

Respiratory System



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ← المناهج الإماراتية ← الصف الثاني عشر المتقدم ← أحياء ← الفصل الأول ← ملفات متنوعة ← الملف

تاريخ إضافة الملف على موقع المناهج: 2026-09-24 11:03:43

ملفات اكتب للمعلم اكتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل
منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

المزيد من مادة
أحياء:

إعداد: Elhddad Ahmed

التواصل الاجتماعي حسب الصف الثاني عشر المتقدم



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة أحياء في الفصل الأول

شرح وأسئلة حول درس علم الوراثة المنديلية

1

أنماط الوراثة المعقدة - بريدج

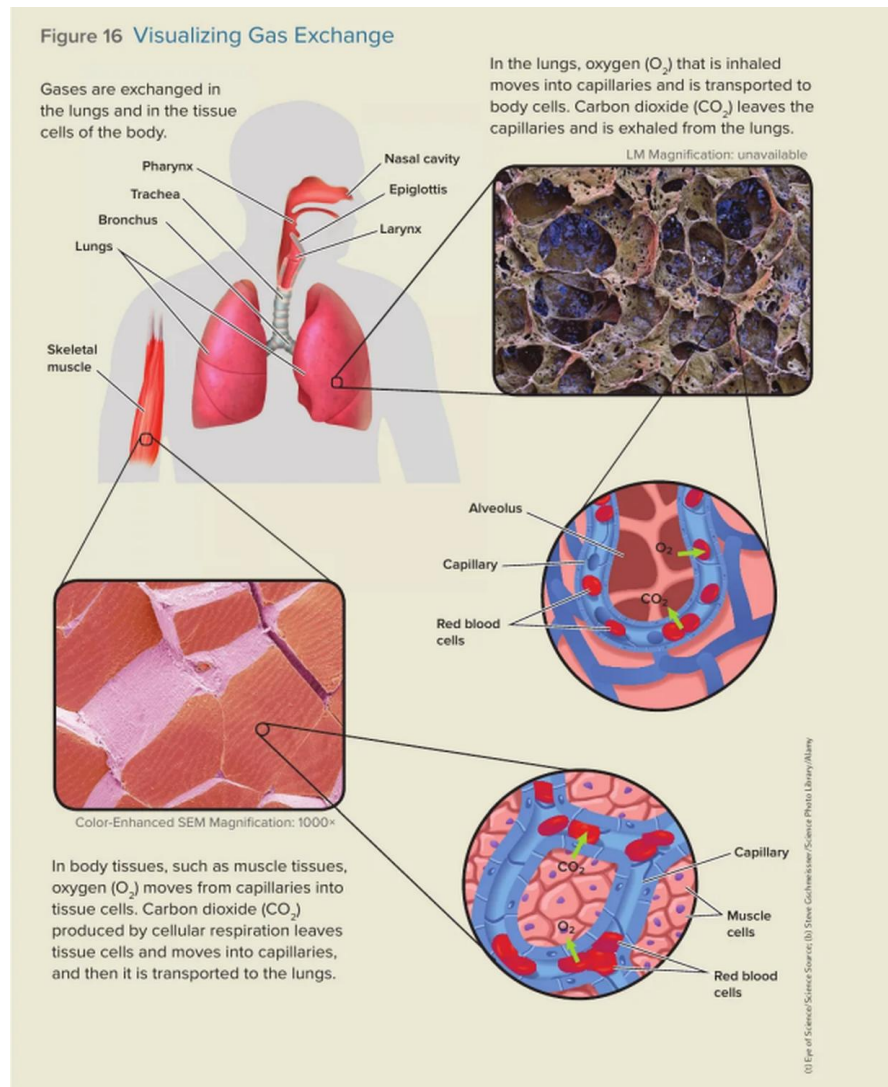
2

LESSON 2 - RESPIRATORY SYSTEM

Grade 12 ATS Biology - Teaching Notes, Diagrams & Exam Practice

Mr. Ahmed Elhddad

"the 1st Biology twacher"



Core idea: the respiratory and circulatory systems work together to exchange and transport gases.

Focus Question Why is exercise good for the respiratory system? During the lesson, connect breathing rate, gas exchange, and oxygen delivery to active cells.

Teaching Goal By the end of this lesson, the student should be able to trace the path of air, explain ventilation and gas exchange, compare internal and external respiration, analyze inhalation/exhalation, and interpret common respiratory disorders.

Lesson Roadmap

A clear sequence for explanation and revision

Part	Main idea	Exam skill
1. Importance of Respiration	Cellular respiration requires O ₂ and releases CO ₂ .	Distinguish breathing from respiration.
2. Path of Air	Air is filtered, warmed, moistened, and conducted to alveoli.	Sequence structures correctly.
3. Gas Exchange in the Lungs	O ₂ and CO ₂ diffuse across thin alveolar-capillary walls.	Read and explain a gas-exchange diagram.
4. Breathing Mechanics & Control	Pressure changes created by diaphragm/rib movements move air.	Compare inhalation and exhalation.
5. Gas Exchange in Body Tissues	O ₂ leaves blood; CO ₂ enters blood at systemic capillaries.	Link respiratory and circulatory systems.
6. Respiratory Disorders	Damage or narrowing reduces ventilation or gas exchange.	Apply structure-function reasoning.

