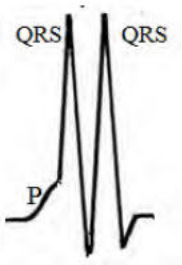
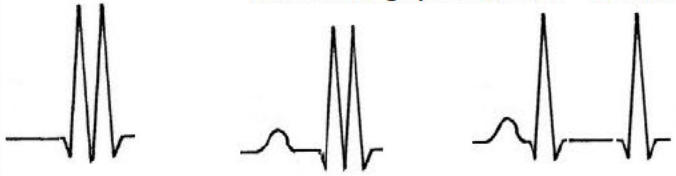
Question			Expected Answers	Marks	Additional Guidance
1	(a)		**C ;** **E ;** **A ;** **B ;**	4	

Question			Expected Answers	Marks	Additional Guidance
	(b)	(i)	P wave combined with larger peak before QRS complex ;  	1	**Note:** - **look for additional QRS peak between P and original QRS peak** - **new peak may be merged with P but there must still be evidence of P** **IGNORE** relative size and width of two QRS peaks **IGNORE** anything drawn after second QRS **IGNORE** small gap / 'bump' between two QRS peaks **ACCEPT** two QRS peaks drawn immediately after P peak if no delay between P and first QRS **IGNORE** relative size and width of two QRS peaks **IGNORE** anything drawn after second QRS **IGNORE** small gap / bump between two QRS peaks  **DO NOT CREDIT** two QRS with no sign of a P peak trace with gap between P and first QRS 

Question			Expected Answers	Marks	Additional Guidance
	(b)	**(ii)**	lower output / less blood leaves heart (for each ventricular contraction) **;** *idea of:* ventricles do not have time to fill (before contracting) **;** OR ventricle contraction inefficient because first contraction is downwards	2	**ACCEPT** less goes around body **CREDIT** 'heart pumps less blood' 'blood flow reduced' e.g. ventricle(s) not full before contracting e.g. atria unable to, contract / empty, before ventricles contract **IGNORE** ref to change in pressure & rate of flow (question asks about blood flow)
	(c)	**(i)**	lungs not, functioning / filled with air **;** blood / haemoglobin, is, not oxygenated in the lungs / oxygenated in placenta **;** (therefore) pulmonary circuit / lungs, bypassed **;**	2 max	**ACCEPT** fetus not breathing **ACCEPT** ref to 'single circulation' **ACCEPT** little blood goes to, lungs / pulmonary circuit **DO NOT ACCEPT** no blood goes to lungs

Question			Expected Answers	Marks	Additional Guidance
	(c)	(ii)	**EITHER** *Difference:* (fetal haemoglobin) higher affinity for oxygen / described / **ORA ;** *Reason:* (fetal haemoglobin) must be able to bind to oxygen, in low(er) partial pressure / in placenta / when adult oxyhaemoglobin dissociates / when adult haemoglobin dissociates from oxygen; **OR** *Difference:* (fetal haemoglobin) contains gamma sub-units ; *Reason:* creates high(er) affinity for oxygen ;	2	**ACCEPT** able to become more saturated than adult haemoglobin at low pO_2 **IGNORE** gets more saturated at low pO_2 (ie no comparison to adult haemoglobin) **IGNORE** ref to saturation curve **CREDIT** 'associate with / combine with / loads' for bind **IGNORE** pick up / take up / gains / absorbs / attracts / attaches / saturates **DO NOT CREDIT** oxygen dissociates or haemoglobin dissociates
			Total	**11**	

