Name _____ **Period** _____

Chapter 22: Gas Exchange

Guided Reading Activities

Big idea: Mechanisms of gas exchange

Answer the following questions as you read modules 22.1–22.5:

1. Gas exchange involves three stages. List and briefly describe the three stages.
   Breathing—inhalation of oxygen and exhalation of carbon dioxide.
   Transport of gases—oxygen and carbon dioxide must be transported to and from the tissues of the body.
   Gas exchange with tissues of the body—oxygen and carbon dioxide must be exchanged at the cellular level.
2. Which of the following statements regarding gas exchange is correct?

   a. Contracting muscle tissue do not need increased amounts of O_2.

   b. Blood that is leaving metabolically active tissues is high in O_2.

   c. Blood that is leaving the lungs is high in O_2 and low in CO_2.

   d. Blood returning to the heart from body tissues is low in CO_2.

3. A person has a mutation in a gene that leads to a decrease in the efficiency at which O_2 is picked up by the blood. Would this person have difficulty doing certain activities? If so, which ones? Briefly explain your answer.
   This person would have difficulty doing even mild exercise or strenuous activities because his or her ability to carry oxygen would be hindered.
4. The part of an animal's body where gas exchange occurs is known as the respiratory surface.

5. True or false: Gas exchange occurs via osmosis. If false, make it a correct statement.
   False, gas exchange occurs via diffusion.

6. Complete the following table, which compares the different respiratory organs for gas exchange with the environment.

	Skin	Gills	Tracheal	Lungs
Description	These organisms obtain oxygen through diffusion across their skin into blood vessels.	Extensions of the body surface specialized for gas exchange	An extensive system of internal tubes with a thin epithelium at the tips; exchanges gases directly with the cells	Internal sacs lined with a moist epithelium; requires a circulatory system to transport gases to and from tissues
Example of an organism	Earthworms	Fish	Insects	Humans

7. The transfer of oxygen between two fluids that are moving in opposite directions is referred to as countercurrent exchange.

8. True or false: The countercurrent creates an oxygen gradient only at the point where the capillaries merge into larger blood vessels. If false, make it a correct statement.
False, countercurrent flow creates an oxygen gradient along the entire capillary.

9. List the two advantages that terrestrial organisms have over aquatic organisms when it comes to respiration.
Air has a higher concentration of oxygen, and air is much lighter than water.

10. In the tracheal system, the circulatory system is bypassed by small branches, called tracheoles, that contact most of the insect's cells.

11. What is the correlation between metabolic activity and the surface area of the gas exchange surface in an organism?
The higher the metabolic activity, the greater the surface area of the gas exchange surface.

Big idea: The human respiratory system

Answer the following questions as you read modules 22.6–22.9:

1. The diaphragm is a muscular partition that separates the thoracic cavity from the abdominal cavity.

2. Match the following terms with their proper description: bronchi, surfactants, bronchioles, pharynx, alveoli, vocal chords.

   Structures that air passes across to produce sound: vocal chords

   The passageway for both air and food: pharynx

   Site of gas exchange within the lungs: alveoli

   Inflammation in these tubes is called bronchitis: bronchioles

   Air passes into these from the trachea: bronchi

   Substances that keep the alveoli from collapsing and sticking shut: surfactants

3. A person has a mutation that causes his cilia to form or function incorrectly. What would this person have difficulty doing?
   This person would have difficulty sweeping mucus out of his or her lungs.

4. What event was a huge step toward warning the public about the dangers of cigarette smoking?
   The Surgeon General's recommendation that cigarettes have warnings

5. When people think of breathing, they typically tend to think of inhalation. Briefly explain why this is inaccurate.
   Breathing includes both inhalation and exhalation.

6. The maximum amount of air you breathe in and out is known as your vital capacity.

7. Briefly explain how the volume in your thoracic cavity changes during inhalation and exhalation. Be sure your answer includes how those changes in volume lead to air moving in and out.
   During inhalation, the volume of air increases, which causes the pressure to drop and air to rush in from outside. During exhalation, the volume of air decreases, which causes the pressure to increase and air rush to out.

8. A common misconception is that your body regulates breathing in response to the levels of O_2. What actually regulates respiration rate?
   The rate of respiration is regulated by the levels of CO_2.

9. *Curare* is a generic term for a toxin prepared from numerous plant species native to South America. Curare interferes with the brain's communication with skeletal muscle cells. In effect, curare stops skeletal muscles from contracting. Would this drug affect human breathing? If so, what would its effect be?
   Yes, because breathing is aided by contraction of skeletal muscles. It would have a negative effect on breathing.

Big idea: Fermentation: transport of gases in the human body

Answer the following questions as you read modules 22.10–22.12:

1. True or false: Oxygen-depleted blood traveling from your leg muscles travels directly to the lungs to get oxygenated without going through the heart. If false, make it a correct statement.
   False, the blood from your leg muscles would first travel to your heart and then to your lungs.

2. Which of the following describes the partial pressure of gases in the vessels leading from the heart to the lungs?

   a. The partial pressure of O_2 is highest compared to other vessels in the body.

   b. The partial pressure of CO_2 is lowest compared to other vessels in the body.

   c. The partial pressures of O_2 and CO_2 equal each other.

   d. None of the above are true statements.

3. The total pressure of a mixture of gas is a combination of all the pressures of the different gases in the mixture. In other words, each gas in the mixture has a(n) partial pressure.

4. A teacher is grading short-answer questions from an anatomy and physiology quiz. The short-answer question she is grading asked the students to describe the role of hemoglobin in humans. A student answers as follows: "Hemoglobin carries oxygen throughout the body to cells that require it." If the teacher is correcting incorrect answers by giving written feedback, what would she write to this student?
   Hemoglobin also carries CO_2 away from tissues and helps to buffer pH in the blood.

5. True or false: The placenta contains both fetal and maternal tissues. If false, make it a correct statement.
   True

6. List the steps involved in an infant taking its first breath upon birth.
   CO_2 levels rise in the fetus once it is born. The pH drops and stimulates the breathing control center in the brain to trigger breathing.

CONNECTING THE BIG IDEAS

Use your knowledge of the information contained within this chapter's "Big Ideas" to answer this question.

You have a cold that prevents you from breathing through your nose. You go to bed and wake up about eight hours later. What effect will breathing through your mouth constantly have on your throat?