High-Yield Exam Pattern Expect sequencing questions, structure-function comparisons, diffusion direction, inhalation/exhalation tables, and questions using alveolus diagrams.

1. The Importance of Respiration

Why cells need oxygen and why the body must remove carbon dioxide

Cellular respiration and the respiratory system

Cells use oxygen and glucose during cellular respiration to release energy and produce ATP, which supports cellular metabolism.

Cellular respiration also produces carbon dioxide and water. Carbon dioxide must be removed because its accumulation can disturb the body's internal balance.

The respiratory system supports cellular respiration by supplying oxygen to the body and removing carbon dioxide.



Exhaled air can become visible in cold conditions because water vapor condenses.

Breathing vs. respiration

Term	Definition	Where it occurs
Breathing (ventilation)	Mechanical movement of air into and out of the lungs.	Respiratory passages and lungs
External respiration	Gas exchange between alveolar air and blood.	Lungs: alveoli and pulmonary capillaries
Internal respiration	Gas exchange between blood and body cells.	Systemic capillaries and tissues
Cellular respiration	Chemical reactions that use O ₂ to help release energy from food.	Inside cells

Exam Trap Breathing is not the same as cellular respiration. Breathing moves air; respiration involves gas exchange or cellular energy release depending on the term used.

Cause-and-Effect More active cells use more oxygen and produce more carbon dioxide. This creates a need for increased breathing and circulation.

Assessment - Multiple Choice (6)**1. Which statement best describes the main role of the respiratory system?**

- A. To digest nutrients B. To supply O₂ and remove CO₂ C. To produce red blood cells D. To pump blood

2. Breathing is best defined as the

- A. chemical release of ATP B. exchange of gases between blood and cells C. mechanical movement of air into and out of lungs D. transport of oxygen by hemoglobin

3. External respiration occurs mainly between the

- A. blood and body cells B. alveoli and pulmonary capillaries C. trachea and bronchi D. nose and pharynx

4. Internal respiration refers to gas exchange between

- A. alveoli and blood B. atmosphere and nose C. blood and body cells D. bronchi and bronchioles

5. Which substance is a waste product of cellular respiration that must be removed by the respiratory system?

- A. Oxygen B. Glucose C. Carbon dioxide D. ATP

6. During exercise, breathing rate usually increases because active cells

- A. need less ATP B. use more O₂ and produce more CO₂ C. stop cellular respiration D. receive oxygen directly from the lungs without blood

Complete (3)

1. The mechanical movement of air into and out of the lungs is called _____.
2. Gas exchange between the atmosphere/alveoli and blood is called _____ respiration.
3. Gas exchange between the blood and body cells is called _____ respiration.

True / False (3)

1. Breathing and cellular respiration are identical processes.
2. The respiratory system helps maintain cellular metabolism by supplying oxygen.
3. Carbon dioxide is released as a product of cellular respiration.

Short Answer (2)

1. Differentiate between external respiration and internal respiration.

2. Explain why exercise usually increases both breathing rate and oxygen demand.

2. The Path of Air

From the atmosphere to the alveoli

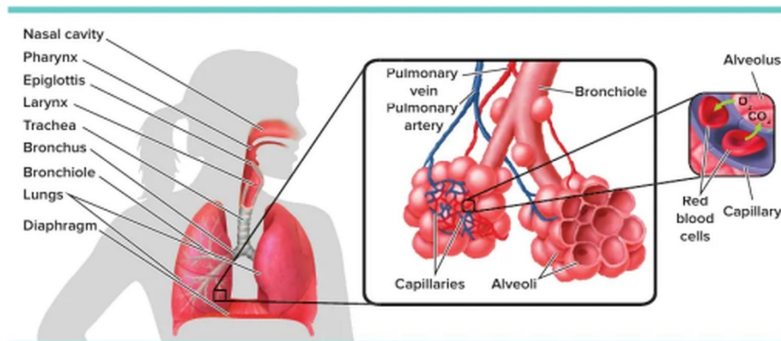


Figure 13 Air travels into the alveoli of the lungs, where gases are exchanged across thin capillary walls.

Diagram Trace the path of oxygen from the atmosphere to the alveoli in the lungs.

Path of air and the alveolar region. Use this diagram for sequencing and labeling practice.

Air pathway

Nose / Mouth -> Pharynx -> Larynx -> Trachea -> Bronchi -> Bronchioles -> Alveoli

- Nasal passages: hairs trap larger particles; mucus traps particles and pathogens; cilia move trapped material away from the lungs; blood vessels in the mucous membranes help warm inhaled air.
- Pharynx: shared passage region leading toward the respiratory tract.
- Epiglottis: flap of tissue that helps prevent food from entering the respiratory tubes during swallowing.
- Larynx: passage from pharynx toward the trachea.
- Trachea: main airway that branches into two bronchi.
- Bronchi: two large tubes leading to the lungs.
- Bronchioles: progressively smaller branches inside the lungs.
- Alveoli: microscopic air sacs with thin walls and a rich capillary supply; they are the major sites of gas exchange.

Why cilia and mucus matter

Mucus helps trap dust, pollen, microorganisms, and other particles.

