Model Answers: Hard

1

The correct answer is **A** because:

- As the stroke volume (**SV**) increases so does the ventricular end-diastolic volume (**VEDV**)
- The **VEDV** is the amount of blood that the veins return to the heart before systole
- The stroke volume can be calculated from the **VEDV**:
- Stroke volume = end-diastolic volume – end-systolic volume
- This is **not a directly proportional relationship** (in such a relationship the two variables change at the same rate) as some blood will remain in the heart after systole

B is incorrect as this graph describes a directly proportional relationship.

C is incorrect as this graph describes a decrease in stroke volume as ventricular-end-diastolic volume increases.

D is incorrect as this graph describes that increasing VEDV has no effect on stroke volume.

2

The correct answer is **B** because there are two regions of the graph where the AV valves and semilunar valves are both closed:

- At point **1** on the graph, the semilunar valves **open**
- At point **2** on the graph, the semilunar valves **close**
- At point **3** on the graph, the atrioventricular valves **close**
- At point **4** on the graph, the atrioventricular valves **open**
- The time that both valves are closed between **1** and **3** is:
    - Time at point 1 = 0.16 s
    - Time at point 3 = 0.12 s
    - **Time closed = 0.04 s**

- The time that both valves are closed at the same time between 2 and 4 from the graph is:
    - Time at point 4 = 0.40 s
    - Time at point 2 = 0.36 s
    - **Time closed = 0.04 s**

- **Total time both valves are closed = 0.04 + 0.04 = 0.08 s**

3

The correct answer is **D** because:

- At point **Q** on the graph, the atrioventricular valves close
- At point **R** on the graph, the semilunar valves open
- At point **S** on the graph, the semilunar valves close
- At point **T** on the graph, the atrioventricular valves open

4

The correct answer is **B** because:

- **B** is the bicuspid valve that is between the left atrium and the left ventricle, the left-hand side of the heart transports oxygenated blood
- The **bicuspid** valve is identifiable by **the** two valve flaps

A is incorrect as this is the tricuspid valve in the right-hand side of the heart, the right-hand side of the heart transports deoxygenated blood

C & **D** are incorrect as these are both semilunar valves and will only open when blood is leaving a ventricle

Exam Tip: If you are not sure about the bicuspid and tricuspid valve position you could use the thickness of the ventricle wall to identify the left side of the heart. Remember the left side has a thicker ventricle wall than the right. The left-hand side of the heart carries oxygenated blood

5

The correct answer is **D** because:

- Fibrillation is an example of an **arrhythmia** which means abnormal rhythm of the heartbeat
- This is characterised in an ECG by an irregular beating pattern beating very fast (up to 400 times a minute)
- Only some of the impulses are passed onto the ventricles which contract less often meaning the heart does not pump very efficiently

A is incorrect as **bradycardia** is when the heart rate slows down to less than 60 bpm. This would be seen on an ECG as large gaps between the heartbeats

B is incorrect as **ectopic heartbeats** are extra heartbeats outside the normal. These would be seen on an ECG as an extra peak almost immediately after the first

C is incorrect as **tachycardia** is a very rapid heartbeat often over 100 bpm. This would be seen on an ECG as rapid beats closer together than normal

6

The correct answer is **C** because:

- The nerve impulse from the atrioventricular node travels to the Purkyne tissue through the bundle of His
- The nerve impulses from the Purkyne tissue travel to the ventricles
- The nerve impulses from the sinoatrial node (SAN) in the right atrium travel to the atrioventricular node

7
The correct answer is **B** because:

- The first structure in the heart that the red blood cell (RBC) will pass by is the **sinoatrial node**, this is located in the wall of the right atrium
- The second structure the RBC will pass through is the **right atrium**
- From the **right atrium**, the RBC will go through the tricuspid valve. The tricuspid valve is located in the right side of the heart between the right atrium and right ventricle (it is an atrioventricular valve)
- After the tricuspid valve, the blood enters the right ventricle
- It will then pass through the semilunar valve into the pulmonary artery

8
The correct answer is **B** because:

- Atrial contraction is controlled by the **sinoatrial node** (SAN) in the wall of the right atrium; the SAN sends out a wave of excitation which spreads across the atria
- A band of nonconductive collagen tissue prevents the wave from being passed from the atria to the ventricles
- The waves are transferred to the **atrioventricular node** (AVN) and passthrough the bundle of His in the septum
- The bundle of His then conducts the wave of excitation to the **Purkyne tissue** in the ventricles
- If the impulse was not reaching the ventricles, but still reaching the atria, then the two faulty areas of the heart would be the **atrioventricular node** and the Purkyne tissue

9
The correct answer is **B** because:

- Vessel **1** will be the vena cava bringing deoxygenated blood from the body to the right atrium
- Vessel **2** will be the aorta taking oxygenated blood from the heart to the body
- Vessel **3** will be the pulmonary artery taking deoxygenated blood from the heart to the lungs
- Vessel **4** will be the pulmonary vein bringing oxygenated blood back to the heart

- The correct option would be **B** as vessels **4** and **1** bring blood to the heart and **2** and **3** take blood away from the heart

10

The correct answer is **D** because:

- At point **1** on the graph, the semilunar valves open
- At point **2** on the graph, the semilunar valves close
- At point **3** on the graph, the atrioventricular valves close
- At point **4** on the graph, the atrioventricular valves open
- This makes option **D** the correct row in the table