Assignment 12: The respiratory system

Due: 11:59pm on Tuesday, April 16, 2013

Note: To understand how points are awarded, read your instructor's Grading Policy.

Art-labeling Activity: Figure 22.1

Part A

Drag the appropriate labels to their respective targets.

ANSWER:

Correct

Art-labeling Activity: Figure 22.10c

Part A

Drag the appropriate labels to their respective targets.

ANSWER:

Correct

BioFlix Quiz: Gas Exchange

Watch the animation at left before answering the questions below.

Part A

During inhalation,

Hint 1.

Review the animation or your Study Sheet for Gas Exchange

ANSWER:

- oxygen molecules move into the lungs, and carbon dioxide molecules move out of the lungs.
- the volume of the thoracic cavity decreases.
- the diaphragm and rib muscles contract.
- air moves up the trachea.
- the diaphragm relaxes.

Correct

The contraction of these muscles causes air to enter the lungs.

Part B

From which structures do oxygen molecules move from the lungs to the blood?

Hint 1.

Review the animation or your Study Sheet for Gas Exchange

ANSWER:

- Alveoli
- Bronchioles
- Bronchi
- Nose
- Trachea

Correct

Alveoli are tiny sacs in the lungs surrounded by capillaries. The alveoli are where oxygen diffuses from the lungs to the blood.

Part C

Which statement is correct?

Hint 1.

Review the animation or your Study Sheet for Gas Exchange

ANSWER:

- As oxygen diffuses from the lungs into capillaries, blood becomes deoxygenated.
- Carbon dioxide diffuses from the alveoli into surrounding capillaries.
- Oxygen is released from the mitochondria as a product of cellular respiration.
- In the blood, oxygen is bound to hemoglobin, a protein found in red blood cells.
- Oxygen diffuses from large blood vessels into the body's cells.

Correct

When oxygen diffuses from the alveoli to the surrounding capillaries, it enters a red blood cell and binds to hemoglobin.

Part D

After blood becomes oxygenated,

Hint 1.

Review the animation or your Study Sheet for Gas Exchange

ANSWER:

- it does not return to the heart, but goes to the nose and mouth.
- it does not return to the heart, but goes directly to capillaries that supply the body's cells with oxygen.
- it does not return to the heart, but goes directly to the lungs.
- it returns to the heart, and is then pumped to the lungs.
- it returns to the heart, and is then pumped to body cells.

Correct

Part E

Hemoglobin

Hint 1.

Review the animation.

ANSWER:

- has five subunits.
- is the site of cellular respiration.
- uses ATP to move oxygen from blood to body cells.
- is a protein that can bind four molecules of oxygen.
- is found in blood plasma.

Correct

Bioflix Activity: Gas Exchange -- Carbon Dioxide Transport

In this activity, you will follow carbon dioxide on its path out of the body.
To review how carbon dioxide is transported in the body, watch this BioFlix animation: Gas Exchange: Transporting Carbon Dioxide.

Part A - Carbon dioxide transport

Drag each label to the appropriate location on the flowchart.

ANSWER:

Correct

BioFlix Activity: Gas Exchange -- Oxygen Transport

In this activity, you will follow oxygen on its path from the lungs to the body tissues.
To review how oxygen is transported in the body, watch this BioFlix animation: Gas Exchange: Transporting Oxygen.

Part A - Oxygen transport

Drag each label to the appropriate location on the flowchart.

ANSWER:

Correct

BioFlix Activity: Gas Exchange -- Key Events in Gas Exchange

In this activity, you will place the key events of gas exchange in the correct sequence.
To review the events of gas exchange, watch this BioFlix animation: Gas Exchange.

Part A - Key events in gas exchange

Drag each label to the appropriate location on the flowchart.

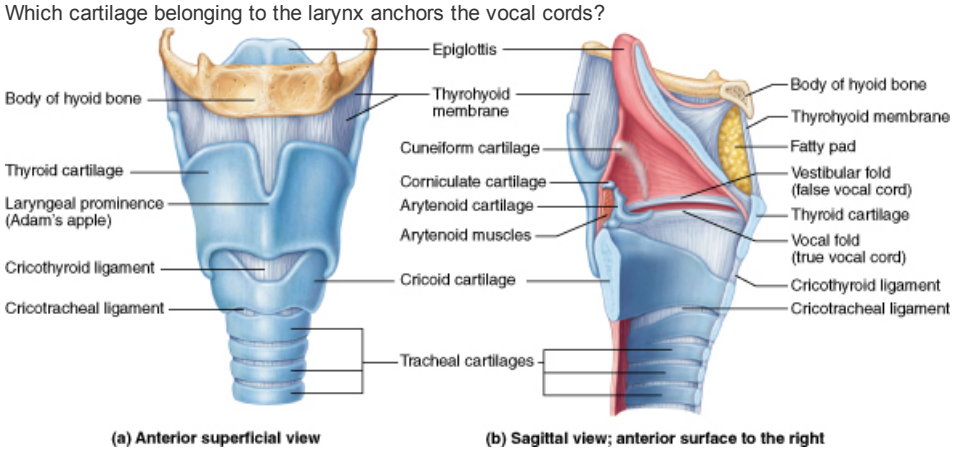
ANSWER:

Correct

Art Question Chapter 22 Question 5

Part A

Which cartilage belonging to the larynx anchors the vocal cords?



(a) Anterior superficial view (b) Sagittal view; anterior surface to the right

ANSWER:

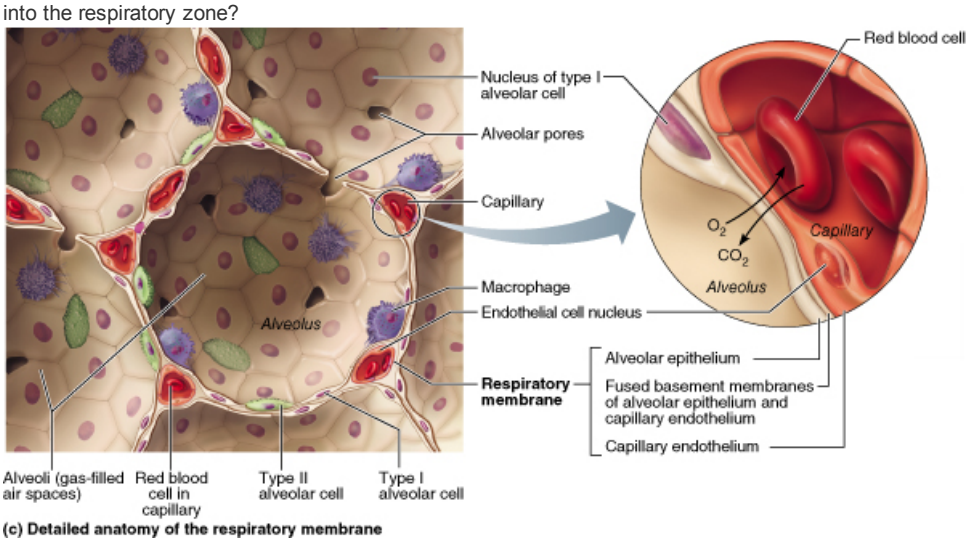
- arytenoid cartilages
- epiglottis
- thyroid cartilage
- cricoid cartilage

Correct

Art Question Chapter 22 Question 7

Part A

Since mucus-producing cells and cilia are sparse in the bronchioles and alveoli, how does the body remove microorganisms that make their way into the respiratory zone?