Hairlike cilia move mucus and trapped material toward the throat, reducing the amount reaching the delicate alveoli.

Together, filtering, warming, and moistening condition the air before it reaches the gas-exchange surface.



Figure 14 Hairlike cilia line the mucous membranes of the nasal cavity.

Hairlike cilia lining respiratory mucous membranes.

Structure -> Function Branching from trachea -> bronchi -> bronchioles distributes air through the lungs, while the enormous number of alveoli provides a very large gas-exchange surface.

Diagram Skill When given a respiratory diagram, first identify the trachea, then follow the branching pattern to bronchi, bronchioles, and finally alveoli.

Assessment - Multiple Choice (6)**1. Which sequence correctly traces air from the trachea to the gas-exchange surface?**

- A. Trachea -> bronchioles -> bronchi -> alveoli B. Trachea -> bronchi -> bronchioles -> alveoli C. Trachea -> alveoli -> bronchi -> bronchioles D. Trachea -> pharynx -> bronchi -> alveoli

2. The primary function of nasal hairs is to

- A. exchange gases B. filter large particles C. produce hemoglobin D. contract the diaphragm

3. Cilia in the respiratory tract help protect the lungs by

- A. moving mucus and trapped particles toward the throat B. increasing blood pressure C. producing oxygen D. closing the bronchioles during inhalation

4. Which structure helps prevent food from entering the respiratory tubes?

- A. Alveolus B. Epiglottis C. Bronchiole D. Diaphragm

5. The trachea divides directly into two

- A. alveoli B. bronchi C. pharynxes D. diaphragms

6. In the pathway diagram, the structure at the end of the smallest airway branches is the

- A. larynx B. trachea C. alveolus D. pharynx

Complete (3)

1. The trachea branches into two large tubes called the _____.
2. Each bronchus branches repeatedly into smaller tubes called _____.
3. The microscopic air sacs where gas exchange occurs are the _____.

True / False (3)

1. Cilia help move trapped particles away from the lungs.
2. The epiglottis is the main site of gas exchange.
3. Alveoli occur at the ends of small air passages in the lungs.

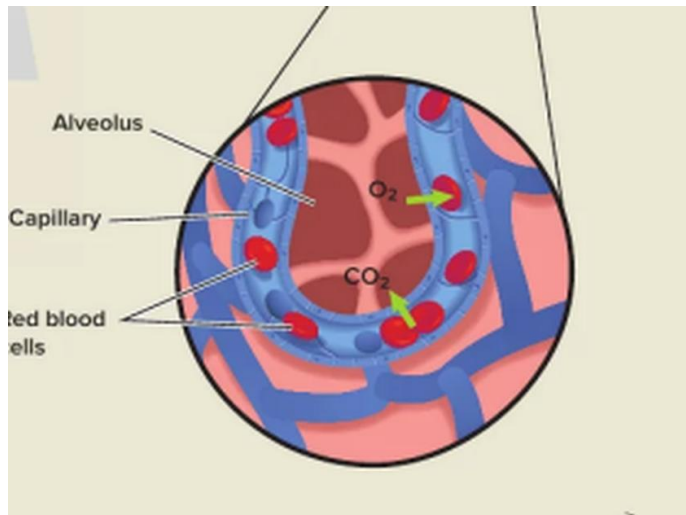
Short Answer (2)

1. Trace the path of inhaled air from the nose or mouth to the alveoli.

2. Explain two ways the nasal passages condition or protect inhaled air.

3. Gas Exchange in the Lungs

Diffusion at the alveolar-capillary surface



Alveolar gas exchange: O₂ enters blood while CO₂ leaves blood.

Inhaled air brings oxygen into the alveoli. Oxygen diffuses from the alveolar air across the thin, moist alveolar and capillary walls into the blood.

Carbon dioxide diffuses in the opposite direction: from the blood into the alveoli, then it is removed during exhalation.

In blood, much oxygen is transported attached to hemoglobin in red blood cells. Carbon dioxide is transported in several forms, including dissolved CO₂ and bicarbonate-related forms.

Why alveoli are efficient gas-exchange surfaces

Feature	How it improves gas exchange
Very large total surface area	Provides more area for diffusion at the same time.
Walls only about one cell thick	Creates a very short diffusion distance.
Moist lining	Allows gases to dissolve before diffusing.
Dense capillary network	Maintains close contact with blood and carries gases away/toward the surface.
Continuous ventilation	Helps maintain useful concentration gradients for O ₂ and CO ₂ .

Diffusion Rule A gas diffuses from a region of higher concentration/partial pressure to a region of lower concentration/partial pressure. In the lungs: O₂ moves alveoli → blood, while CO₂ moves blood → alveoli.

Exam Trap The pulmonary artery carries deoxygenated blood to the lungs, while the pulmonary vein carries oxygenated blood away from the lungs. Do not decide oxygenation from the words "artery" or "vein"; decide it from direction of flow relative to the heart.

