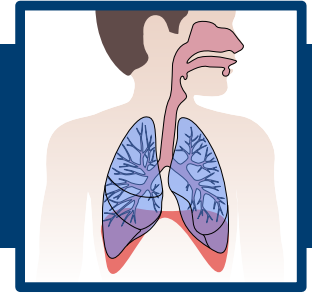


### PULMO PARK

#### LESSON 3: RESPIRATORY EXPLORATORY – DIVING DEEPER

##### Activity 3D: Confusion About Diffusion



TEXAS BIOMEDICAL  
RESEARCH INSTITUTE  
HEALTH STARTS WITH SCIENCE

**NEXT GENERATION SCIENCE STANDARDS (NGSS)**  
**TEXAS ESSENTIAL KNOWLEDGE AND SKILLS (TEKS)**

### ACTIVITY 3D: CONFUSION ABOUT DIFFUSION | TEKS

#### High School | Biology | Process Skills

**(4)** Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

**(A)** Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

**(B)** Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

**(6)** Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

#### High School | Biology | Knowledge & Skills

**(1)** Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

**(A)** ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

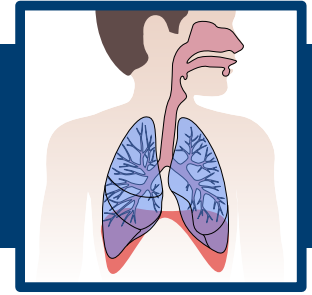
**(B)** apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

**(C)** use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

### PULMO PARK

#### LESSON 3: RESPIRATORY EXPLORATORY – DIVING DEEPER

##### Activity 3D: Confusion About Diffusion



- (D) use appropriate tools such as microscopes, slides, Petri dishes, laboratory glassware, metric rulers, digital balances, pipets, filter paper, micropipettes, gel electrophoresis and polymerase chain reaction (PCR) apparatuses, microcentrifuges, water baths, incubators, thermometers, hot plates, data collection probes, test tube holders, lab notebooks or journals, hand lenses, and models, diagrams, or samples of biological specimens or structures;
  - (E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence;
  - (F) organize quantitative and qualitative data using scatter plots, line graphs, bar graphs, charts, data tables, digital tools, diagrams, scientific drawings, and student-prepared models;
  - (G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and
  - (H) distinguish among scientific hypotheses, theories, and laws.
- (2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:
- (A) identify advantages and limitations of models such as their size, scale, properties, and materials;
  - (B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;
  - (C) use mathematical calculations to assess quantitative relationships in data; and
  - (D) evaluate experimental and engineering designs.
- (3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:
- (A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;
  - (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and
  - (C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

### High School | Anatomy & Physiology

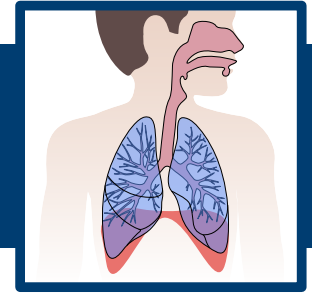
- (4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:
- (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking;
  - (E) evaluate models according to their limitations in representing biological objects or events

## Education Standards

### PULMO PARK

#### LESSON 3: RESPIRATORY EXPLORATORY – DIVING DEEPER

##### Activity 3D: Confusion About Diffusion



- (7) The student examines the body processes that maintain homeostasis. The student is expected to:
- (A) investigate and describe the integration of the chemical and physical processes, including equilibrium, temperature, pH balance, chemical reactions, passive transport, active transport, and biofeedback, that contribute to homeostasis; and
  - (A) determine the consequences of the failure to maintain homeostasis.
- (9) The student explores the body's transport systems. The student is expected to:
- (A) analyze the physical, chemical, and biological properties of transport systems, including circulatory, respiratory, and excretory;
  - (B) determine the factors that alter the normal functions of transport systems; and
  - (C) contrast the interactions among the transport systems.

### High School | Health

- (2) The student applies mathematics, science, English language arts and social studies in health science. The student is expected to:
- (G) describe biological and chemical processes that maintain homeostasis;
  - (H) identify and analyze principles of body mechanics and movement such as forces and the effects of movement, torque, tension, and elasticity on the human body;
  - (K) identify the concepts of health and wellness throughout the life span;
  - (L) analyze and evaluate communication skills for maintaining healthy relationships throughout the life span;

### ACTIVITY 3D: CONFUSION ABOUT DIFFUSION | NGSS

#### Middle School | (MS-LS1-2)

**Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.**

**Clarification Statement:** *Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.*

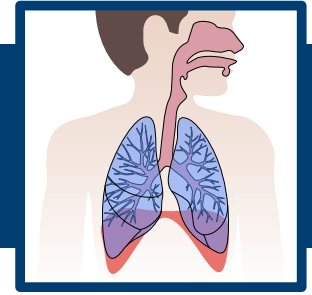
**Assessment Boundary:** *Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.*

**Evidence Statements** [\[Link\]](#)

## PULMO PARK

### LESSON 3: RESPIRATORY EXPLORATORY – DIVING DEEPER

#### Activity 3D: Confusion About Diffusion



#### Middle School | (MS-LS1-3)

**Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.**

**Clarification Statement:** *Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.*

**Assessment Boundary:** *Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.*

**NGSS: Observable Features of Student Performance** [\[Link\]](#)

#### High School | (HS-LS1-2)

**Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.**

**Clarification Statement:** *Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.*

**Assessment Boundary:** *Assessment does not include interactions and functions at the molecular or chemical reaction level.*

**NGSS: Observable Features of Student Performance** [\[Link\]](#)

#### High School | (HS-LS1-3)

**Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.**

**Clarification Statement:** *Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.*

**Assessment Boundary:** *Assessment does not include the cellular processes involved in the feedback mechanism.*

**Evidence Statement** [\[Link\]](#)