(c) Detailed anatomy of the respiratory membrane

ANSWER:

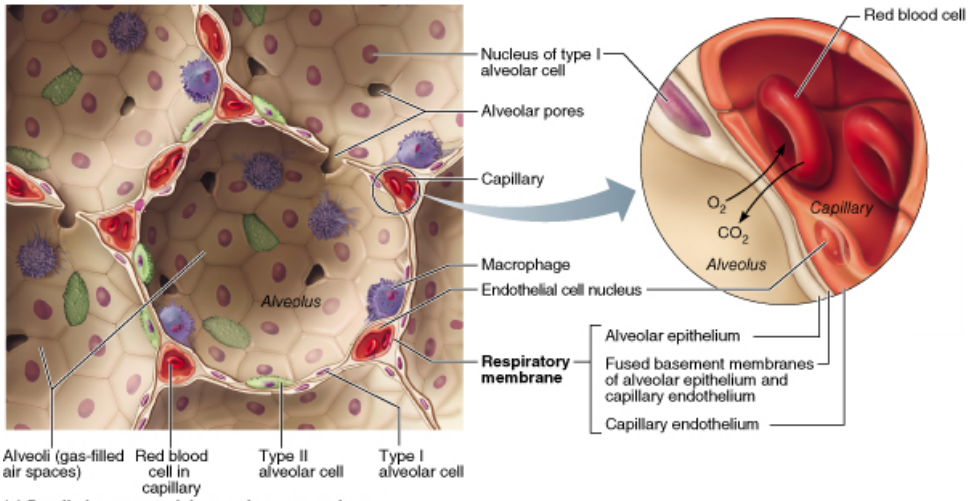
- type II alveolar cells secrete a substance called surfactant
- type I alveolar cells produce antimicrobial proteins
- the pleurae produce pleural fluid
- alveolar macrophages crawl freely along internal alveolar surfaces

Correct

Art Question Chapter 22 Question 8

Part A

What type of epithelial tissue forms the walls of the alveoli?



(c) Detailed anatomy of the respiratory membrane

ANSWER:

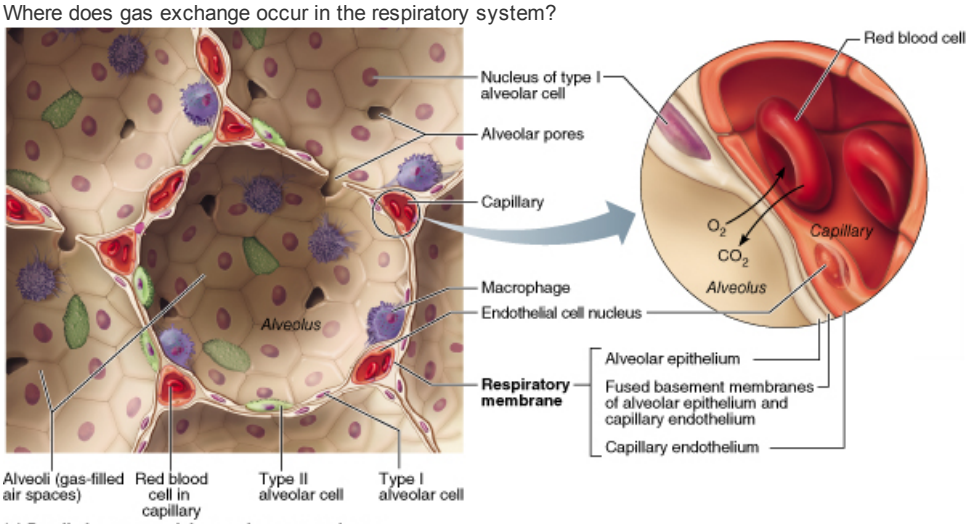
- pseudostratified ciliated columnar epithelium
- simple squamous epithelium
- simple cuboidal epithelium
- stratified squamous epithelium

Correct

Art Question Chapter 22 Question 9

Part A

Where does gas exchange occur in the respiratory system?



(c) Detailed anatomy of the respiratory membrane

ANSWER:

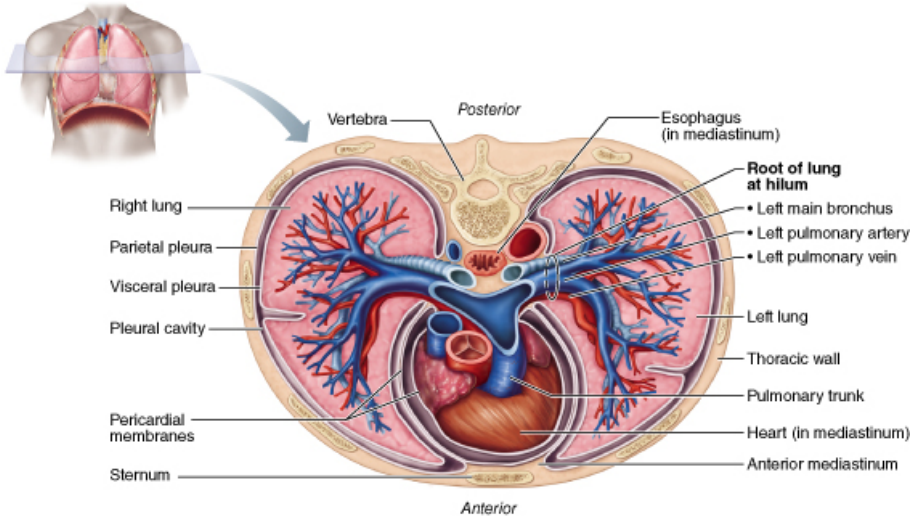
- trachea
- terminal bronchioles
- alveoli
- lobar (secondary) bronchi

Correct

Art Question Chapter 22 Question 10

Part A

Which of the following features characterizes the right lung?



(c) Transverse section through the thorax, viewed from above. Lungs, pleural membranes, and major organs in the mediastinum are shown.