Assessment - Multiple Choice (6)**1. In the lungs, oxygen normally diffuses from the**

A. blood to alveoli B. alveoli to capillary blood C. body cells to blood D. bronchioles to trachea

2. Carbon dioxide normally diffuses from pulmonary capillary blood into the

A. alveoli B. red bone marrow C. diaphragm D. nasal cavity

3. Which alveolar feature most directly reduces diffusion distance?

A. Large number of alveoli B. Thin walls C. Mucus in nose D. Cartilage in trachea

4. A dense capillary network around alveoli mainly helps by

A. preventing breathing B. bringing blood close to the gas-exchange surface C. blocking diffusion D. warming air in the nasal cavity

5. Which vessel brings deoxygenated blood to the lungs?

A. Pulmonary vein B. Aorta C. Pulmonary artery D. Vena cava

6. In an alveolus diagram, an arrow showing O₂ should point generally from

A. capillary to alveolar air B. alveolar air to blood C. blood to bronchiole lumen D. body cells to alveolus directly

Complete (3)

1. Oxygen is carried in red blood cells mainly by the protein _____.

2. Gas exchange across the alveolar wall occurs mainly by _____.

3. In the lungs, carbon dioxide moves from the blood into the _____.

True / False (3)

1. Alveolar walls are thick and multilayered to prevent diffusion.

2. A rich capillary supply helps make alveoli efficient gas-exchange surfaces.

3. Oxygen and carbon dioxide diffuse in opposite directions across the alveolar-capillary surface.

Short Answer (2)

1. Give three adaptations of alveoli for efficient gas exchange and explain each briefly.

2. Using the alveolus diagram, explain why O₂ enters the blood while CO₂ leaves the blood.

4. Breathing Mechanics and Control

How pressure changes move air into and out of the lungs

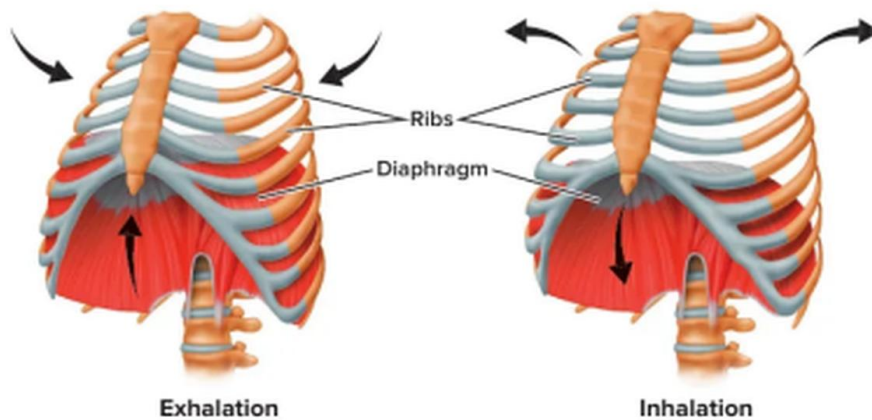


Figure 15 Rib and diaphragm muscles contract and relax during breathing.

Breathing mechanics. Compare rib movement, diaphragm shape, chest volume, and pressure during inhalation and exhalation.

Inhalation vs. exhalation

Feature	Inhalation	Exhalation
Diaphragm	Contracts and flattens / moves downward	Relaxes and becomes more dome-shaped / moves upward
Rib cage	Moves upward and outward	Moves downward and inward toward resting position
Thoracic cavity volume	Increases	Decreases
Pressure inside lungs	Falls below atmospheric pressure	Rises above atmospheric pressure
Air movement	Air enters lungs	Air leaves lungs

Pressure Principle Air moves because of a pressure gradient. Increasing chest volume lowers pressure and draws air in; decreasing chest volume raises pressure and pushes air out.

Control of breathing

- The brain adjusts breathing according to internal chemical conditions.
- A rise in carbon dioxide in the blood is an important signal that can increase breathing rate.
- As cellular activity rises, cells usually consume more O₂ and release more CO₂, so ventilation and circulation must increase to maintain gas exchange.

Exercise Connection Regular exercise can improve the efficiency and endurance of muscles involved in breathing and supports better integration of the respiratory and circulatory systems. During activity, ventilation rises to match the increased demand for O₂ and removal of CO₂.

Assessment - Multiple Choice (6)**1. During inhalation, the diaphragm**

A. relaxes and moves upward B. contracts and moves downward C. does not change D. closes the trachea

2. When thoracic cavity volume increases, pressure inside the lungs generally

A. increases above atmospheric pressure B. decreases below atmospheric pressure C. stays exactly equal
D. becomes unrelated to airflow

3. Which change occurs during exhalation at rest?

A. Diaphragm contracts B. Chest volume increases C. Pressure in lungs rises and air leaves D. Ribs move upward and outward

4. The immediate physical cause of airflow into the lungs is

A. active transport of oxygen B. a pressure difference C. hemoglobin contraction D. cilia pushing air

5. A rise in blood carbon dioxide can cause breathing rate to

A. increase B. stop permanently C. become unrelated to metabolism D. decrease to zero

6. In Figure 15, the side with a flattened lower diaphragm represents

A. inhalation B. external respiration only C. internal respiration D. swallowing

Complete (3)

1. During inhalation, the diaphragm _____ and moves downward.
2. A larger thoracic volume produces a _____ pressure inside the lungs.
3. During exhalation, air moves out because pressure inside the lungs becomes _____ than atmospheric pressure.