Question			Answer	Mark	Guidance
2	(a)		gap(s) between endothelium cells (too) small ; (erythrocytes) too large / cannot change shape (much) ; to, fit / move / pass, between (endothelium) cells **OR** through, gaps / pores / fenestrations;	2 max	**IGNORE** holes in wall **ACCEPT** pores / fenestrations too small Look for idea that they are **too** big not just big **ACCEPT** not small enough **ACCEPT** squeeze **DO NOT CREDIT** diffusion of cells **IGNORE** to pass through capillary wall (it is in question and we want to know how they get through) **Note:** too big to pass through gaps = 2 marks (mp2 & 3)
	(b)		1 (haemoglobin has) high affinity for oxygen ; 2 oxygen binds to haemoglobin in, lungs / alveoli / high pO_2 ; 3 oxyhaemoglobin ; 4 oxygen released, in tissues / where needed / where pO_2 is low / where respiration is occurring ;	3 max	**ACCEPT** haem group / iron ions for haemoglobin **ACCEPT** high, oxygen tension / concentration **ACCEPT** attaches / combines / loads / associates / becomes more saturated **IGNORE** picks up / oxygenated **DO NOT CREDIT** reacts with **ACCEPT** unloads **/** dissociates from Hb **Note:** do not give a mark for '***oxygen*** dissociates' as this implies oxygen is forming ions / atoms **ACCEPT** low, oxygen tension / concentration **IGNORE** gives up / drops off **IGNORE** ref to high carbon dioxide concentration

Question			Answer	Mark	Guidance
	(c)	(i)		3 max	**CREDIT** mark points taken from equations or flow charts e.g. $CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$ this = mp 2 & 4 to award mp 3 & 5 correctly located annotations needed **ACCEPT** correct symbols and formulae throughout (but **NOT** for QWC mark) **CON** If name and formula contradict e.g. hydrogencarbonate ions = H_2CO_3
			1 carbon dioxide, enters / diffuses into, erythrocytes **;**		**ACCEPT** red blood cells
			2 (carbon dioxide) combines / reacts, with water **;**		
			3 correct ref to **carbonic anhydrase;**		**Note:** correct context is it catalyses, combination of carbon dioxide and water / formation of carbonic acid **IGNORE** if linked to dissociation of carbonic acid
			4 forms **carbonic acid ;**		**IGNORE** carbolic/carboxylic
			5 (carbonic acid) **dissociates** to form hydrogencarbonate ions *and,* **hydrogen ions** / **protons ;**		**ACCEPT** splits / broken down **ACCEPT** bicarbonate ions **Note:** both products must be ions produced from dissociation of a compound (not dissociation of hydrogencarbonate ions)
			QWC **;**	1	Any two technical terms from the list below used appropriately and spelled correctly : **carbonic acid** **carbonic anhydrase,** **dissociates** (or derivatives of this word) **hydrogen ions / protons**

Question			Answer	Mark	Guidance
		(ii)	*Name* 1 Bohr (effect / shift) **;** *Explanation (**any 2** of the following marks)* 2 reduces <u>affinity</u> (of Hb) for oxygen **;** 3 formation of haemoglobinic acid / hydrogen ions interact with haemoglobin **;** 4 prevents, fall in pH / build-up of H^+, in cells **OR** provides buffering effect **;** 5 alter, structure / shape, of haemoglobin **;** 6 ***more*** oxygen released where, needed / more respiration / carbon dioxide concentration high **;** 7 CO_2 binds to haemoglobin forming carb<u>amino</u>haemoglobin **;**	3 max	**Maximum 2 marks if effect not named correctly** **ACCEPT** phonetic spelling **IGNORE** ref to 'curve shifting' **ACCEPT** hydrogen ions, combine / bind, with Hb **ACCEPT** HHb for haemoglobinic acid **ACCEPT** $H^+ + Hb \rightarrow HHb$ **ACCEPT** causes **more** oxygen to leave (oxy)haemoglobin / high**er** levels of oxygen released **IGNORE** ref to oxygen released more quickly or more easily **Note:** do not give a mark for 'more ***oxygen*** dissociates' as this implies oxygen is forming ions / atoms (as this explains reduced oxygen transport)
			Total	**12**	