ANSWER:

- presence of a superior, middle, and inferior lobe
- presence of the cardiac notch
- smaller of the two lungs
- presence of only two lobes

Correct

Chapter 22 Chapter Test Question 5

Part A

The _____ is also known as the "guardian of the airways."

ANSWER:

- glottis
- epiglottis
- vestibular folds
- larynx

Correct

Chapter 22 Chapter Test Question 6

Part A

The smallest subdivisions of the lung visible with the naked eye are the _____, which appear to be connected by black carbon in smokers.

ANSWER:

- pulmonary hila
- pleura
- lobules
- lobes

Correct

Chapter 22 Homeostatic Imbalance Question 6

Part A

During pleurisy, the inflamed parietal pleura of one lung rubs against the inflamed _____.

ANSWER:

- thoracic wall
- parietal pleura of the other lung
- visceral pleura of the same lung
- visceral pleura of the other lung

Correct

Normally the visceral and parietal pleura of one lung glide easily over one another during breathing because they are smooth and lubricated by pleural fluid. During pleurisy, they become rough and friction between the two pleura develops.

Chapter 22 Clinical Application Question 3

Part A

Jane had been suffering through a severe cold and was complaining of a frontal headache and a dull, aching pain at the side of her face. What regions are likely to become sites of secondary infection following nasal infection?

ANSWER:

- The paranasal sinuses
- The lower respiratory tract
- The oral cavity and larynx
- The oral cavity
- The larynx and trachea

Correct

Chapter 22 Matching 11-17

Part A

Match the following terms to their definitions.

Drag the appropriate labels to their respective targets. Terms may be used more than once.

ANSWER:

Correct

Chapter 22 Multiple Choice Question 2

Part A

The loudness of a person's voice depends on the _____.

ANSWER:

- strength of the intrinsic laryngeal muscles
- length of the vocal folds
- force with which air rushes across the vocal folds
- thickness of vestibular folds

Correct

Chapter 22 Multiple Choice Question 6

Part A

Which of the following maintains the patency (openness) of the trachea?

ANSWER:

- C-shaped cartilage rings
- pseudostratified ciliated epithelium
- surfactant production
- surface tension of water

Correct

Chapter 22 Multiple Choice Question 41

Part A

The respiratory membrane is a combination of _____.

ANSWER:

- respiratory bronchioles and alveolar ducts
- atria and alveolar sacs
- alveolar and capillary walls and their fused basement membranes
- respiratory bronchioles and alveolar sacs

Correct

Chapter 22 Multiple Choice Question 50

Part A

The factors responsible for holding the lungs to the thorax wall are _____.

ANSWER:

- the diaphragm and the intercostal muscles alone
- the smooth muscles of the lung
- the visceral pleurae and the changing volume of the lungs
- surface tension from pleural fluid and negative pressure in the pleural cavity

Correct

Chapter 22 Multiple Choice Question 52

Part A

Most inspired particles such as dust fail to reach the lungs because of the _____.

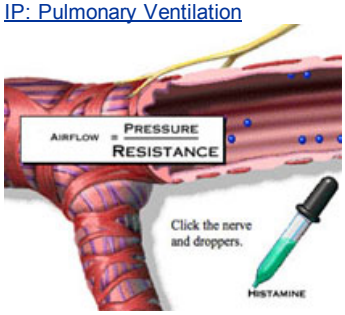
ANSWER:

- action of the epiglottis
- abundant blood supply to nasal mucosa
- ciliated mucous lining in the nose
- porous structure of turbinate bones

Correct

IP: Pulmonary Ventilation

Click on the link or the image below to explore pulmonary ventilation in Interactive Physiology (IP), then answer the questions to the right.
IP: Pulmonary Ventilation



Part A

Which of the following descriptions accurately describes Boyle's law?

Hint 1.

Boyle's law explains how air moves in and out of the lungs during inspiration and expiration.

ANSWER:

- How well a gas dissolves in a liquid such as blood depends on both its partial pressure and its solubility.
- The pressure of gas in your lungs is inversely proportional to the volume in your lungs.
- The partial pressure of a gas in the air you breathe in is equal to the total atmospheric pressure times the fractional concentration of the gas.

Correct

Yes, Boyle's Law describes how air moves into and out of the lungs during inspiration and expiration. By changing the volume of the thoracic cavity, the pressure changes in the lungs. Increasing volume of the thoracic cavity leads to a decreased pressure, causing air to flow into the lungs (down its pressure gradient) and thus causing inspiration.

Part B

Which muscles, when contracted, would increase the volume of air in the thoracic cavity?

Hint 1.

This would occur during inspiration.

ANSWER:

- internal intercostals and external oblique
- diaphragm and external intercostals
- diaphragm and internal intercostals

Correct

Yes, contraction of both the diaphragm (the diaphragm flattens) and the external intercostals (pulls the ribs up and out) will increase the volume of the thoracic cavity. This will cause air to move into the lungs (inspiration).

Part C

Which pressure is the result of the natural tendency of the lungs to decrease their size (because of elasticity) and the opposing tendency of the thoracic wall to pull outward and enlarge the lungs?

Hint 1.

This pressure prevents the lungs from collapsing.

ANSWER:

- intrapulmonary pressure
- atmospheric pressure
- intrapleural pressure

Correct

Yes, the lungs tend to decrease their size while the chest wall tends to pull the thorax outward. This makes the intrapleural pressure more negative than the other two pressures (described as subatmospheric), thus keeping the lungs inflated.

Part D

During an allergic reaction, which of the following would aid respiration?

Hint 1.

Allergies are hypersensitivity reactions producing increased resistance in the bronchioles, causing difficulty breathing.

ANSWER:

- epinephrine
- histamine
- acetylcholine (ACh)
- an increase in the parasympathetic nervous system

Correct

Yes, during an allergic reaction, there is increased resistance in the bronchioles and epinephrine dilates the bronchioles, thus making it easier to breathe. Epinephrine is released from the adrenal gland during stressful situations. People with severe allergies carry an EpiPen in case the allergic reaction produces anaphylaxis.

Part E

If the transpulmonary pressure equals zero, what will happen to the lung?

Hint 1.

The transpulmonary pressure is the difference between the intrapulmonary and intrapleural pressures.

