8. Transport in Mammals

8.3 The Heart

Paper 2

Marking Scheme

Q1.

(c)(i)	**X** is positioned <u>above</u> the join on the coronary artery on, left-hand side of Fig. 6.1 / right heart ; **R** if placed at the junction of the vein and artery	1

Q2.

(d)	sinoatrial node ; **I** SAN	1

Q3.

(a)	**3** = (atrial) systole (ventricular) diastole **5** = (atrial) diastole (ventricular) systole ; **7** = (atrial) diastole (ventricular) diastole ;	2
(b)	*allow responses in context of both sides or one side of heart* *any **two** from:* atria and ventricles, do not contract / are not in systole, at the same time ; AW ventricles, contract / are in systole, after atria ; AW ora *idea that* allows atria to empty (completely) / allows ventricles to fill ; **A** *idea that* (all) blood, pumped / AW, into ventricles (ready for systole)	2
(c)	*opening of tricuspid valve* pressure in (right) ventricle becomes lower than pressure in (right) atrium **or** pressure in (right) atrium becomes higher than pressure in (right) ventricle ; *opening of pulmonary (semilunar) valve* pressure in (right) ventricle becomes higher than pressure in pulmonary artery **or** pressure in pulmonary artery becomes lower than pressure in (right) ventricle ; *if mp1 **and** 2 have correct ideas but not referred to pressures on both 'sides' of the valve, allow one mark for idea of, increasing / high, pressure opening <u>each</u> of the valves* *help flow of blood through the heart* *any **two** from:* one-way flow of blood / prevents backflow of blood / directs blood in correct direction / blood flows in one direction / AW ; **A** blood flows from atrium to ventricle to, pulmonary artery / lungs blood flows from (area of) higher pressure to (area of) lower pressure ; *idea that* (blood) pressure changes aid coordination ; e.g. semilunar valve is open (about same time) when tricuspid valve is shut	3

Q4.

(c)	*any* ***four*** *from:* 1 *ref. to* compression on ventricles ; 2 (so) volume of the ventricles reduces / ventricles cannot fully increase in size / AW ; 3 less blood, filling / leaving, ventricles (each cardiac cycle) ; 4 *idea that* ventricular, contraction / systole, less powerful / weaker / less forceful ; 5 less blood pumped to the, pulmonary / systemic, circulation (per, contraction / cardiac cycle / unit time ; **A** lungs / rest of body *faster breathing rate to compensate for* 6 consequence in, lungs / rest of body ; e.g. less oxygen, diffuses / AW, into the blood less carbon dioxide, diffuses / AW, out of the blood less oxygen delivered to the tissues / AW 7 faster breathing rate to (try and) increase quantity of oxygen, absorbed / AW (in the lungs) ; **A** increase quantity of carbon dioxide excreted 8 AVP ; e.g. heart / cardiac muscle, does not receive enough, glucose / oxygen	**4**

Q5.

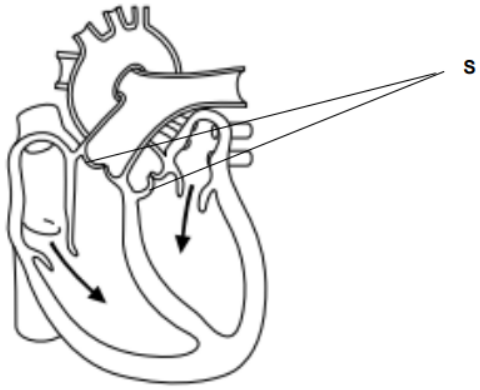
(d)	**I** *ref. to* metabolism *any* ***two*** *from:* need more, / large quantities of, oxygen / glucose **or** more / large quantities, of, oxygen / glucose, delivered / reaches tissues / transported / AW **or** *idea of* enough, oxygen / glucose supplied to meet needs ; *idea that* heart pumps blood (to tissues more) efficiently ; e.g. forcefully / in greater volumes / more / with higher pressure / faster *more oxygenated blood is mp2 only* suggestion of reason for needing more oxygen or glucose ; **I** migration e.g. more active fly / wing muscles search for food longer constantly moving / move for longer time generate heat to maintain body temperature, qualified ; e.g. (generally) smaller size / larger SA:V *ref. to* need to meet demands of carbon dioxide removal (from muscle action / respiration) ; *idea that more carbon dioxide produced (so must be removed)*	**2**

Q6.