Question			Answer	Mark	Guidance
3	(a)		mental and physical well-being **;** absence of disease **;**	2	**IGNORE** social **ACCEPT** "not just the absence of disease"
3	(b)	(i)	185.2 **; ;**	2	**Correct answer = 2 marks** **CREDIT** either in the table or seen in the working space answer should be given to 1dp (to be consistent with the other calculated data) If answer incorrect or given to the incorrect number of d.p. **ALLOW** 1 mark for 185 / 185.18 / 185.19 / 185.185 / 185.1 seen anywhere
3	(b)	(ii)	**1** death from , CHD / lung cancer / both , increased (in smokers) ; **2** CHD has bigger increase in number (of deaths) due to smoking (than lung cancer) ; **ora** **3** lung cancer has bigger , relative / percentage , increase (in deaths) due to smoking (than CHD) ; **ora**	2 max	**IGNORE prompt lines – mark as prose** **1 ACCEPT** AW **1 IGNORE** figures – must be a comparative statement **2 ACCEPT** implication from correct (1388 and 360) calculated increases **3 IGNORE** figures – must be a comparative statement **3 IGNORE** bigger impact

Question			Answer	Mark	Guidance
3	(c)			6 max	***N** marking points*
			N1 nicotine ;		**N1 DO NOT CREDIT** if any **N** mark is associated with a chemical other than nicotine
			N2 increases stickiness of platelets ;		**N2 ACCEPT** makes platelets sticky
			N3 thrombosis / formation of blood clot ;		**N3 ACCEPT** thrombus formation
			N4 causes release of adrenaline ;		
			N5 causes constriction of , arterioles / small arteries ;		**N5 IGNORE** narrowing of lumen
			N6 reduced , blood flow / oxygen supply , to (named) extremities ;		
					***C** marking points*
			C7 carbon monoxide / CO ;		**C7 DO NOT CREDIT** if any **C** mark is associated with a chemical other than carbon monoxide
			C8 combines (permanently) with haemoglobin / forms carboxyhaemoglobin ;		**C8 IGNORE** carbamino
			C9 reduced oxygen carrying capacity of blood ;		**C9 ACCEPT** reduced amount of oxygen in blood **C9 IGNORE** 'less oxygenated blood is delivered to tissues' as this could imply reduced cardiac output

Question			Answer	Mark	Guidance
			10 increased , heart rate / blood pressure ; **11** damage to, lining / endothelium , (of blood vessels) ; **12** atherosclerosis / atheroma ; **13** coronary heart disease / CHD / heart attack / stroke / myocardial infarction / MI / angina **;**		**10 IGNORE** heart must work harder **11 ACCEPT** epithelium **12 IGNORE** plaques **13 IGNORE** conary / chronic / part of heart dying / cardiac arrest / heart failure
			QWC - **N1 and C7 plus** another **N** mark **or C** mark **and no** discussion of tar	1	**DO NOT AWARD** QWC if candidate discusses a lung disease or any non-cardiovascular effects **DO NOT AWARD** QWC tar is *discussed* at all **IGNORE** nicotine is addictive **IGNORE** 'tar' if it appears as a list of chemicals
				7	
			Total	**13**	

Question			Answer	Marks	Guidance
4	(a)	(i)	1 placenta has low pO_2 ;		**ACCEPT** oxygen tension for pO_2 throughout **IGNORE** lower
			2 adult (oxy)haemoglobin will, release O_2 / dissociate, (in, low pO_2 / placenta) ;		
			3 fetal haemoglobin has higher affinity for oxygen / described ;		This must be a comparative statement **CREDIT** *Idea that* fetal haemoglobin picks up more oxygen than the adult haemoglobin at a given pO_2 / fetal haemoglobin picks up oxygen at lower pO_2 **IGNORE** ref to easier / quicker, uptake of O_2
			4 fetal haemoglobin, is (still) able to take up (some) oxygen, in placenta / at low(er) pO_2 ;		This is not a comparative point, the emphasis is on the ability of fetal haemoglobin to take up some oxygen even when little is available **DO NOT CREDIT** if response suggests that % saturation increases as pO_2 decreases
				max 3	**ACCEPT** fetal oxyhaemoglobin
		(ii)	(fetal) haemoglobin may not crystallise (much) (at low pO_2) ;		assume candidate refers to fetal haemoglobin unless adult / maternal stated
			red blood cells do not change shape ;		
			(fetal) haemoglobin can pick up more oxygen at low pO_2 (than sickle haemoglobin);		Emphasis for this mp is the fetal haemoglobin being able to pick up more oxygen than sickle haemoglobin **CREDIT** (fetal) haemoglobin becomes more saturated at low pO_2 (than sickle haemoglobin) Allow ref to lower pO_2 unless it is implied that fetal haemoglobin picks up more oxygen at lower pO_2 than higher pO_2
			idea that more oxygen, transported / delivered (around body) ;		Emphasis for this mp is the distribution of oxygen **IGNORE** more oxygen obtained by person (as this implies breathing)
				max 2	

