IGNORE 'sends out' (wave) IGNORE through / to, the atrium DO NOT CREDIT signal / message for impulse, allow ecf DO NOT CREDIT pulse IGNORE delays contraction ACCEPT Purkinje
Total		7	

Question	Expected Answers	Marks	Additional Guidance
(c)	<p>1 (histamine), binds / attaches, to, receptor / glycoprotein ;</p> <p><i>idea of :</i></p> <p>2 in / on, plasma / cell surface, membrane (of muscle cell) ;</p> <p>3 <u>complementary</u> (shape) ;</p> <p>4 triggers response / causes effect, inside cells ;</p>	2 max	<p>binds to complementary receptor = 2 marks ACCEPT glycolipids IGNORE binding site, ref antigens</p> <p>ACCEPT in / on, cell surface / cell membrane (of muscle cells) ACCEPT membrane bound receptors (on muscle cells)</p> <p>CREDIT correct examples of effects / details inside cells e.g. ref to opening sodium channels in cell surface membrane ref to second messenger ref to cyclic AMP ref to activation of enzymes / kinases ref to phosphorylation</p>
(d)	<p><i>idea of :</i></p> <p>1 more tissue fluid formed / increase in volume of tissue fluid ;</p> <p>2 increase pressure in tissue ;</p> <p>3 swelling / inflammation / oedema;</p> <p>4 (more) white blood cells pass into tissues ;</p> <p>5 larger molecules / (named) proteins, pass into tissue fluid ;</p>	2 max	<p>Mark the first two suggestions only. Read as prose unless candidate has indicated two points by bullets or numbers – in this case mark the first comment in each bullet.</p> <p>IGNORE refs to the capillaries becoming more leaky IGNORE more water passes out</p> <p>DO NOT CREDIT cells swell</p> <p>ACCEPT (more) white blood cells leave the capillary</p> <p>IGNORE ref to more, glucose / nutrients / gases, leave blood capillary IGNORE ref to increased rate of diffusion</p>
	Total	8	

Question	Expected Answers	Marks	Additional Guidance
3	surface area to volume ratio ; <u>erythrocytes</u> ; affinity ; oxyhaemoglobin ; carbon dioxide / CO ₂ / hydrogen ions / H ⁺ ; Bohr / bohr (shift) ;	6	ACCEPT SA / VOL or SA:Vol ACCEPT minor spelling errors if phonetically correct e.g. erythrocyte DO NOT CREDIT erthrocytes, erephosite, erthrocyte IGNORE red blood cells ACCEPT attraction ACCEPT Hbo / HbO ₈ DO NOT CREDIT HbO ₂ etc ACCEPT carbonic acid DO NOT CREDIT CO ² DO NOT CREDIT hydrogen, H, H ₂ ACCEPT phonetic spellings e.g. bohr, bore, both
	Total	6	

Question	Expected Answer	Mark	Additional Guidance
3 (a) (i)	<p>X = <u>right</u> atrium ;</p> <p>Y = aorta ;</p> <p>Z = (left) pulmonary artery ;</p>	3	<p>Mark the first answer for each letter. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT <u>right</u> atria</p> <p>IGNORE RA</p> <p>IGNORE PA</p>
3 (a) (ii)	<p>left ventricle</p> <p>1 (more muscle to create) more force ;</p> <p>2 (needs to create) <u>higher</u> pressure ;</p> <p>3 push blood against greater , resistance / friction ;</p> <p>4 (left ventricle) pumps blood further / pumps blood to all parts of body / supplies systemic circulation ;</p>	3 max	<p>Assume answer refers to left ventricle unless otherwise stated.</p> <p>ACCEPT ORA for left atrium throughout</p> <p>1 IGNORE more powerful contraction</p> <p>ACCEPT stronger contraction</p> <p>2 IGNORE withstanding or maintaining pressure</p> <p>4 ACCEPT pumps blood , all round body / greater distance</p> <p>IGNORE pumps blood to the body</p> <p>DO NOT CREDIT references to , right ventricle / lungs</p>