(c)	label line pointing to, left atrioventricular / tricuspid, valve and labelled **R** ; **R** if pointing to one of the chordae tendinae label line pointing to, pulmonary artery and labelled **L** ; **A** pointing to left or right pulmonary artery	**2**

Q7.

(a)	atrial systole ; **A** atrial contraction *and* ***one*** *from:* volume of the atria is small(er) than in **A** ; **A** atria in stage **B** are smaller than those in stage **A** the atrioventricular / bicuspid and tricuspid, valves are open (and semilunar valves are closed) ; the blood is flowing (from the atria) into the ventricles ; *if name of stage is incorrect accept correct description of atrial systole, no ecf for incorrectly named stage*	**2**

(b)(i)	label line to any part of a semilunar valve ;  	**1**
(b)(ii)	prevent blood flowing backwards ; from the (named) arteries to the (named) ventricles ; **or** ensure blood flows in one direction ; from the (named) ventricles to the arteries ;	**2**

Q8.

(a)	sinoatrial node / SAN, sends out, wave of excitation / impulses / electrical impulses ; R nerve impulses wave of excitation / AW, spreads across atrial wall ;	**2**
(b)	*any two from* non-conducting fibres between atrial and ventricle walls ; impulse must pass down septum ; AVN (in interatrial septum) delays impulse ; (gives) time for atria to, complete contraction / empty ;	**2**

(c)(i)	one mark if **F** and **G** are semilunar and **E** and **H** are bicuspid ; one mark for **E** and **G** opens ; one mark for **F** and **H** closes ; ***E*** *bicuspid / (left) atrioventricular, valve,* *closes* ***F*** *semilunar / aortic, valve* *opens* ***G*** *semilunar / aortic, valve* *closes* ***H*** *bicuspid / (left) atrioventricular, valve* *opens*	**3**
(c)(ii)	(during contraction) left ventricle, generates / AW, higher pressure (than left atrium) ; **A** do not produce the same pressure when contracting *any one from* (because) wall of left ventricle thicker / more (cardiac) muscle, so reaches higher ; data from Fig. 2.1 to show difference in pressure ;	**2**

Q9.

(a)(ii)	chordae tendineae / tendinous cords ; **A** tendons / 'heart strings' *any **two** from:* *idea that* (atrioventricular) valve, held in position / prevented from inverting, during ventricular, systole / contraction ; **A** AV valve *for atrioventricular valve* connect the papillary muscle to the (atrioventricular / AV), valve ; *ref. to* tension, in the chordae tendineae / AW, (during ventricular contraction) ; (allows valve to) prevent backflow of blood into atrium / ensure one way blood flow (through the heart) ; *ecf max 2 marks for function if structure A is a correctly named valve (atrioventricular / tricuspid / bicuspid)*	**3**

Q10.

(c)(i)	*two from* emits, impulses / waves of depolarisation / waves of excitation / AW ; at regular intervals / AW ; e.g. acts as a pacemaker spreads across the, atria / atrial muscles / AW **or** stimulates / AW, atrial, contraction / systole ; **A** initiates, heart beat / contraction of the heart	**2**

(c)(ii)	*three from* faster heart rate / increased rate of contraction (of ventricles) ; no, slowing / delay of, impulse / wave of excitation / AW, by AVN ; more impulses reaching the ventricle per unit time ; ventricles may contract before they are full ; irregular heart rate ; AVP ; e.g. may have no effect if only a small proportion of impulses pass through suggestion that ventricles may not contract from apex up	**3**

Q11.