ANSWER:

- lung volume will stay the same
- lungs will collapse
- lungs will inflate

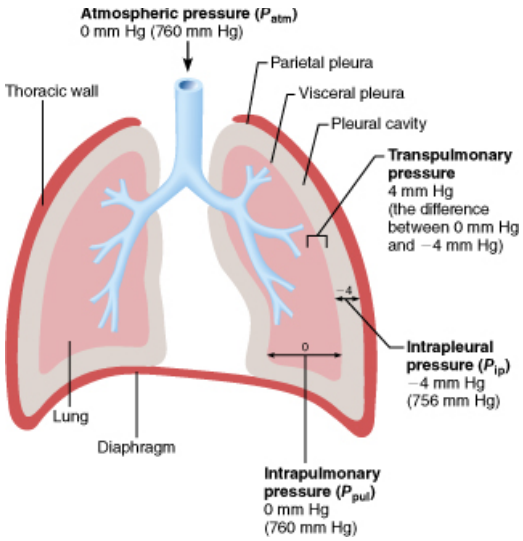
Correct

Yes, the transpulmonary pressure creates the suction that keeps the lungs inflated. When room air enters the pleural space, transpulmonary pressure is zero and the lungs deflate – this is known as a pneumothorax.

Art Question Chapter 22 Question 13

Part A

Which of the following pressures rises and falls with the phases of breathing, but eventually equalizes with the atmospheric pressure?



ANSWER:

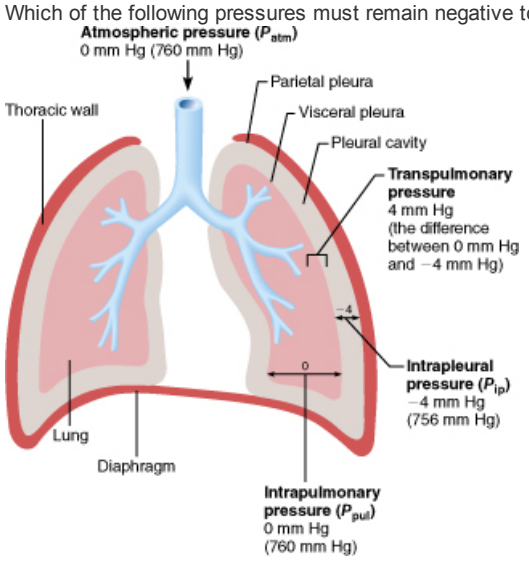
- transpulmonary pressure
- intrapulmonary pressure
- intrapleural pressure
- atmospheric pressure

Correct

Art Question Chapter 22 Question 14

Part A

Which of the following pressures must remain negative to prevent lung collapse?



ANSWER:

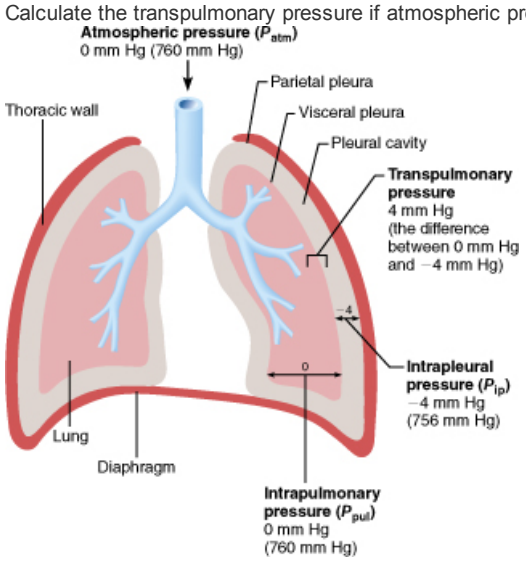
- transpulmonary pressure
- intrapleural pressure
- atmospheric pressure
- intrapulmonary pressure

Correct

Art Question Chapter 22 Question 15

Part A

Calculate the transpulmonary pressure if atmospheric pressure is 755 mm Hg.



ANSWER:

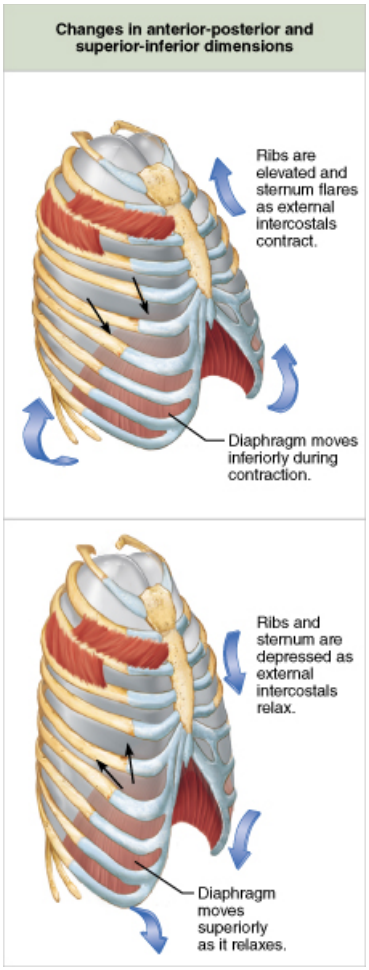
- -1 mm Hg
- -4 mm Hg
- 9 mm Hg
- 4 mm Hg

Correct

Art Question Chapter 22 Question 16

Part A

Which of the following gives the relationship between the pressure and volume of a gas?



ANSWER:

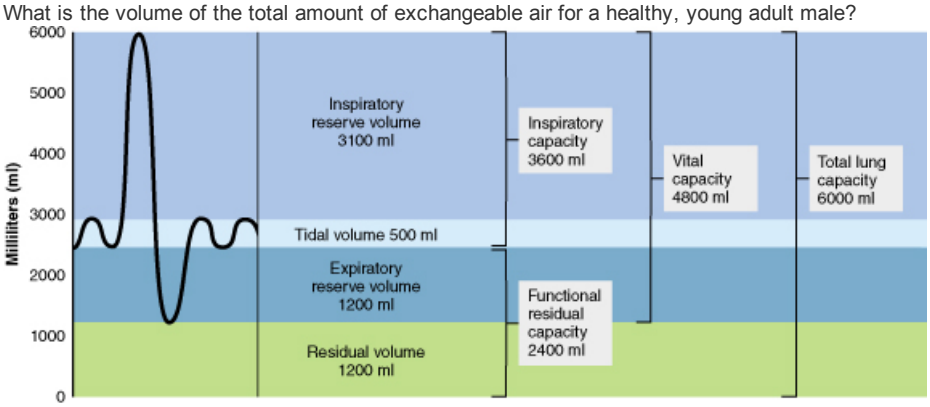
- Boyle's law
- Dalton's law of partial pressures
- Haldane effect
- Henry's law

Correct

Art Question Chapter 22 Question 19

Part A

What is the volume of the total amount of exchangeable air for a healthy, young adult male?



(a) Spirographic record for a male

ANSWER:

- 4800 ml
- 6000 ml
- 3600 ml
- 2400 ml

Correct

Chapter 22 Chapter Test Question 11

Part A

Which form of CO_2 transport accounts for the least amount of CO_2 transported in blood?