Question	Expected Answer	Mark	Additional Guidance
3	<p>(a) (iii)</p> <p>1 ventricular systole or ventricle, wall / muscle, contracts;</p> <p>2 (ventricular contraction) raises ventricular pressure;</p> <p>3 (ventricular pressure) higher than atrial pressure;</p> <p>4 idea of (pressure / movement of blood, generated by ventricular contraction) pushes valve shut;</p> <p>5 chordae tendinae prevent inversion;</p>	max 2	<p>1 DO NOT CREDIT statements that refer to right atrium or right ventricle</p> <p>1 IGNORE ref to atrial contraction</p> <p>4 DO NOT CREDIT 'valve shuts' alone</p> <p>DO NOT CREDIT in context of blood flowing from atrium to ventricle resulting in pressure increase to close valve</p> <p>5 ACCEPT valve tendons / tendinous cords</p>
(b)	<p>aorta / (named) artery / arteries / arteriole(s);</p> <p>blood / plasma;</p> <p>capillary / capillaries / capillary wall / (capillary) endothelium;</p>	3	<p>Mark the first answer for each role. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT smooth muscle / elastic tissue / collagen / narrow lumen</p> <p>DO NOT CREDIT valves</p>
	Total	11	

Question	Answer				Marks	Guidance
3 (a)	feature	arterial blood	tissue fluid	lymph		<p>Mark the first answer for each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>Award 1 mark per correct row.</p> <p>IGNORE yes and no in first row</p> <p>IGNORE yes and no in first row</p> <p>ACCEPT some / few / low / usually, for yes in rows 2 and 3 DO NOT CREDIT not usually for yes</p> <p>In row two mark is awarded for idea that tissue fluid and lymph are the same (proteins in tissue fluid will enter lymph) - both responses must be the same to achieve a mark.</p> <p>Mark is awarded for tissue fluid response only.</p>
	hydrostatic pressure	high	low	low		
	presence of large proteins	yes	no OR yes	no yes		
	presence of neutrophils	yes	yes	(yes / no)		
	presence of erythrocytes	yes	no	no		
					4	

Question	Answer	Marks	Guidance
(b) (i)	maintain / high(er), (blood) pressure ; increase rate of, flow / delivery ; flow can be, diverted / directed / AW ;	2 max	<p>Mark the first suggestion on each prompt line.</p> <p>IGNORE separates oxygenated from deoxygenated blood</p> <p>IGNORE generate / create, pressure</p> <p>IGNORE ref to pressure gradient</p> <p>ACCEPT blood moves faster / quicker</p> <p>IGNORE ref to going to, all cells / where needed</p>

Question	Answer	Marks	Guidance
(ii)	<p><i>to withstand pressure</i></p> <p>D1 wall is thick ; D2 (thick layer of) collagen ; E3 (wall / collagen) provides strength ;</p> <p>D4 endothelium, corrugated / folded ;</p> <p>E5 <i>idea of: no damage to, endothelium / artery (wall) (as it stretches) ;</i></p> <p><i>to maintain pressure</i></p> <p>D6 (thick layer of) elastic tissue / elastic fibres / elastin ; E7 to cause recoil / return to original size ;</p> <p>D8 (thick layer of) <u>smooth muscle</u> ; E9 narrows / constricts, lumen / artery ;</p> <p>E10 AVP ;</p> <p style="text-align: right;">max 3</p>	4 max	<p>Ensure that there is at least one D mark and one E mark for four marks AND Ensure that there is at least one withstand mark and one maintain mark for four marks</p> <p>ACCEPT tunica media, tunica adventitia, tunica externa for wall ACCEPT (wall / collagen) is strong</p> <p>ACCEPT tunica intima for endothelium IGNORE lining IGNORE prevents artery bursting / breaking ACCEPT wall will not tear</p> <p>IGNORE elastic unqualified</p> <p>Ref to lumen must be in context of explaining how pressure is maintained eg makes lumen smaller) = 1 mark DO NOT CREDIT in context of constriction to push or pump the blood along the artery IGNORE 'lumen is narrow' or 'has small lumen' as these are a description of the lumen not referring to the wall eg: <i>idea of: blood is forced (through narrow, channel / lumen)</i> <i>idea of: restriction of blood flow to one area allows pressure to be maintained elsewhere</i></p> <p style="text-align: right;">QWC rubric continued on next page.....</p>

