
Interactive Learning Objects

Biology

Gas Exchange Lesson Plan

TVOntario



Gas Exchange

Learning object description

This learning object has three interactive segments that take students from a macro to microscopic exploration of the movement of gases into and out of the human body. Students learn the anatomy and physiology of the human respiratory system and investigate factors that affect breathing (ventilation) and gas exchange across the alveoli. Students are able to manipulate and test the effect of changes to temperature, humidity, pollution levels, and altitude.

Learning objective

The students will be able to:

- Predict the effect of changing temperature, humidity, pollution level and altitude on ventilation and the rate of gas exchange
- Differentiate between ventilation (breathing) and gas exchange
- Describe the mechanism of movement of gas molecules across the plasma membrane and throughout the body

Correlation to the Ontario Curriculum

Grade 11 Biology – SBI3U Academic:

- Describe and explain the major processes, mechanisms, and systems, including the respiratory, circulatory, and digestive systems, by which plants and animals maintain their internal environment
- Illustrate and explain, through laboratory investigations, the contribution of various types of systems and processes to internal regulation in plant and animal systems
- Describe the process of ventilation and gas exchange from the environment to the cell (e.g., describe the pathway of oxygen from the atmosphere to the cell, and the roles of ventilation,

haemoglobin, and diffusion in this process)

- Design and carry out, in a safe and accurate manner, an experiment on feedback mechanisms, identifying specific variables (e.g., investigate feedback controls by comparing resting rates of heartbeat and breathing with those after exercise, and then again after rest).

Vocabulary

- Ventilation (breathing)
- Gas exchange
- Alveoli
- Oxygenated
- Deoxygenated

Pre-viewing

- Have students do a think/pair/share to think of all the factors they can that affect their breathing rate. They will likely include: general health, level of fitness, exercise, temperature, body position.

While viewing

Have the class work either individually or in pairs, depending on your and their preference and access to computers. As students work through each of the interactive activities, have them complete the following instructions:

Lungs:

- Predict the effect that changing temperature, humidity, pollution levels, and altitude will have on gas exchange in the lungs. Students should record their prediction before they try each condition at each setting: low, medium, high.
- Have students make a note of the settings of all four factors that results in

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- optimal conditions for gas exchange.
- Have students write a paragraph, based on what they know about diffusion, to explain why these levels are optimal.

Alveoli:

- Have students predict, and then test, how changing temperature, humidity, pollution levels, and altitude will affect the rate of gas exchange in the alveoli.
- Have students write a statement that summarizes the difference between breathing and gas exchange.

Cellular Level:

- As students view this demonstration of the movement of O₂ and CO₂ across the plasma membrane, have them write an explanation of why each type of gas moves in the direction shown in the animation.

Circulation quiz:

- Have students test their understanding of how gas molecules are transported throughout the body.

Post viewing

- Have students create a colourful poster showing the movement of gas molecules (O₂ and CO₂) into, around, and out of the body. Their posters should be clearly and relevantly annotated to show the connection between the respiratory and circulatory systems, and describe the role played by diffusion in the process.

Follow-up activity - *investigate factors that affect lung capacity*

- Have students design a controlled experiment to investigate factors that affect tidal volume (volume of air moved in and out in a regular breath) or vital capacity (the maximal volume that can be inhaled and exhaled).

- Commercially available lung volume bags are useful tools for this lab. Possible independent variables include: body position, posture, exercise.

Assessment

- Assess students' posters for Knowledge and Understanding: understanding of concepts, principles, laws, and theories (e.g., identifying assumptions; eliminating misconceptions; providing explanations); knowledge of facts and terms; understanding of relationships between concepts.
- Lab reports can be assessed for Inquiry: application of the skills and strategies of scientific inquiry (e.g., initiating and planning, performing and recording, analysing and interpreting, problem solving); and for Knowledge and Understanding: understanding of concepts, principles, laws, and theories (e.g., identifying assumptions; eliminating misconceptions; providing explanations).