ANSWER:

- chemically bound to hemoglobin
- dissolved in plasma
- as bicarbonate ion in plasma
- as carbon monoxide in plasma

Correct

Chapter 22 Reading Quiz Question 3

Part A

What is the most immediate driving force behind pulmonary ventilation?

ANSWER:

- intrapulmonary pressure change
- air sac contraction
- smooth muscle contraction
- environmental stimuli

Correct

Chapter 22 Reading Quiz Question 10

Part A

What is the amount of air that can be exhaled with the greatest possible exhalation after the deepest inhalation called?

ANSWER:

- tidal volume
- expiratory reserve volume
- vital capacity
- inspiratory reserve volume

Correct

Chapter 22 Homeostatic Imbalance Question 9

Part A

In babies born prematurely, pulmonary surfactant may not be present in adequate amounts _____.

ANSWER:

- in the conducting zone structures of the lungs
- due to insufficient exocytosis in the type II alveolar cells
- to permit adequate surface tension in the alveoli
- because the presence of collapsed alveoli prevents surfactant production

Correct

Type II alveolar cells make surfactant. Without surfactant, the surface tension created by the water vapor within the alveoli would cause them to collapse.

Chapter 22 Multiple Choice Question 22

Part A

Which of the following determines lung compliance?

ANSWER:

- flexibility of the thoracic cage
- muscles of inspiration
- airway opening
- alveolar surface tension

Correct

Chapter 22 Multiple Choice Question 30

Part A

The amount of air that can be inspired above the tidal volume is called _____.

ANSWER:

- vital capacity
- reserve air
- inspiratory reserve
- expiratory capacity

Correct

Chapter 22 True/False Question 19

Part A

Atelectasis (lung collapse) renders the lung useless for ventilation.

ANSWER:

- (•) True
- ( ) False

Correct

Chapter 22 Chapter Test Question 15

Part A

Dalton's law of partial pressures states that the total pressure exerted by a mixture of gases is the sum of the pressures exerted independently by each gas in the mixture.

ANSWER:

- (•) True
- ( ) False

Correct

Chapter 22 Homeostatic Imbalance Question 13

Part A

Emphysema can result in an _____.

ANSWER:

- ( ) increased level of carbaminohemoglobin
- ( ) increased level of deoxyhemoglobin
- ( ) increased likelihood of the skin of Caucasians developing a slightly blue coloration
- (•) All of the listed responses are correct.

Correct

Using your textbook, review the structure of hemoglobin and how oxygen and carbon dioxide bind. Additionally review the pathophysiology of emphysema.

Chapter 22 Multiple Choice Question 14

Part A

The local matching of blood flow with ventilation is _____.

ANSWER:

- (•) ventilation-perfusion coupling
- ( ) the Bohr effect
- ( ) chloride shifting
- ( ) the Haldane effect

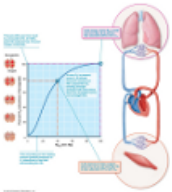
Correct

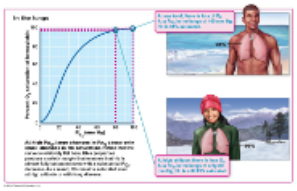
Focus Figure 22.20: The Oxygen-Hemoglobin Dissociation Curve

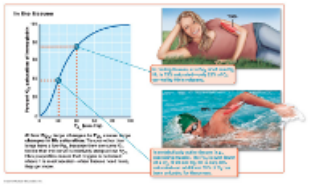
The amount of oxygen carried by hemoglobin depends on the P_{O_2} (the amount of oxygen) available locally. This relationship ensures optimal oxygen pickup and delivery.

The oxygen-hemoglobin dissociation curve will help you understand how the properties of hemoglobin (Hb) affect oxygen binding in the lungs and oxygen release in the tissues.

Read through Focus Figure 22.20 Part 1, Part 2, Part 3.

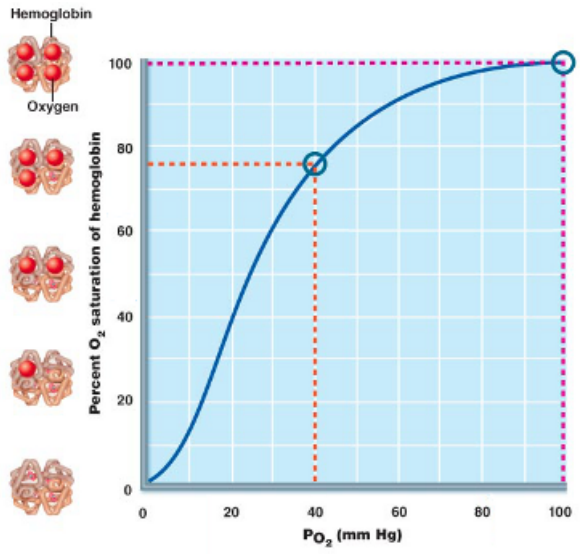






Focus your attention on the graph of the percent of O_2 saturation of hemoglobin plotted against P_{O_2} (mm Hg) on the left side. Then complete the activities and questions below.

Part A - Hemoglobin Saturation



Focus your attention on the graph above, from the left side of the Focus Figure. The percent of O_2 saturation of hemoglobin is plotted (on the y-axis) against P_{O_2} (mm Hg) (on the x-axis). Use this graph to complete Parts A-C below. On this graph, the y-axis (the vertical edge) tells you how much O_2 is bound to hemoglobin (Hb). At 100%, each Hb molecule has four bound oxygen molecules. The x-axis (the horizontal edge) tells you the relative amount (partial pressure) of O_2 dissolved in the fluid surrounding the Hb.

If more O_2 is present, more O_2 is bound. However, because of Hb's properties (O_2 binding strength changes with saturation), this is an S-shaped

curve, not a straight line.

Which of the following represents a correct statement about data presented in the graph?

Hint 1. Binding sites

There are four irons in hemoglobin, one on each polypeptide chain. Each site can bind one oxygen. If more oxygen is present in blood, more oxygen is bound. After the binding of the first oxygen, the hemoglobin changes shape and the binding of additional oxygens is facilitated, giving an S-shaped curve.

Hint 2. P_{O_2} concentrations

The oxygen dissolved in the fluid bathing the hemoglobin protein is referred to as the partial pressure of oxygen, P_{O_2}, and determines hemoglobin binding. If more O_2 is present, more O_2 is bound.

ANSWER:

- In blood with 60% oxygen saturation of hemoglobin, each individual hemoglobin binds ~2.5 oxygens.
- In blood with a P_{O_2} of 30 mm of Hg, the average saturation of all hemoglobin proteins is 60%.
- In blood with 30% oxygen saturation of hemoglobin, there is a P_{O_2} of ~60 mm Hg in surrounding fluid.
- Blood with three oxygens per hemoglobin represents a saturation of P_{O_2} at ~30 mm Hg.