Question	Answer	Marks	Guidance
3 (b)(ii)	Q QWC - two technical terms used and spelt correctly ;	1	Words must be used in correct context and section. any 2 from: <i>withstanding pressure:</i> collagen endothelium / endothelial <i>maintaining pressure:</i> elastic / elastin recoil smooth muscle lumen constriction
Total		11	

Question	Answer	Marks	Guidance						
3	<table border="1"> <tr> <td data-bbox="1235 416 1334 658">open circulatory system</td> <td data-bbox="1235 658 1334 900">single circulatory system</td> <td data-bbox="1235 900 1334 1151">closed circulatory system</td> </tr> <tr> <td data-bbox="1038 416 1137 658">double circulatory system</td> <td data-bbox="1038 658 1137 900"></td> <td data-bbox="1038 900 1137 1151">✓ ;</td> </tr> </table>	open circulatory system	single circulatory system	closed circulatory system	double circulatory system		✓ ;	1	<p>ACCEPT cross / other mark DO NOT CREDIT if a tick is placed in more than one box</p>
open circulatory system	single circulatory system	closed circulatory system							
double circulatory system		✓ ;							
(a)	(i)	2 max	<p>IGNORE 'the heart' or 'the heart beating' or 'the heart pumping' without further qualification IGNORE ref to right (side) for mp 1 - 3 ACCEPT ref to peak on graph for increasing pressure ACCEPT ref to trough on graph for decrease in pressure ACCEPT ventricular systole</p>						
(b)	(ii)	1	<p>IGNORE heart beat / beats per minute</p>						

Question	Answer	Marks	Guidance
(c)	<p><i>marks for pressure change:</i> pressure drops, as distance from heart increases ; greatest / rapid / significant, pressure drop while blood is in the arteries ; pressure, constant / does not drop, in veins ;</p> <p><i>marks for amplitude of fluctuations:</i> fluctuation / AW, decreases from aorta to arteries ; no fluctuation in, capillaries / veins ; use of comparative figures with unit ;</p>	3 max	<p>ACCEPT from aorta to arteries / correctly named blood vessels – look for decrease in pressure trend</p> <p>ACCEPT plateaus / level</p> <p>IGNORE ref to frequency of fluctuations</p> <p>ACCEPT ‘smaller fluctuations in artery’</p> <p>correct figures must be quoted from the graph to back up <u>one</u> point – correct unit used at least once. eg ‘peak to peak’, between aorta and arteries, falls 18.5 to 14 kPa pressure in aorta between 18.5 and 12.5 kPa pressure in arteries drops from 12.5 to 5 kPa pressure in capillary drops from 5 to 0.5 kPa overall drop from 18.5 to 0.5 kPa</p> <p><i>Any other figures must be checked against graph</i></p> <p>ACCEPT correct calculated figure eg pressure drops 6kPa in aorta</p>

Question	Answer	Marks	Guidance
(d) (i)	<p>blood flows into larger number of vessels ;</p> <p>(total) cross-sectional area of the <u>arteries</u> is greater than the aorta ;</p> <p>(total) cross-sectional area of the <u>capillaries</u> is greater than the, aorta / <u>arteries</u> ;</p>	2 max	<p>IGNORE ref to pressure fluctuations and structure of vessel walls as not relevant to overall pressure change</p> <p>ACCEPT idea of vessels branching to many/more (smaller) vessels</p> <p>IGNORE ref to lumen size</p>
	<p>capillary (wall) is, thin / only one cell thick ;</p> <p>(high pressure would) burst / damage, capillary (wall) ;</p> <p>reduce chance of, tissue fluid build up / oedema ;</p>	11	<p>IGNORE ref to rate of flow</p> <p>IGNORE ref to capillary walls small / made of squamous cells</p> <p>ACCEPT cannot withstand (high) pressure</p>
	Total	11	