**Pulmonary Function Questions**

**Mechanics of Breathing**

* Explain the mechanics of breathing which allow a performer to fill the lungs

with air during exercise. *(3 marks)*

**Spirometer Traces/ Lung Volumes**

* Complete **Table 3** below to show how the tidal volume, inspiratory reserve volume **and** expiratory reserve volume change during exercise.

*(3 marks)*

**Figure 1** shows the spirometer reading of an athlete. (Blank spirometer trace)

* Which ‘lung volume’ is represented by the letter **B**. *(1 mark)*

**Role of CO2/Diffusion**

* Explain how the gas exchange system operates at muscles. *(4 marks)*

*As a runner exercises, chemoreceptors will detect any increase in carbon dioxide levels.*

* Explain how this causes an increase in the runners breathing rate (3 marks)

*During a game of tennis, a player’s breathing rate may vary.*

* Explain how increases in levels of carbon dioxide **and** acidity in the blood cause breathing rate to rise. (3 marks)

*Breathing rate increases to get more oxygen into the blood. Gaseous exchange involves oxygen diffusing across membranes.*

* Identify the membranes involved in this diffusion **and** identify **one** characteristic of these membranes that allows diffusion to happen. (2 marks)
* Use the information in **Figure 2 (picture of alveoli and blood capillary)** to explain how oxygen and carbon dioxide move between the two locations. *(3 marks)*

*The alveoli provide the lungs with a large surface area for diffusion.*

* Name **two** other structural features of the lungs that assist diffusion.

*(2 marks)*

* How is ‘breathing rate’ controlled to meet the demands of changing levels of

exercise? *(4 marks)*

**Pulmonary Function Answers**

**Mechanics of Breathing**

**Explain the mechanics of breathing which allow a performer to fill the lungs**

**with air during exercise. *(3 marks)***

A. Diaphragm/intercostal muscles contract/ flattens;

B. Lungs/ribs also pulled upwards and outwards;

C. Lungs attached to pleural membranes;

D. Volume/size of chest/thoracic cavity/lungs increases;

E. Reducing pressure within lungs;

F. Air sucked in;

G. During exercise other muscles – strernocleidomastoid / scalenes and pectoralis minor increase action;

**Spirometer Traces/ Lung Volumes**

**Complete Table 3 below to show how the tidal volume, inspiratory reserve volume and expiratory reserve volume change during exercise.**

***(3 marks)***

*A. Tidal volume – increases*

*B. Inspiratory reserve volume – decreases*

*C. Expiratory reserve volume – decreases*

**Figure 1 shows the spirometer reading of an athlete. (Blank spirometer trace)**

**Which ‘lung volume’ is represented by the letter B. *(1 mark)***

B = Inspiratory reserve (volume)

**Role of CO2**

**Explain how the gas exchange system operates at muscles. *(4 marks)***

*A. Process of diffusion – high concentration/partial pressure to low/down a diffusion gradient*

*B. Requires thin/permeable membranes/short distance*

*C. High pO2 in blood/low pO2 in muscles and oxygen moves into muscles*

*D. Low pCO2 in blood/high pCO2 in muscles and carbon dioxide moves into blood*

*E. Oxygen into myoglobin/ (disassociates) from haemoglobin*

*F. Carbon dioxide dissolves in plasma/ combines with haemoglobin/forms bicarbonate ion*

**As a runner exercises, chemoreceptors will detect any increase in carbon dioxide levels.**

**Explain how this causes an increase in the runners breathing rate (3 marks)**

* Nerve impulses to Respiratory control centre/medulla
* Sympathetic nerve/ impulse to breathing muscles
* Diaphragm/ intercostal muscles
* Deeper breathing/ increase Tidal Volume
* Use of Sternocleidomastoid/scalenes/pectorals muscles

**During a game of tennis, a player’s breathing rate may vary. Explain how increases in levels of carbon dioxide and acidity in the blood cause breathing rate to rise. (3 marks)**

A. Detected by chemoreceptors (in carotid arteries/aortic arch/medulla)

B. Nerve impulses/message to respiratory control centre in/medulla of brain

C. Nervous output to breathing muscles/via Phrenic/ sympathetic nerve

D. Increased rate of contraction of diaphragm and intercostal muscles

**Breathing rate increases to get more oxygen into the blood. Gaseous exchange involves oxygen diffusing across membranes.**

**Identify the membranes involved in this diffusion and identify one characteristic of these membranes that allows diffusion to happen. (2 marks)**

A. Alveolar/muscle and capillary membranes identified

B. Requires thin membranes/one cell thick

C. Requires short distance between membranes/moist/(semi) permeable/ short diffusion pathway

**Use the information in Figure 2 (picture of alveoli and blood capillary) to explain how oxygen and carbon dioxide move between the two locations. *(3 marks)***

*A. Process of diffusion – high to low concentrations/down a concentration gradient/partial pressures/pO2;*

*B. Oxygen partial pressure/pO2 higher in alveoli (104)/lower in capillary (40)*

*OR Carbon dioxide partial pressure/pCO2 lower in alveoli (40)/higher in capillary (46);*

*C. Gases move – oxygen from alveoli to capillary and carbon dioxide from capillary to alveoli.*

**The alveoli provide the lungs with a large surface area for diffusion.**

**Name two other structural features of the lungs that assist diffusion.**

***(2 marks)***

*A. Large blood supply;*

*B. Thin/semi-permeable membrane for diffusion/one cell thick/walls are thin;*

*C. Short distance for diffusion;*

D. *Layer of moisture;*

E. *Slower blood flow/transit time.*

**How is ‘breathing rate’ controlled to meet the demands of changing levels of**

**exercise? *(4 marks)***

A. (Exercise/movement) - more carbon dioxide

B. Increased acidity/decrease in pH/increase hydrogen ions (in blood)

C. Detected by chemoreceptors

D. (Nerve impulses to) respiratory centre/medulla (of brain)

E. Phrenic nerve

F. Diaphragm/intercostals