Correct

Cooperative binding of oxygen to an individual hemoglobin protein occurs with one oxygen per hemoglobin representing 25% saturation; two oxygens per hemoglobin, 50%; three oxygens per hemoglobin, 75%; and four oxygens per hemoglobin, 100% saturation. Only collectively with all hemoglobins can there be percentages in between, as seen in the S-shaped curve graph of saturation plotted against P_{O_2} of blood.

Part B - Hemoglobin Saturation

Using the same graph as in Part A above, what is the average number of oxygens bound to hemoglobin at a saturation of 50%?

Hint 1. Binding sites

There are four irons in hemoglobin, one on each polypeptide chain. Each site can bind one oxygen. If more oxygen is present in blood, more oxygen is bound. After the binding of the first oxygen, the hemoglobin changes shape and the binding of additional oxygens is facilitated, giving an S-shaped curve.

Hint 2. P_{O_2} concentrations

The oxygen dissolved in the fluid bathing the hemoglobin protein is referred to as the partial pressure of oxygen, P_{O_2}, and determines hemoglobin binding. If more O_2 is present, more O_2 is bound, and the binding strength of oxygen changes with saturation.

ANSWER:

- 2
- 1
- 3
- 4

Correct

Binding of oxygen to an individual hemoglobin protein occurs at one oxygen per hemoglobin representing 25% saturation; two oxygens per hemoglobin, 50%; three oxygens per hemoglobin, 75%; and four oxygens per hemoglobin, 100% saturation. If an average of two oxygens are bound in all hemoglobins collectively, there is 50% saturation, shown at a blood P_{O_2} of 25 mm of Hg.

Part C - Hemoglobin Saturation

Using the graph in Part A above as reference, drag the correct value item of P_{O_2} mm Hg to the correct target molecule of hemoglobin.

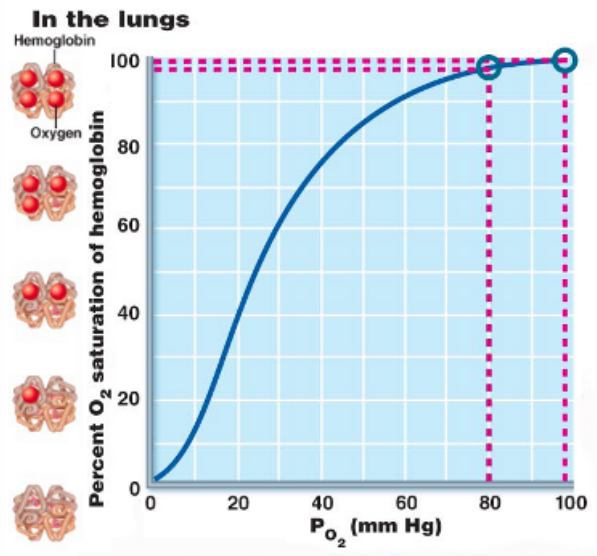
Hint 1. Hemoglobin saturation

The partial pressure of oxygen dissolved in fluid surrounding hemoglobin determines the percent saturation of hemoglobin with oxygen. The oxygen saturation of hemoglobin versus P_{O_2} in mm Hg graphs as an S-shaped curve, due to cooperative changes in binding strength with saturation.

ANSWER:

Correct

Part D - Hemoglobin Saturation in the Lungs



Focus your attention on the graph above, from the top right box, "In the Lungs," of the Focus Figure.

Drag and drop the numerical terms to the appropriate blank target locations in the sentences. Terms may be used once, more than once, or not at all.

Hint 1. Changes in P_{O_2} in the lungs

Changes in P_{O_2} in the airways and subsequently in the blood between 80-100 mm Hg cause little change in hemoglobin saturation. Binding is highest and changes the least in blood locations where the P_{O_2} is highest.

Hint 2. Changes in hemoglobin saturation in the lungs

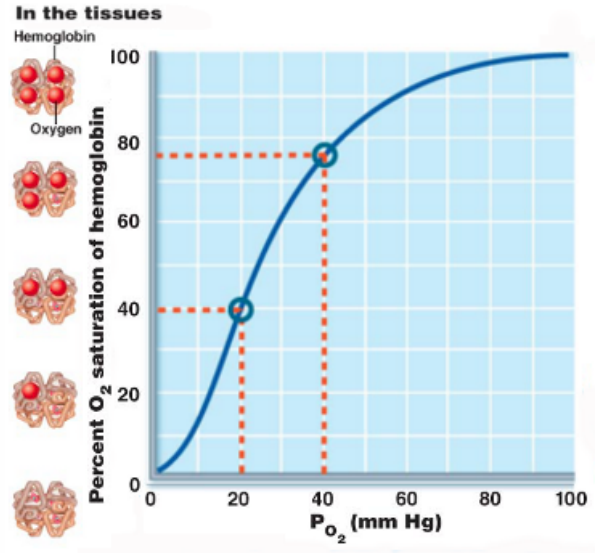
The saturation of hemoglobin in blood at the lungs remains at four oxygens per hemoglobin or 98% at sea level, and decreases only slightly at a high altitude, changing little over 20 mm Hg of P_{O_2} change. Even at a low P_{O_2} of 60mm Hg in the lungs, hemoglobin is still 90% saturated. The flat slope resulting from cooperative hemoglobin binding ensures more likely hemoglobin saturation.

ANSWER:

Correct

Part E - Comparison of Oxygen Binding in Resting and Metabolic Tissue

Focus your attention on the graph above, from the lower right box, "In the Tissues," of the Focus Figure.



Sort the correct pressures into the appropriate bins that represent tissue descriptions.

Hint 1. Changes in P_{O_2} at resting and metabolic tissues

In resting tissues of the body other than the lungs, the P_{O_2} is lower [~40 mm Hg], and Hb has a lower saturation with oxygen, 75% or three oxygens. At 100% saturation of hemoglobin, the fourth oxygen can dissociate most easily, as seen by the flat slope. Notice the steep slopes at 75% and at 50% O_2 saturations, indicating increased unloading of oxygen as P_{O_2} decreases.

Hint 2. Changes in hemoglobin saturation at resting and metabolic tissues

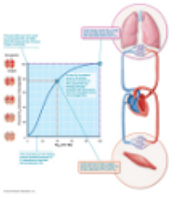
Delivery of oxygen to active metabolic tissue increases or favors oxygen dissociation when hemoglobin is in the lower P_{O_2} environment of actively metabolic tissue. The steep slope of binding saturation versus P_{O_2} mm Hg favors delivery of oxygen to tissue, from 75% down to 40% O_2 saturation.