(b)(i)	pulmonary vein ; semi-lunar / AW, valve ; **A** pulmonary valve **R** aortic valve right, atrium / auricle ;	**3**

(b)(ii)	*any three from:* **1** left ventricle / chamber **Y**, pumps blood into, systemic circulation / described ***or*** right ventricle / chamber **X** pumps blood into, pulmonary circulation / described ***or*** distance travelled by blood in systemic circulation is greater than distance travelled by blood in pulmonary circulation / AW; **2** to overcome great(er) resistance to flow in systemic circulation ; **ora** **3** high (blood) pressure is required for blood to travel around the systemic circulation ; **4** high pressure requires more muscular force ; **ora** **5** pulmonary capillaries, rupture easily / damaged by high pressure ; **I** more cardiac muscle	**3**
(c)	*any four from:* **1** impulse / wave of excitation / AW, passes from SAN to atria (muscles) ; **R** nervous impulse / signal *once only* **2** atria both contract, together / at the same time ; **A** atrial systole *if not contradicted by one contracting before the other* **3** atria contract before ventricles ; **4** fibrous / non-conducting, tissue prevents impulse travelling to ventricles ; **5** impulse delayed at AVN ; **6** AVN passes impulse to, bundle of His / Purkyne fibres ; **7** Purkyne fibres conduct impulses to <u>muscle</u> in wall of ventricles ; **8** ventricles contract together (if mp2 not awarded) ; **A** ventricular systole if not contradicted as for atria **9** ventricles contract from the bottom upwards ;	**4**

Q12.

(b)	*two from:* blood pressure, decreases / returns to normal ; platelets no longer sticky / risk of thrombosis decreases / risk of blood clotting decreases ; endothelial repair (more likely to be) successful ; **A** endothelium no longer damaged **A** decreased risk of, atheroma / atherosclerosis **I** less fatty deposits heart rate, decreases / returns to normal ; **I** heartbeat decreases AVP ; e.g. increased peripheral circulation / AW blood vessels, not / less, constricted **A** less vasoconstriction **A** blood vessel (lumen) diameter increases / vasodilation occurs	**2**

Q13.

(d)(i)	*allow* *systole for contraction and diastole for relaxation* *bicuspid valve or mitral valve for (left) atrioventricular* *aortic valve for semi-lunar valves* *any four from (max 3 if whole response based on right side of heart)* *before atrial contraction / during relaxation of the left atrium and left ventricle* **1** atrioventricular valve, opens / is open **A** *following atrial contraction* **or** blood trickling into ventricle / some blood enters ventricle ; **2** atrial contraction, blood flow to ventricles / ventricles fill (with blood) **or** atrial contraction then ventricular contraction ; *ventricular contraction* **3** biscuspid valve closes and semi-lunar valve opens ; **R** *if occurs before ventricular contraction* **4** blood flows into aorta ; **R** if states 'from atrium' or 'then to lungs' **R** *if occurs before ventricular contraction* **5** *ref. to* atrium in relaxation during ventricular contraction ; *pressure changes* **6** contraction of, atrium / ventricle, increases pressure (of that chamber) **or** *ref. to* (blood) pressure differences to cause opening or closing of valves ; e.g. pressure in atrium greater than in ventricle so atrioventricular valve opens pressure in ventricle greater than aorta so semilunar valves open pressure in ventricle greater than atrium so bicuspid valve closes	**4**

(d)(ii)	**I** *ref. to* fibrillation / cardiac cycle rhythm *any three from* **1** more powerful contraction of (cardiac) muscle / increased ability for (cardiac) muscle (**A** cardiac cells) to contract ; **A** stronger contraction / contract strongly / increased contractility **I** contracts more / increased contraction **2** blood (pumped) at higher pressure ; **I** blood at high pressure **3** more force to overcome resistance (in blood vessels) ; **4** more blood reaches lungs to obtain oxygen (per unit time) / more oxygen reaches (rest of) body / tissues (per unit time) (in blood) ; *allow idea of efficient delivery of oxygen* **A** more oxygenated blood can be delivered to heart, muscle / tissue AW **5** less fatigue / increased energy / increased mobility / AW ;	**3**