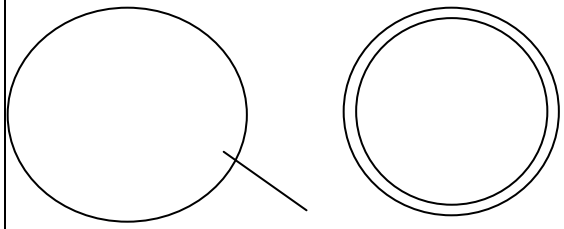
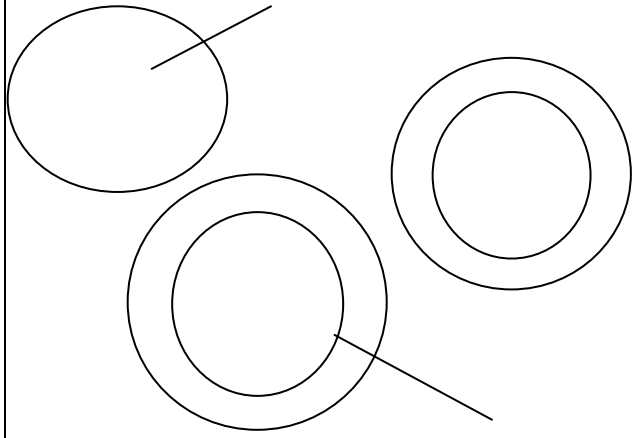
Question			Expected Answers	Marks	Additional Guidance
1	(a)		a single value between 67 and 80 **; ;**	max 2	two marks for correct answer If answer incorrect, allow one mark for appropriate working i.e. 60 divided by time from trace selected by candidate
1	(b)		heart rate**,** slower / lower / reduced / 60 – 63 beats per minute **;** rest period / diastole longer **;** ventricle takes longer to contract / ventricular systole longer **;**	max 2	*Mark first point on each numbered line* **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
1	(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
2	(a)	(i)	vein with thinner wall than artery **;**	1	**CREDIT:** Correct position of endothelium as indicated by circle or label line Must be clearly **thinner** than shown on artery  **DO NOT CREDIT**: 

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

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

Marks			Expected Answers	Marks	Additional Guidance
2	**(c)**		**X** = carbonic anhydrase **;**		**ACCEPT** correct phonetic spelling **DO NOT ACCEPT** anahydrase
			Y = carbonic acid / H_2CO_3 **;**		If formula <u>only</u> given, it must be correct. Incorrect formula can be ignored if correct name given.
			Z = hydrogen (ion) / H^+ **;**	**3**	**DO NOT CREDIT** H alone
			Total	**12**	

Question			Expected Answers	Marks	Additional Guidance	
3	(a)	(i)	cardiac **;**	1	**ACCEPT** myogenic	
3	(a)	(ii)	(muscle) contraction / systole **;**	1	**ACCEPT** atrial or ventricular systole **DO NOT ACCEPT** atrial or systolic pressure	
3	(b)	(i)	*correct answer = two marks* 75 **; ;** *if answer incorrect **ALLOW** one mark for correct working* 60 / 0.8	 2		
3	(b)	(ii)	pressure in **ventricle** is below (pressure in) **atrium ;** **bicuspid** / **atrioventricular** valve, open(s) **;** blood flows into (atrium and) ventricle **;** max 3 QWC - technical terms used appropriately and spelt correctly **;** 1	 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**		

Question			Expected Answers	Marks	Additional Guidance
4	(a)		*single circulatory system:* blood passes through the heart once for each, circulation / circuit / cycle, of the body **;** *closed circulatory system:* the blood is maintained inside vessels **;**	**2**	**DO NOT ACCEPT** ref to <u>cardiac</u> cycle **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'
4	(b)	(i)	**T** SAN / sinoatrial node **;** **U** AVN / atrioventricular node **;** **V** bundle of His / Purkyne tissue **;**	**3**	**ACCEPT** pacemaker **DO NOT ACCEPT** sinoarterial / artrial node **DO NOT ACCEPT** arterioventricular node **ACCEPT** Purkinje

Question			Expected Answers	Marks	Additional Guidance
4	(b)	(ii)	**T** / SAN, creates / initiates / starts / originates, **excitation ;** wave (of excitation) spreads over **atrial,** wall / muscle **;** ref to, AVN / **U ;** atria contract / atrial **systole ;** contraction is synchronised / AW **;** delay at AVN **;** (excitation spreads) down **septum ;** ref to, **bundle of His** / **Purkyne** fibres **;** ventricles contract / ventricular systole, 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			Answer	Marks	Guidance
5	(a)		low / small, surface area to volume ratio **;** diffusion, too slow / distance too great **;** to supply enough**,** oxygen / (named) nutrients **;** to prevent, CO_2 / (named) waste product, building up **;** active **;**	3 max	**Mark the first 3 suggestions** **CREDIT** SA/Vol, SA:Vol **ACCEPT** surface area to volume (ie if 'ratio' missed) **IGNORE** lower SA / Vol **ACCEPT** diffusion pathway too long **ACCEPT** diffusion insufficient because, body too large / tissues too deep **ACCEPT** 'transport enough' for 'supply enough' idea of 'enough' is important **ACCEPT** to remove waste products **ACCEPT** to prevent waste reaching toxic levels **ACCEPT** high demand for oxygen / energy **OR** high metabolic rate **OR** endotherm / maintaining temperature / exercising
	(b)	**(i)**	electrocardiogram **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** ECG **DO NOT CREDIT** electrocardiograph
		(ii)	**A** sinoatrial node / SAN **;** **B** atrioventricular node / AVN **;**	2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** sinalatrial node / sanatrial node = NBOD atroventricular / atrialventricular, node= BOD artrialventricular / avioventricular node = NBOD

Question			Answer	Marks	Guidance
	(c)	(i)	(to allow time) for the atria to (fully) contract **;** to allow (time for), atria to empty / blood to move / ventricles to fill **;** so that ventricle(s) do not contract, too early **;**	2 max	**ACCEPT** systole for contraction **IGNORE** pumping **ACCEPT** so atria and ventricles do not contract at the same time **ACCEPT** (atria contract) before ventricular systole occurs **Note:** so ventricles do not contract before they are full = 2 so ventricles do not contract before atria are empty = 2 so atria have time to empty before the ventricles start to contract = 2
		(ii)	so that (ventricular) contraction starts at, apex / base / bottom **;** to push blood upwards OR into/ towards, (named) arteries **;** complete / efficient, emptying of ventricles **;**	2 max	**IGNORE** ref to gravity / ref to blood pressure **ACCEPT** systole for contraction **ACCEPT** contract from the apex **IGNORE** pumping **ACCEPT** force all blood out of heart
			Total	**10**	