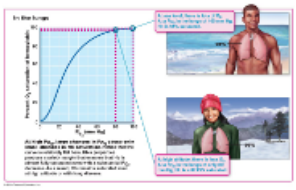
ANSWER:

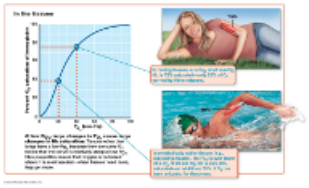
Correct

Part F - Conclusion: Oxygen-Hemoglobin Dissociation Curve

Focus your attention again on Focus Figure 22.20.
Focus Figure 22.20 Part 1, Part 2, Part 3.







A fireman breathes in air normally as he enters a building following an explosion and fire. He has a meter that predicts the P_{O_2} will approximate 15 mm Hg in his tissue fluids as he actively moves about the room.

Select the best statement.

Hint 1. Hemoglobin saturation in exercising tissue

Each of the four iron sites of hemoglobin can bind one oxygen, depending on the P_{O_2} of the surrounding solution. As P_{O_2} in active tissue decreases from 40mm down to 20 mm, the slope is steep, and decreased changes in oxygen binding to hemoglobin are marked, down to 40% in exercising muscle.

Hint 2. Changes in saturation at low P_{O_2}

Metabolically active tissues consume oxygen and have a lower P_{O_2} than the lungs. At low P_{O_2}, large changes in P_{O_2} cause large changes in oxygen binding to hemoglobin, shown in the steep slope below 75% saturation.

ANSWER:

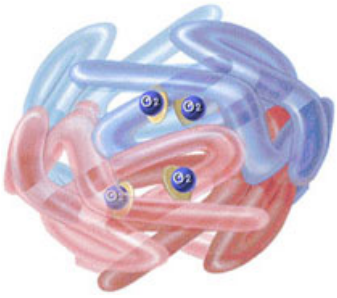
- The fireman's hemoglobin saturation will be about one oxygen per hemoglobin, and he will require an external air tank.
- The fireman is at about 10% hemoglobin O_2 saturation, and he requires an external air tank.
- The S-shaped saturation curve of hemoglobin is flat at this P_{O_2}, and O_2 saturation doesn't change much with P_{O_2} changes in mm Hg.
- The large changes in P_{O_2} tissue environments cause only very small changes in hemoglobin O_2 saturation, and no oxygen is needed.

Correct

An O_2 saturation of hemoglobin of ~25% is insufficient for the fireman moving about the room, and he should use external oxygen.

IP: Gas Transport

Click on the link or the image below to explore gas transport in Interactive Physiology (IP), then answer the questions to the right.
IP: Gas Transport



Part A

If a red blood cell is 100% saturated, how many molecules of O2 are bound to it?

Hint 1.

There are 4 heme groups per hemoglobin molecule. There are 250 million molecules of hemoglobin in each red blood cell.

ANSWER:

- 1 billion molecules of O_2
- 250 million molecules of O_2
- 4 molecules of O_2

Correct

Yes, there are 4 heme groups in each hemoglobin molecule and there are 250 million hemoglobin molecules in each red blood cell.

Part B

From the oxygen-hemoglobin dissociation curve, hemoglobin is _____ when the partial pressure of oxygen is 40 mm Hg. Would this be in the lungs, inactive tissues, or active tissues?

Hint 1.

Consider the shape of the oxygen-hemoglobin dissociation curve. Where would the partial pressure of oxygen be 40 mm Hg? Would increased activity increase or decrease the amount of saturation of hemoglobin?

ANSWER:

- 75% saturated; in the inactive tissues
- 98% saturated; in the active tissues
- 75% saturated; in the active tissues
- 35% saturated; in the active tissues

Correct

Yes, hemoglobin saturation would be 75% when the partial pressure of oxygen is 40 mm Hg and this would be in the inactive tissues. Active tissues would have a lower saturation.

Part C

Predict which way exercise would shift the oxygen-hemoglobin dissociation curve. Would this shift in the curve increase or decrease hemoglobin saturation?

Hint 1.

Exercise would increase body temperature, PCO_2, and BPG and decrease pH. Consider that hemoglobin saturation is inversely related to oxygen availability to the tissues.

ANSWER:

- The curve would shift to the left thus decreasing the hemoglobin saturation.
- The curve would shift to the right thus decreasing the hemoglobin saturation.
- The curve would shift to the left thus increasing the hemoglobin saturation.
- The curve would shift to the right thus increasing the hemoglobin saturation.

Correct

Yes, exercise shifts the curve to the right, making more oxygen available to the tissues.

Part D

How is the majority of CO_2 transported in blood?

Hint 1.

CO_2 is transported as part of a molecule that acts as a buffer to control pH.

ANSWER:

- bound to the heme portion of hemoglobin
- dissolved in the plasma
- converted to and transported as bicarbonate ions
- bound to the globin portion of hemoglobin

Correct

Yes, 70% of CO_2 is converted to bicarbonate ions in the red blood cells. The bicarbonate then moves out of the red blood cell into the plasma.

Part E

In the lungs, O_2 loading facilitates CO_2 unloading from hemoglobin. This is known as _____.

Hint 1.

This explains how CO_2 is influenced by O_2 – not how O_2 is influenced by CO_2.

ANSWER:

- the Bohr effect
- the chloride shift
- cooperativity or positive cooperativity
- the Haldane effect

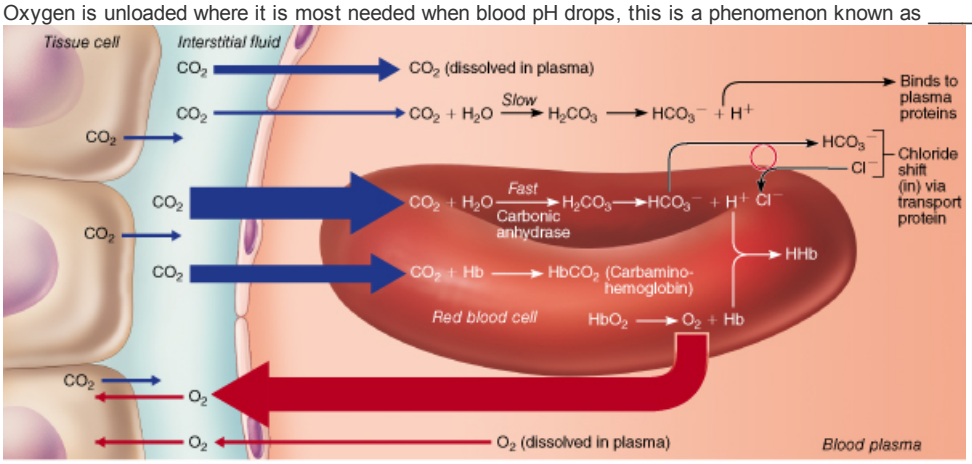
Correct

Yes, the Haldane effect states that the amount of CO_2 carried in the blood is influenced by the amount of O_2 carried in the blood. Thus, O_2 loading facilitates CO_2 unloading.

