Model Answers: Medium

1

The correct answer is **D** because:

- The semilunar valves are at the base of the arteries leaving the heart (the aorta and the pulmonary artery)
- These valves will close after ventricular contraction to prevent backflow of blood from the artery into the ventricle
- The point that this is shown on the graph is point **D**

A is incorrect as at this point in the graph, the semilunar valves are opening at the start of ventricular systole.

B is incorrect as at this point in the graph, the atria have finished atrial systole and the atrioventricular valves are shut to prevent backflow into the atria.

C is incorrect as this point in the graph shows the atrioventricular valves opening for passive filling during diastole.

2

The correct answer is **B** because:

- The part of the heart labelled **3** on the diagram is the **right atrium**; deoxygenated blood comes into the right atrium via the vena cava
- The part of the heart labelled **4** on the diagram is the pulmonary artery; this artery carries deoxygenated blood from the right ventricle to the lungs to be oxygenated
- The part labelled **2** in the diagram is the left atrium; this receives blood from the **pulmonary vein** from the lungs
- The part labelled **1** in the diagram is the aorta this is the vessel leaving the left ventricle and transporting oxygenated blood to the body tissues

Exam Tips:

- Remember that **arteries** always go **away** from the heart '**A** – **a**way'
- You may think that option C is correct, and technically blood does through the heart in this sequence in one complete circulation of the body
- We discuss the flow of blood through the heart starting from when deoxygenated blood enters the heart from the vena cava into the right atrium

3

The correct answer is **A** because:

- The section labelled **A** on the graph describes the end of **atrial systole**

- Atrial systole is the **contraction** of the **atria** caused by the excitation from the sinoatrial node (SAN) in the right atrium
- At the end of atrial systole, blood is pushed into the ventricles so that they become full of blood

B is incorrect as this section of the graph describes ventricular systole where the pressure in the ventricles is increasing – blood is being pushed into the arteries.

C is incorrect as this part of the graph describes the middle and end of ventricular systole – when pressure in the ventricles is dropping as blood enters the pulmonary artery and aorta.

D is incorrect as this part of the graph describes diastole; both the atria and the ventricles are relaxing at this point.

4

The correct answer is **C** because:

- The **P wave** represents depolarisation of the atria in response to signaling from the sinoatrial node (i.e. **atrial contraction**)
- The **T wave** represents repolarisation of the ventricles (i.e. **ventricular relaxation**) and the completion of a standard heartbeat

The **QRS complex** represents depolarisation of the ventricles (i.e. ventricular contraction), triggered by signals from the AV node

5

The correct answer is **A** because:

- The **aortic semilunar valve** is at the base of the aorta where it joins the left ventricle; its role is to prevent the backflow of blood
- If this valve narrows, then not as much blood will be able to pass through to the aorta
- This will mean for the same cardiac flow the left **ventricle** will need to **pump more**, this will lead to a thickening of the wall over time
- The thicker the wall, the larger the heart - but the smaller the left ventricle - becomes
- The heart cannot relax fully during diastole and this can lead to heart failure

B is incorrect as the left ventricle will increase in size, not decrease. When the heart has less heart muscle and is generally weaker, this is known as **cardiomyopathy.**

C is incorrect as the blood will not be leaking out of the left ventricle, this condition could be caused by a hole in the **septum.**

D is incorrect as the bicuspid valve is there to prevent the backflow of blood. The condition that causes this is **bicuspid or mitral valve prolapse.**

6
The correct answer is **B** because:

- There are two complete heartbeats in **1.5 seconds**
- **60 seconds** in 1 minute so:
- **60/1.5 x 2** = **80** beats per minute

Exam tip: You could be asked in an exam to calculate **cardiac output**. This is the **volume of blood** pumped from the heart in one minute (measured in cm3 min-1). The formula to calculate this
is **cardiac output** = **heart rate** x **stroke volume.**

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

- The question states that fish oils are thought to improve the electrical excitation of the ventricles
- The part of the heart that carries electrical excitation to the ventricles is the Purkyne tissue (in the inner wall of the ventricles)

A is incorrect as he vagus nerve is one of the cranial nerves that connects the brain to the body. The heart is one of the connections of the vagus nerve.

B is incorrect as the sinoatrial node (SAN) is the pacemaker of the heart, situated in the wall of the right atrium. The SAN initiates and controls the heart rhythm for all other cardiac muscle cells in the heart.

C is incorrect as the atrioventricular node (AVN) is situated at the junction between the atria and ventricles. It causes a slight delay in the transmission of the wave of excitation before stimulating the bundle of His.

8
The correct answer is **A** 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 passed through the bundle of His in the septum
- The bundle of His then conduct the wave of excitation to the **Purkyne tissue** in the ventricles

9

The correct answer is **D** because:

- The **hole** in the **septum** shown in the diagram would allow the mixing of blood from the **left** atrium and the **right** atrium
- The left atrium would contain oxygenated blood
- The right atrium would contain deoxygenated blood
- The mixing of the blood would reduce the overall oxygen saturation of haemoglobin as deoxygenated blood would be pumped around the body and not just to the lungs

A is incorrect as irregular heartbeats are generally caused by problems with the SAN and AVN.

B is incorrect as a delay in ventricular systole would be caused by issues with the conductivity of the atrioventricular node, the bundle of His or the **Purkyne tissue.**

C is incorrect as the pulmonary artery takes blood from the right ventricle to the lungs. A hole in the septum in the atria would not cause an increase in pressure in this vessel.

10

The correct answer is **C** because:

- Cardiac output is the **volume of blood** pumped in one minute
- If the aortic pressure decreased the cardiac output would increase to increase the pressure
- There would be no change to the pressure in the vena cava as this is the pressure in the vessels after the blood has passed through the body
- An **increase** in **carbon dioxide** levels (eg. during exercise) would increase the volume of blood pumped by the heart to increase **oxygenation** of the tissues and remove excess carbon dioxide as quickly as possible.
- The Vagus nerve controls the heartbeat through excitation of the sinoatrial node (SAN). Specifically, it acts to lower the heart rate. This will remain unchanged when the cardiac output is increased