**Topic D.6: Transport of Respiratory Gases**

**Essential Idea: Red blood cells are vital in the transport of respiratory gases.**

**Statements & Objectives:**

**D.6.U1 Oxygen dissociation curves show the affinity of hemoglobin for oxygen.**

Define partial pressure.

**(Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

State the relative partial pressures of oxygen in the atmosphere at sea level, in the alveoli, in alveoli blood capillaries, and in respiring tissue.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Define affinity.

**(Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

Describe the saturation of hemoglobin at different oxygen partial pressures.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

Draw the oxygen dissociation curve to show affinity of hemoglobin for oxygen at different partial pressures of oxygen

**D.6.U2 Carbon dioxide is carried in solution and bound to hemoglobin in the blood.**

State the three ways carbon dioxide is carried in the blood.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

State which form of carbon dioxide transport accounts for the highest amount of carbon dioxide transported.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

 **D.6.U3 Carbon dioxide is transformed in red blood cells into hydrogen carbonate ions.**

Outline the reaction that transforms carbon dioxide into hydrogencarbonate ion, including the role of carbonic anhydrase.

(**Outline** Give a brief account or summary.)

**D.6.U4 The Bohr shift explains the increased release of oxygen by hemoglobin in respiring tissues.**

Explain the mechanism and benefit of the Bohr shift.

(**Explain**: Give a detailed account including reasons or causes)

**D.6.U5 Chemoreceptors are sensitive to changes in blood pH.**

Outline the location and role of chemoreceptors that help regulate the ventilation rate.

(**Outline** Give a brief account or summary.)

**D.6.U6 The rate of ventilation is controlled by the respiratory control centre in the medulla oblongata.**

List the neural structures that control the rate of ventilation.

(**List** Give a sequence of brief answers with no explanation.)

Outline the feedback loop that regulates the rate of ventilation, including the role of stretch receptors.

(**Outline** Give a brief account or summary.)

**D.6.U7 During exercise the rate of ventilation changes in response to the amount of CO2 in the blood.**

​Describe the relationship between carbon dioxide concentration and blood pH.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

State the effect of exercise on CO2 production.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Outline the relationship between CO2 production and blood pH.

(**Outline** Give a brief account or summary.)

Explain how and why hyperventilation occurs in response to exercise.

(**Explain**: Give a detailed account including reasons or causes)

**D.6.U8 Fetal hemoglobin is different from adult hemoglobin allowing the transfer of oxygen in the placenta onto the fetal hemoglobin.**

Compare the oxygen dissociation curves of adult and fetal hemoglobin.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

State the reason why it is adaptive for fetal hemoglobin to have a higher oxygen affinity than adult hemoglobin.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

**D.6.A1 Consequences of high altitude for gas exchange.**

State the effect of altitude on the atmospheric partial pressure of oxygen.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Outline human physiological responses to high altitude.

(**Outline** Give a brief account or summary.)

**D.6.A2 pH of blood is regulated to stay within the narrow range of 7.35 to 7.45.**

State the range of normal human blood pH.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Describe the relationship between carbon dioxide concentration and blood pH.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

Outline physiological responses that maintain blood pH.

(**Outline** Give a brief account or summary.)

**D.6.A3 Causes and treatments of emphysema.**

Outline the causes of emphysema.

(**Outline** Give a brief account or summary.)

State the symptoms of emphysema.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Outline reasons why gas exchange and ventilation are less effective in people with emphysema.

(**Outline** Give a brief account or summary.)

List treatment options for people with emphysema.

(**List** Give a sequence of brief answers with no explanation.)

**D.6.S1 Analysis of dissociation curves for hemoglobin and myoglobin.**

Contrast myoglobin and hemoglobin.

(**Contrast** Give an account of the differences between two (or more) items or situations, referring to

both (all) of them throughout.)

Compare the oxygen dissociation curves of hemoglobin and myoglobin.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

**D.6.S2 Identification of pneumocytes, capillary endothelium cells and blood cells in light micrographs and electron micrographs of lung tissue.**

Label the following structures on a micrograph of lung tissue: type 1 pneumocyte, type 2 pneumocyte, capillary endothelium, basement membrane and blood cells.

**(Label** Add title, labels or brief explanation(s) to a diagram or graph.)

**D.6.NOS Scientists have a role in informing the public—scientific research has led to a change in public perception of smoking.**

Describe how scientific evidence about the effects of smoking lead to a change in public perception of smoking.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**Key Terms**

Hemoglobin

​Affinity

​chemoreceptors

​blood pH

​myoglobin

basement membrane

​plasma

​gas exchange

respiratory gas

​oxygen

ventilation rate

​hyperventilation

type 1 pneumocyte

blood cells

​intercostal nerves

​endothelium cells

partial pressure

​carbon dioxide

carbonic anhydrase

​fetal hemoglobin

​type 2 pneumocyte

​diaphragm

inspiration

oxygen dissociation

hydrogen carbonate

medulla oblongata

​hypoxia

​endothelium

​smoking

alveoli

​Bohr shift

​stretch receptors

​emphysema

​capillary

​dissolved CO2

expiration