Art Question Chapter 22 Question 22

Part A

Oxygen is unloaded where it is most needed when blood pH drops, this is a phenomenon known as _____.



(a) Oxygen release and carbon dioxide pickup at the tissues

ANSWER:

- ventilation-perfusion coupling
- the Bohr effect
- a chloride shift
- the Haldane effect

Correct

Chapter 22 Multiple Choice Question 25

Part A

Possible causes of hypoxia include _____.

ANSWER:

- too little oxygen in the atmosphere
- getting very cold
- obstruction of the esophagus
- taking several rapid deep breaths

Correct

Chapter 22 True/False Question 22

Part A

As carbon dioxide enters systemic blood, it causes more oxygen to dissociate from hemoglobin (the Haldane effect), which in turn allows more CO_2 to combine with hemoglobin and more bicarbonate ion to be generated (the Bohr effect).

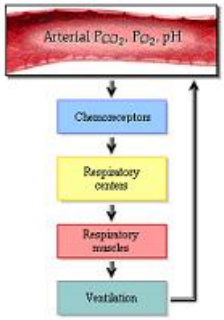
ANSWER:

- True
- False

Correct

IP: Control of Respiration

Click on the link or the image below to explore Control of Respiration in Interactive Physiology (IP), then answer the questions to the right.
IP: Control of Respiration



Part A

What area in the brain sets the respiratory rhythm?

Hint 1.

This center is located in the medulla oblongata.

ANSWER:

- ventral respiratory group (VRG)
- hypothalamus
- dorsal respiratory group (DRG)
- pontine respiratory group (PRG)

Correct

Yes, the VRG is the rhythm-generating center in the medulla.

Part B

Inspiratory neurons send information to the diaphragm via what nerve?

Hint 1.

This nerve originates mainly from the 4th cervical nerve (3rd and 5th cervical nerves to a lesser extent). Stimulation of this nerve causes the diaphragm to contract.

ANSWER:

- phrenic nerve
- vegus nerve
- glossopharyngeal nerve
- intercostal nerves

Correct

Yes, the phrenic nerve innervates the diaphragm. Stimulation causes the diaphragm to contract (increasing volume and decreasing pressure), thus causing inspiration.

Part C

What directly stimulates the central chemoreceptors, thus increasing respiration?

Hint 1.

This is an ion not a gas.

ANSWER:

- high CO_2 (carbon dioxide)
- low O_2 (oxygen)
- high pH
- H^+ (hydrogen ions)

Correct

Yes, hydrogen ions (H^+) stimulate the central chemoreceptors. CO_2 is converted to H^+ in the extracellular fluid of the brain.

Part D

As a result of hyperventilation, what will happen to the partial pressures of CO_2 (pCO_2) and pH?

Hint 1.

If you increase respiration, will you retain more or get rid of more CO_2?

ANSWER:

- increased pCO_2 and increased pH
- decreased pCO_2 and increased pH
- decreased pCO_2 and decreased pH
- increased pCO_2 and decreased pH

Correct

Yes, pCO_2 would decrease and pH would increase. As CO_2 is blown off, H^+ would decrease, thus increasing pH.

Part E

Which receptors inhibit inspiration during hyperinflation of the lungs?

Hint 1.

This reflex is known as the inflation reflex or the Hering-Breuer reflex.

ANSWER:

- pulmonary stretch receptors
- Hypothalamic receptors
- irritant receptors
- peripheral chemoreceptors

Correct

Yes, inspiration stimulates the pulmonary stretch receptors (PSRs), which send input to the respiratory centers, inhibiting further inspiration.

Part F

What stimulates increased respiration at the beginning of exercise?

Hint 1.

This would be before you have generated much CO_2.

ANSWER:

- decreased plasma oxygen levels
- increased plasma carbon dioxide levels
- increased hydrogen ion levels
- sensory input from receptors in joints, neural input from the motor cortex, and other factors

Correct

Yes, at the beginning of exercise, blood gases have not changed; thus, other factors such as anticipation of exercise contribute to the increase in respiration.

Part G

A homeostatic control mechanism controls respiration. What acts as the effector(s) in this system?

Hint 1.

A homeostatic control mechanism involves the receptors (sensors), the control center, and the effectors (which effect the change).

ANSWER:

- peripheral chemoreceptors
- respiratory muscles
- central chemoreceptors
- medulla oblongata

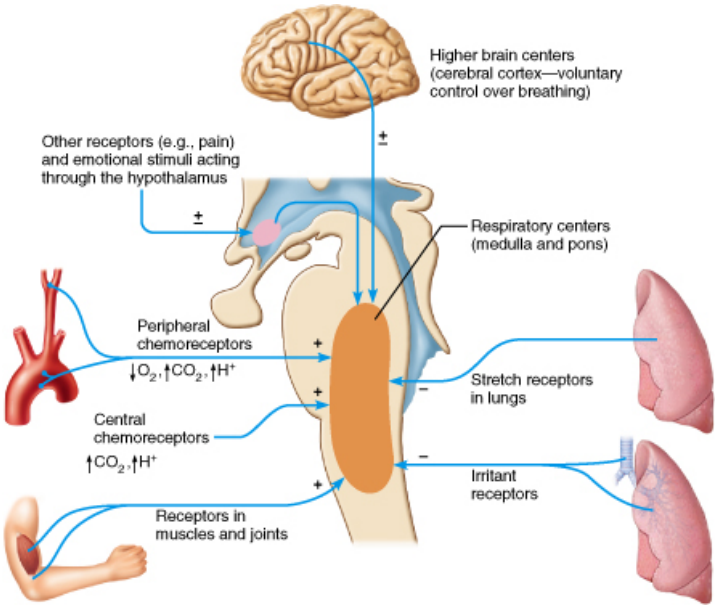
Correct

Yes, the respiratory muscles change the volume of the thoracic cavity (and thus the pressure), resulting in inspiration and expiration.

Art Question Chapter 22 Question 28

Part A

Which of the following stimuli is the *most* powerful respiratory stimulant to increase respiration?



ANSWER:

- a rise in body temperature
- rising carbon dioxide levels
- an increase in blood pH
- arterial pH

Correct

Chapter 22 True/False Question 20

Part A

The Hering-Breuer reflex is a potentially dangerous response that may cause overinflation of the lung.

ANSWER:

- True
- False

Correct

Score Summary:

Your score on this assignment is 96.3%.
You received 43.34 out of a possible total of 45 points.