True / False (3)

1. During inhalation, the ribs tend to move upward and outward.
2. Air is pulled into lungs because lung pressure becomes greater than atmospheric pressure.
3. A rise in blood CO₂ can stimulate an increase in breathing rate.

Short Answer (2)

1. Describe the complete sequence of changes that causes inhalation.

2. Compare inhalation and exhalation in terms of diaphragm movement, chest volume, pressure, and airflow.

5. Gas Exchange in Body Tissues

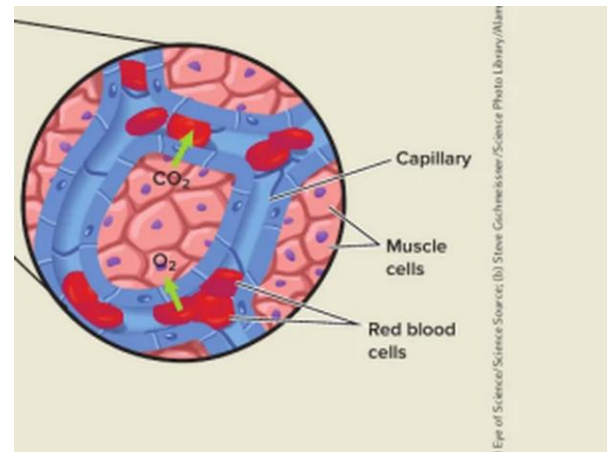
Internal respiration and coordination with circulation

After oxygen enters the blood in the lungs, circulation transports it to body tissues.

At tissue capillaries, oxygen diffuses from the blood into cells where it can be used in cellular respiration.

Carbon dioxide produced by cells diffuses into the blood and is transported back toward the lungs for removal.

This is why the respiratory and circulatory systems function as a coordinated transport-and-exchange system.



Internal respiration at body tissues: O₂ leaves blood, CO₂ enters blood.

Two gas-exchange sites - one continuous pathway

Location	O ₂ direction	CO ₂ direction	Term
Lungs	Alveoli -> blood	Blood -> alveoli	External respiration
Body tissues	Blood -> cells	Cells -> blood	Internal respiration

Integrated Flow Atmosphere -> respiratory passages -> alveoli -> blood -> tissues -> cells. Carbon dioxide travels mainly in the reverse direction: cells -> blood -> lungs -> atmosphere.

Diagram Skill When a question shows capillaries near body cells, label O₂ arrows toward the cells and CO₂ arrows toward the blood. When it shows alveoli, reverse those directions.

Assessment - Multiple Choice (6)

1. At body tissues, oxygen diffuses primarily from the

- A. cells into blood B. blood into cells C. alveoli into bronchioles D. trachea into blood

2. Carbon dioxide produced by cells enters the

- A. blood in tissue capillaries B. alveoli directly without transport C. nasal cavity D. bronchi before entering blood

3. Gas exchange between systemic capillaries and body cells is called

- A. external respiration B. internal respiration C. ventilation D. filtration

4. Which system transports oxygen from the lungs to body tissues?

- A. Digestive only B. Circulatory C. Skeletal only D. Integumentary only

5. In a tissue-exchange diagram, the arrow for CO₂ should point

- A. from blood to cells B. from cells to blood C. from alveoli to blood D. from nose to pharynx

6. Which statement best explains coordination of respiratory and circulatory systems?

- A. Lungs make ATP for every cell B. Respiratory exchange loads O₂ into blood and circulation delivers it to tissues C. Blood enters alveoli directly as air D. The diaphragm pumps blood through arteries

Complete (3)

1. Gas exchange between blood and body cells is called _____ respiration.
2. At body tissues, oxygen diffuses from the blood into the _____.
3. Carbon dioxide produced by cells is carried by blood back toward the _____.

True / False (3)

1. At body tissues, oxygen moves from cells into blood.
2. The circulatory system transports respiratory gases between lungs and tissues.
3. Carbon dioxide produced by cells can be removed from the body through the lungs.

Short Answer (2)

1. Explain how the respiratory and circulatory systems work together to supply a muscle cell with oxygen.

2. Compare the direction of O₂ and CO₂ diffusion in the lungs with their directions in body tissues.

6. Respiratory Disorders

How changes in airways or alveoli affect breathing and gas exchange

Table 2 Common Respiratory Disorders

Disorder	Brief Description
Asthma	Respiratory pathways become irritated, and bronchioles constrict.
Bronchitis	Respiratory pathways become infected, resulting in coughing and production of mucus.
Emphysema	Alveoli break down, resulting in reduced surface area needed for gas exchange with the alveoli's blood capillaries.
Pneumonia	Infection of the lungs causes the alveoli to collect mucous material.
Lung cancer	Uncontrolled cell growth in lung tissue can lead to a persistent cough, shortness of breath, bronchitis, or pneumonia, and can lead to death.

Common respiratory disorders from the lesson. Focus on the structure affected and the resulting effect on airflow or gas exchange.

Disorder	Main change	Likely functional effect
Asthma	Airways become irritated; bronchioles constrict.	Airflow becomes more difficult.
Bronchitis	Respiratory passages become infected/inflamed; coughing and mucus increase.	Air passages are irritated and airflow can be reduced.
Emphysema	Alveoli break down, reducing effective surface area.	Gas exchange becomes less efficient.
Pneumonia	Lung infection causes alveoli to collect mucus/fluid-like material.	Diffusion distance/effective air space is impaired.
Lung cancer	Uncontrolled cell growth in lung tissue.	Can cause persistent cough, shortness of breath and impaired lung function.

