1.2 The Cardiovascular System
1.3 The Respiratory System

Mark Scheme

1.Which one of the following describes residual volume? **(1 mark)**

A) The volume of air that can be forcibly expired following a normal breath
B) The volume of air that can be forcibly inspired following a normal breath
C) The volume of air that remains in the lungs after maximum expiration
D) The volume of air breathed in or out per breath

Mark One - C

2. Which of the following shows the correct order that is followed by the conduction system of the heart? **(1 mark)**

A) Purkinje Fibres, Bundle of HIS, SA Node, AV Node
B) AV Node, SA Node, Bundle of HIS, Purkinje Fibres
C) AV Node, SA Node, Purkinje Fibres, Bundle of HIS
D) SA Node, AV Node, Bundle of HIS, Purkinje Fibres

Mark One - D

3. **Starling's Law** outlines that during exercise there will be an increase in stroke volume? Explain the factors leading to this increase in stroke volume? **(3 marks)**

Mark One – An increase in venous return

Mark Two – Results in increased diastolic filling of the heart

Mark Three – Cardiac Muscle/Wall is stretched

Other Possible Marks – Therefore there is a more powerful contraction/increased ejection fraction

4. If a performer exercises in warm conditions, cardiovascular drift can occur. Explain the process that leads to cardiovascular drift? **(4 marks)**

Mark One – Occurs during steady state exercise/exercising for longer than 10 minutes

Mark Two – Due to a decrease in fluid in the plasma/blood viscosity

Mark Three – Which leads to a decrease in venous return

Mark Four – Therefore there is a decrease in stroke volume and heart rate must rise to ensure cardiac output remains the same

Accept Other Appropriate Answers

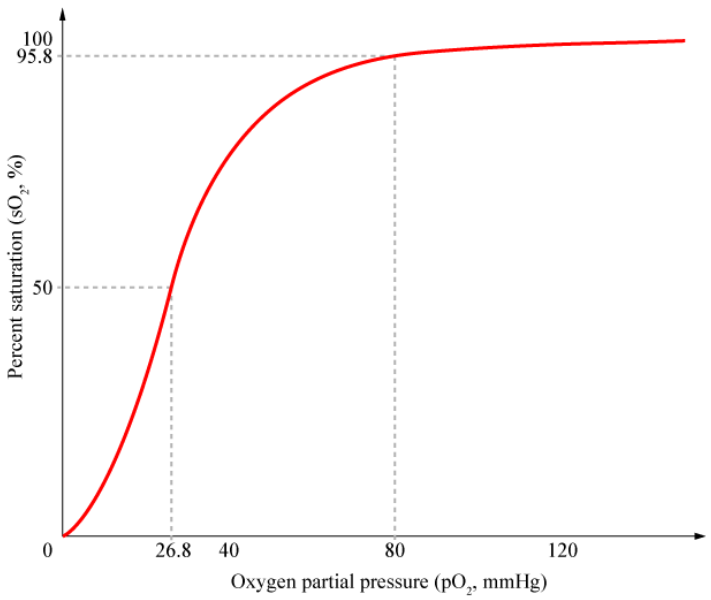
Location	**Partial Pressure of Oxygen (P02)**	**Partial Pressure of Carbon Dioxide (PC02)**
Alveoli	100 mm Hg	40 mm Hg
Blood Capillary	40 mm Hg	46 mm hg

5. The table above shows the partial pressure of oxygen at the site of the lungs. Using the data from the table, explain how diffusion occurs at the site of the lungs**. (3 marks)**

Mark One – The alveoli have a high concentration of oxygen and a low concentration of carbon dioxide

Mark Two – The blood capillary has a higher partial pressure of carbon dioxide compared with oxygen

Mark Three – Therefore there is a concentration gradient whereby the oxygen will diffuse from the alveoli to the blood capillary/blood stream and the carbon dioxide will diffuse from the blood capillary to the alveoli



6. The graph outlined above shows the dissociation curve. Explain what the dissociation curve is and discuss the changes that occur to this curve during exercise. **(8 marks)**

A01 – 2 A02 – 3 A03 – 3

A01 – Knowledge of the dissociation curve e.g.

- The dissociation curve shows how much oxygen separates from haemoglobin
- The dissociation curve shows the difference in partial pressure at the site of the muscles and the lungs

A02 – Explanation of the changes to the dissociation curve during exercise e.g.

- The Bohr shift will occur whereby the curve shifts to the right
- This shows a lower level of saturation of oxygen in the blood at the site of the muscle tissue. This is because more oxygen has diffused into the muscle tissue to cope with the demands of exercise.
- The amount of oxygen saturated with haemoglobin at the site of the lungs will stay roughly the same

A03 – Evaluation of why the changes to the dissociation curve occur during exercise e.g.

- The changes occur due to an increase in blood temperature
- The changes occur due to an increase in the partial pressure of C02 in the muscle tissue. This leads to a greater concentration gradient which will lead to more oxygen separating from haemoglobin in order to get rid of the oxygen debt/supply the required energy
- The changes occur due to a decrease in the PH of the blood/increase in blood acidity.

Accept other appropriate answers

7. An elite swimmer begins a 400m race. Explain the different receptor systems present in the swimmer's body and evaluate how they can have an effect on performance in **swimming**. **(15 marks)**

A01 – 4 A02 – 5 A03 – 6

A01 – Knowledge of the receptor systems e.g.

- The chemoreceptors detect a change in blood acidity/lactic acid/C02
- The baroreceptors detect a change in blood pressure
- The proprioceptors detect a change in muscle movement

A02 – Explanation of the how the receptor systems work during exercise e.g.

- During exercise the chemoreceptors pick up on an increase in C02. A signal is sent to the medulla oblongata which activates the sympathetic nervous system. An impulse is sent to the SA Node of the heart to speed up contractions
- The baroreceptors will detect an increase in blood pressure during exercise. However, an impulse **will not** be sent to the brain because during exercise the baroreceptors set point changes to allow for an increase in in systolic blood pressure
- The proprioceptors detect an increase in muscle movement during exercise. A signal is sent to the medulla oblongata which activates the sympathetic nervous system. An impulse is sent to the SA Node of the heart to speed up contractions

A03 – Analysis and evaluation of how the receptor systems effect performance in **swimming** e.g.

- The chemoreceptors pick up on an increase in C02 in areas such as the quadriceps, hamstrings, biceps and triceps during swimming. Therefore the medulla oblongata will signal for vascular shunting to occur whereby vasodilation occurs to the working muscles, allowing more oxygen to get to these areas. Vasoconstriction will occur to areas such as the digestive system and liver, which do not require oxygen during the race.
- By changing its set point, the baroreceptors allow systolic blood pressure to increase during exercise, which enables more powerful contractions to take place, therefore increasing the amount of oxygen getting to the muscle tissue
- The proprioceptors in muscles such as the quadriceps and hamstrings will pick up on movement at the start of the race. This will enable more oxygen to be delivered to these areas and as a result the swimmer will be able to work at a higher intensity for longer, without becoming fatigued.

Accept other appropriate answers