



ANSWER BOOK

The heart and the cardiac cycle: pressure decides everything

Animal transport and cardiovascular biology · Unit B09

AQA 3.3.4.2 · OCR A 3.1.2 (h)–(k) · Edexcel A Topic 1.1–1.6 · CAIE 8.3

6 questions · 20 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **B1** a difference in pressure across the valve, with blood pushing harder on one face than on the other. [1]
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SECTION B · Standard, 3 to 5 marks

- B1** **B1** ventricular pressure rises above atrial pressure, so the atrioventricular valves are pushed shut, which is the first heart sound. **B1** for a short period both sets of valves are shut, so ventricular pressure climbs with no blood moving and no change in volume. **B1** ventricular pressure rises above aortic pressure, so the semilunar valves are forced open and blood is ejected. **B1** as the ventricles relax their pressure falls below aortic pressure, so blood in the aorta pushes the semilunar valves shut, which is the second heart sound. **A1** ventricular pressure keeps falling until it is below atrial pressure, at which point the atrioventricular valves open and the ventricles begin to fill again. [5]
- B2** **M1** heart rate = $60 \div 0.80$, converting the time for one cycle into beats per minute. **A1** 75 beats per minute. **M1** cardiac output = stroke volume $\times$ heart rate = $70 \times 75 = 5250 \text{ cm}^3 \text{ min}^{-1}$. **A1** $5.25 \text{ dm}^3 \text{ min}^{-1}$ after dividing by 1000, with the unit given. [4]
- B3** **B1** cardiac muscle is myogenic, so the beat originates within the muscle itself and needs no nerve impulse to start it. **B1** the sinoatrial node in the wall of the right atrium depolarises spontaneously about 75 times a minute and acts as the pacemaker, while nerves and hormones only alter the rate. **B1** a band of connective tissue between atria and ventricles will not conduct, so the atrioventricular node is the only route through and it holds the impulse for about 0.13 s. **A1** that pause lets the atria finish emptying before the ventricles contract, so the ventricles are properly filled; without it both would contract together and the ventricles would fill badly. [4]
- B4** **B1** blood passes through the heart once per circuit in a fish but twice per circuit in a mammal. **B1** in a fish blood travels straight from the gill capillaries to the body and so reaches it at low pressure, whereas in a mammal it returns to the heart and is re-pressurised by the left ventricle. **A1** delivery is therefore faster in the mammal, which supports a higher metabolic rate, while its gas exchange surface sees only about a fifth of the systemic pressure rather than the full output of the heart. [3]
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B5 **B1** the septum normally keeps oxygenated and deoxygenated blood apart, [3]
and a hole lets the two mix. **B1** the left ventricle generates about 120 mmHg against the
right ventricle's 24 mmHg, so blood is pushed from left to right and oxygenated blood is
sent back to the lungs instead of to the body. **A1** blood leaving for the body therefore
carries less oxygen per unit volume, so less is delivered to respiring tissue and the heart
has to work harder to compensate.