Structure -> Function Reasoning Any disorder that narrows airways reduces ventilation. Any disorder that damages alveoli, reduces surface area, or fills alveoli with material reduces gas exchange.

- Smoking can irritate respiratory tissues and inhibit cellular metabolism, and it is associated with serious respiratory disease.
- Airborne materials such as pollen can trigger respiratory problems in susceptible individuals with allergic reactions.
- When gas exchange is reduced, the body may compensate by increasing breathing effort/rate, but compensation may not fully restore normal oxygen delivery.

Exam Trap Do not memorize disorders as isolated names. Link each disorder to a structure and then predict the effect on airflow, diffusion distance, or surface area.

Assessment - Multiple Choice (6)**1. Asthma reduces airflow mainly because**

- A. alveoli increase surface area B. bronchioles constrict C. red blood cells burst D. the diaphragm disappears

2. Emphysema directly reduces gas exchange by

- A. increasing alveolar surface area B. breaking down alveoli and reducing surface area C. thickening nasal hairs D. opening bronchioles

3. Pneumonia can interfere with gas exchange because

- A. alveoli may fill with mucus/material B. trachea becomes a blood vessel C. hemoglobin stops existing D. ribs cannot move at all

4. Bronchitis primarily involves

- A. infection/inflammation of respiratory passages B. loss of all red blood cells C. damage to the heart valves D. excess alveolar surface area

5. A disorder that reduces alveolar surface area would most directly reduce the rate of

- A. diffusion of respiratory gases B. food digestion C. bone growth D. nerve conduction

6. Which explanation best predicts why severe airway narrowing increases breathing difficulty?

- A. Less air can move through the narrowed passages B. Oxygen becomes heavier C. Blood stops circulating instantly D. Alveoli turn into bronchi

Complete (3)

1. In asthma, the _____ may constrict and reduce airflow.
2. In emphysema, breakdown of alveoli reduces the available _____ area for gas exchange.
3. An infection in which alveoli may collect mucus/material is called _____.

True / False (3)

1. Emphysema can reduce the total surface area available for gas exchange.
2. Asthma improves airflow by widening bronchioles during an attack.
3. Respiratory disorders can interfere with either ventilation, gas exchange, or both.

Short Answer (2)

1. Choose two respiratory disorders and explain how each affects respiratory function.

2. A patient has damage that greatly reduces alveolar surface area. Predict the effect on oxygen entry into the blood and explain why.

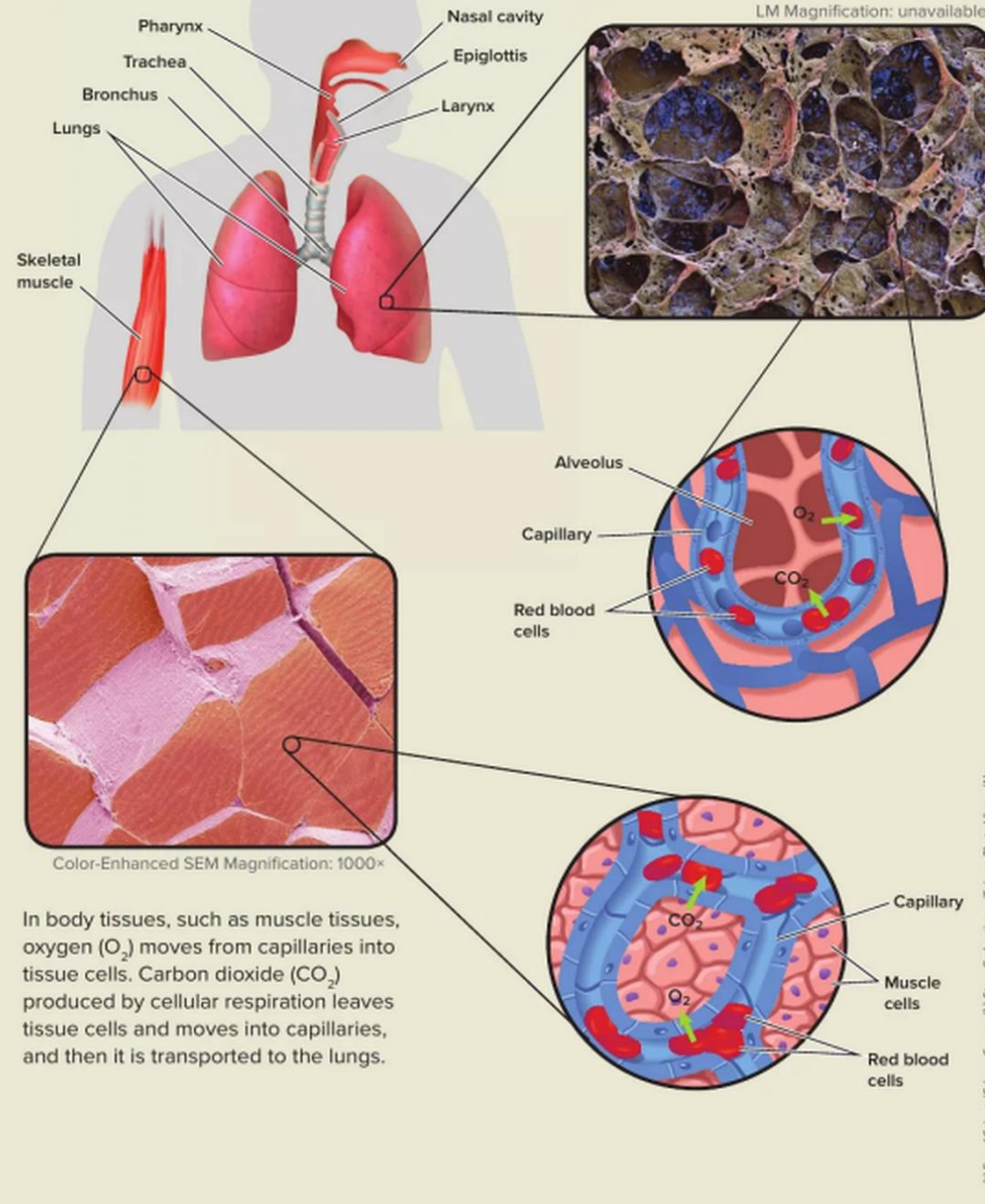
Master Diagram - Visualizing Gas Exchange