	(b)		**diffusion ;** from high concentration to low concentration / down **concentration gradient;** (**hydrostatic**) **pressure** in capillary high(er than in tissue fluid) **;** capillary (walls) leaky / described **;** fluid / plasma, forced out (of capillary) OR fluid / plasma, moves, from higher pressure to lower pressure / down pressure gradient **;** (as the fluid / plasma moves out) glucose / oxygen / small molecules, leave with, fluid / plasma **;** **max 3**	**IGNORE** diffusion of glucose throughout answer 'down diffusion gradient' = 1 for 'diffusion' (mp 1 **not** mp 2) **DO NOT CREDIT** diffusion linked to pressure **ACCEPT** pO_2 for concentration **ACCEPT** permeable **IGNORE** pores / fenestrations / holes **ACCEP**T *idea of* small gaps between cells Emphasis here is on pressure forcing fluid out **DO NOT CREDIT** tissue fluid forced out Emphasis here is on glucose/ oxygen being carried out as a result of mass flow of fluid (not diffusion)
			QWC**;** **1**	**award** if any two terms spelt correctly and used in correct context from: **diffusion / diffuse**, **pressure**, **hydrostatic, concentration gradient**
			Total	**9**	

Question			Answer	Marks	Guidance
5	(a)	(i)	provides, strength / support **;** to keep, it / the vessel / the tube, open **OR** prevent collapse of, vessel / tube **;** (because) transpiration produces, tension / negative pressure **;** to waterproof the, cell / vessel / tube / wall **;** (so) <u>cell</u>**,** dies / content decays **;** to create a hollow, tube / vessel **OR** to create a continuous column / allow unimpeded flow **;** to limit lateral flow of water **;** ref to adhesion (between water molecules and wall) **;**	3 max	**IGNORE** ref to flexibility **IGNORE** xylem unqualified **IGNORE** 'collapse of wall' **IGNORE** 'xylem' **IGNORE** xylem vessels die **CREDIT** reduce / prevent lateral movement **ACCEPT** lignin helps water move by adhesion
		(ii)	(provides) strength / support, to keep, it / trachea / airway, open **OR** (provides) strength / support, to prevent collapse **;** during, inspiration / inhaling / breathing in **;** volume of, chest cavity / thorax / lungs, increases **;** low(er) / negative, pressure in, trachea / thorax / lungs **;**	3 max	**IGNORE** ref to alveoli / C-shape of cartilage **ACCEPT** in context of bending the neck

Question			Answer	Marks	Guidance
	(b)			3 max	ensure that 'surface area to volume ratio' is used correctly
			body has small <u>surface area to volume ratio</u> **OR** lungs, provide / have, large <u>surface area to volume ratio</u> **;**		**CREDIT** SA/Vol, SA:Vol **ACCEPT** person for body
			correct calculation of (one) surface area to volume ratio **;**		25.7 /26 (:1) for body OR 1000(:1) for lungs DO NOT CREDIT 1 : 1000 OR 1 : 26
			idea of: body SA / SA:Vol is not big enough to meet body's needs **OR** lung SA / SA:Vol is big enough to meet body's needs **;**		**e.g.** allows gaseous exchange at a high enough rate **IGNORE** ref to efficiency
			oxygen into (blood / body) **and** carbon dioxide out (of blood / body) **;**		**CREDIT** O_2 and CO_2
			Total	**9**	