Use this page for oral explanation, labeling, and diagram-based questions

Figure 16 Visualizing Gas Exchange

Gases are exchanged in the lungs and in the tissue cells of the body.

In the lungs, oxygen (O_2) that is inhaled moves into capillaries and is transported to body cells. Carbon dioxide (CO_2) leaves the capillaries and is exhaled from the lungs.



One-page visual summary: air pathway, alveolar gas exchange, and tissue gas exchange.

Oral Teaching Prompt Ask the student to start at the nasal cavity and narrate one oxygen molecule's journey until it reaches a muscle cell, then trace one carbon dioxide molecule back to the atmosphere.

Rapid Revision Sheet

The whole lesson on one page

Topic	Must-know statement
Purpose	Supply O ₂ for cellular respiration and remove CO ₂ .
Path of air	Nose/mouth -> pharynx -> larynx -> trachea -> bronchi -> bronchioles -> alveoli.
Protection	Nasal hairs + mucus + cilia filter particles; nasal tissues warm and moisten air.
External respiration	O ₂ : alveoli -> blood; CO ₂ : blood -> alveoli.
Internal respiration	O ₂ : blood -> cells; CO ₂ : cells -> blood.
Alveoli	Large area, thin moist walls, rich capillary supply.
Inhalation	Diaphragm contracts/down; volume up; pressure down; air enters.
Exhalation	Diaphragm relaxes/up; volume down; pressure up; air leaves.
Breathing control	Rising CO ₂ is an important signal for increased ventilation.
Disorders	Airway narrowing -> reduced ventilation; alveolar damage/fluid -> reduced gas exchange.

Memory Line AIR IN: volume up, pressure down. AIR OUT: volume down, pressure up.

Exam Strategy For any unfamiliar respiratory scenario, identify: (1) the structure affected, (2) the process affected - airflow or diffusion, and (3) the predicted effect on O₂/CO₂ exchange.

Final Lesson Review

Cumulative exam-style practice

A. Multiple Choice (10)

1. Which structure is the main site of gas exchange in the lungs?
A. Trachea B. Alveoli C. Larynx D. Pharynx
2. Which sequence is correct?
A. Pharynx -> trachea -> larynx -> alveoli B. Nose -> pharynx -> larynx -> trachea C. Trachea -> pharynx -> bronchi -> alveoli D. Bronchioles -> bronchi -> trachea -> alveoli
3. During inhalation, lung pressure becomes
A. higher than atmospheric B. lower than atmospheric C. equal to blood pressure D. unrelated to chest volume
4. Which process is external respiration?
A. O₂ moving from blood to muscle B. O₂ moving from alveoli to blood C. ATP production in mitochondria D. Air moving through the nose
5. Which feature of alveoli most directly creates a short diffusion distance?
A. Thin walls B. Large number C. Rich capillaries D. Moist air
6. At body tissues, CO₂ moves
A. blood -> cells B. cells -> blood C. alveoli -> blood D. nose -> pharynx
7. Which structure prevents food from entering the respiratory passages during swallowing?
A. Epiglottis B. Alveolus C. Diaphragm D. Bronchiole
8. Which disorder is associated with breakdown of alveoli and reduced gas-exchange surface?
A. Asthma B. Bronchitis C. Emphysema D. Laryngitis
9. A rise in blood CO₂ usually causes breathing rate to
A. increase B. decrease to zero C. remain permanently fixed D. stop responding to metabolism
10. In a diagram of inhalation, which combination is correct?
A. Diaphragm down; chest volume up; pressure down B. Diaphragm up; volume up; pressure up C. Diaphragm down; volume down; pressure up D. Diaphragm up; volume down; pressure down

B. True / False (5)

1. The pulmonary vein carries oxygenated blood away from the lungs.
2. During exhalation, thoracic cavity volume decreases.
3. Cilia are the main site of oxygen diffusion into blood.
4. Internal respiration occurs between systemic capillary blood and body cells.
5. Damage that reduces alveolar surface area can reduce oxygen uptake.

C. Complete (5)

1. The smallest air sacs of the lungs are called _____.
2. The flap that helps keep food out of the respiratory passages is the _____.
3. During inhalation, the diaphragm _____.
4. Gas exchange between alveoli and blood is called _____ respiration.

5. The protein in red blood cells that binds oxygen is _____.

D. Short Answer (5)

1. Trace the path of air from the nose to the alveoli.

2. Explain four adaptations of alveoli for gas exchange.

3. Explain inhalation using diaphragm movement, thoracic volume, pressure, and airflow.

4. Compare external respiration with internal respiration.

5. Use structure-function reasoning to explain why emphysema makes gas exchange less efficient.

Diagram Challenge

Ministerial-style application and interpretation

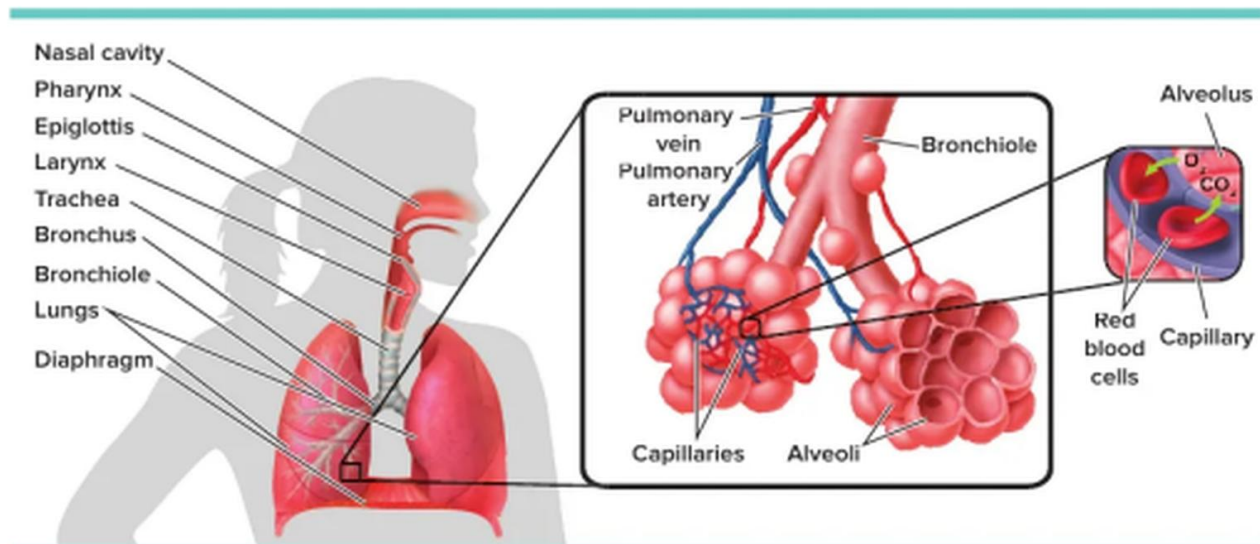


Figure 13 Air travels into the alveoli of the lungs, where gases are exchanged across thin capillary walls.

Diagram Trace the path of oxygen from the atmosphere to the alveoli in the lungs.

Diagram A - Path of air and alveoli

1. Write the correct sequence for air movement from the nasal cavity to the alveoli using labels visible in Diagram A.
2. Identify the structure that branches into the bronchi and state its role.
3. Explain why alveoli are surrounded by capillaries.
4. Predict what would happen to oxygen uptake if the alveolar walls became much thicker.

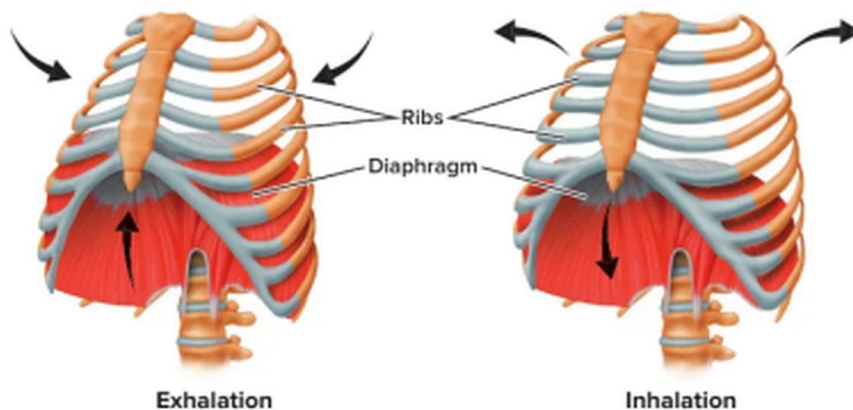


Figure 15 Rib and diaphragm muscles contract and relax during breathing.

Diagram B - Exhalation and inhalation

5. Which side of Diagram B represents inhalation? Give two visual clues.
6. Explain how the diaphragm movement shown on the inhalation side changes lung pressure.
7. If the diaphragm could not contract effectively, predict the effect on inhalation.
