

Chapter 7: Review Answers

Student Textbook pages 264–265

Answers to Understanding Concepts Questions

- nasal cavity, pharynx, larynx, glottis, bronchiole, alveoli
- (a) False: Respiration can be divided into internal and external respiration.

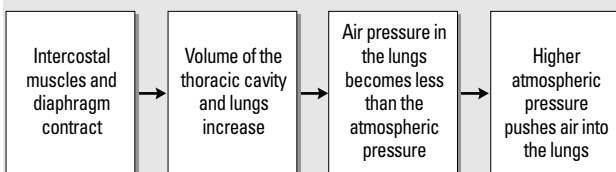
(b) True

(c) False: Air enters the lungs when air pressure inside the lungs is less than the air pressure in the external environment.

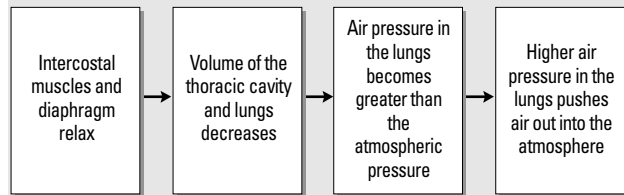
(d) False: The tidal volume is the amount of air inhaled and exhaled during one normal breath.

3. Stages in the process of respiration:

- Breathing involves two basic processes: inspiration (breathing in) and expiration (breathing out, or exhaling).
 - External respiration is the process by which oxygen and carbon dioxide are exchanged between the air and the blood.
 - Internal respiration is the process by which oxygen and carbon dioxide are exchanged between the body's tissue cells and the blood.
 - Cellular respiration is the series of energy-releasing chemical reactions that take place inside the cells. Cellular respiration is the final stage in respiration. It is the sole means for providing energy for all cellular activities.
- 4.** The two basic requirements of a gas exchange system are (a) a large enough surface area for the quick and efficient exchange of gases; and (b) for internal respiration to take place a moist environment. Alveoli are thin-walled structures that are surrounded by capillaries. There are about 300 million alveoli in each lung, providing a large surface area for gas exchange. The alveoli of human lungs are lined with a thin film of water provided by the water vapour added to air as it passes through the respiratory tract.
- 5.** Lower respiratory system diseases include:
- Pneumonia: Alveoli fill with thick fluid, making gas exchange difficult.
 - Bronchitis: Airways are inflamed due to infection or an irritant. Air flow into and out of the thoracic cavity is impaired.
 - Asthma: Airways are inflamed due to irritation, and bronchioles constrict due to muscle spasms. Obstruction of the airway makes breathing difficult.
 - Emphysema: Alveoli burst and fuse into enlarged spaces. Surface area is greatly reduced, making gas exchange difficult.
- 6.** Lung cancer is the uncontrolled and invasive growth of abnormal cells in the lungs. The abnormal cells multiply and form a malignant tumour, or carcinoma. The carcinoma continues to grow and invade surrounding tissues, including lymphatic tissue and blood vessels. These vessels carry the cancerous cells to new locations.
- 7.** Inspiration: The intercostal muscles contract, lifting the rib cage up and out. At the same time, the diaphragm contracts and pulls downward. As the air pressure inside the thoracic cavity decreases, air will move into the lungs from the environment.



Expiration: The intercostal muscles relax, allowing the rib cage to return to its normal position. The diaphragm also relaxes and resumes its domed shape. As pressure in the thoracic cavity increases, air moves from the lungs into the environment.



8. Look for any **two** of the following:

Benefits of quitting smoking:

- reduced chances of developing lung cancer and / or emphysema
- improved breathing
- chest infections and colds become less frequent
- reduction in chronic bronchitis (smokers' cough)
- the smell of stale tobacco on clothes, hair, breath, and face is gone
- food tastes and smells much better

Aids to help with quitting:

- nicotine replacement therapies (nicotine gum, nicotine patches, nicotine inhalers)
- non-nicotine based prescription medication

- 9. (a)** Dissolving is the process of going into a solution. Carbon dioxide, for example, dissolves in the water (blood) and is transported from the cells of the body to the lungs.
- (b)** Diffusion is the movement of particles from a region of higher concentration to a region of lower concentration. Oxygen gas, for example, diffuses into the plasma and then into the red blood cells in the capillaries surrounding the alveoli in the lungs.

Answers to Applying Concepts Questions

- 10. (a)** Answers should indicate that they are using volumes associated with a normal breath. Tidal Volume = 4000 mL – 3400 mL = 600 mL
- (b)** In most cases there are approximately 3 breaths every 12 seconds or 15 breaths per minute. The following is a calculation that students might use to arrive at an answer:
- $$\frac{3 \text{ breaths}}{12 \text{ s}} = \frac{x}{60 \text{ s}}$$
- $$12 x = 3 \times 60$$
- $$\frac{12 x}{12} = \frac{180}{12}$$
- $$x = 15 \text{ breaths}$$

(c) The total lung capacity of a smoker will be significantly less than the vital capacity of a non-smoker.

11. This breathing pattern would force a maximum amount of carbon dioxide out of the lungs after a deep exhalation. This would lower the concentration of carbon dioxide in the alveolar air and facilitate the diffusion of carbon dioxide out of the blood. The deep inhalation would also have a similar effect, bringing more oxygen into the lungs and increasing the concentration gradient, thus allowing more oxygen into the blood and to the body cells.

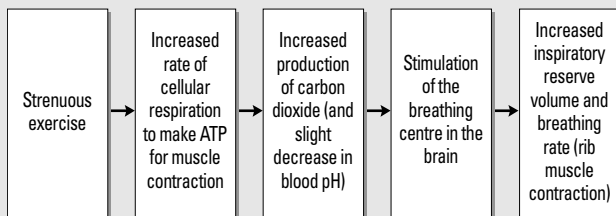
12. The key points that should be included in the answer include:

- External respiration is the process by which oxygen and carbon dioxide are exchanged between the air and the blood.
- Diagram should show oxygen diffusing from the alveoli into the capillaries that surround each alveolus.
- Diagram should show carbon dioxide diffusing from the capillaries into the alveoli.

13. Here is one example of an acceptable answer: You cannot smell many pollutants in the air that may affect your respiratory system. One example of this is carbon monoxide, which is a colourless, odourless gas that can kill you. It binds to hemoglobin in the red blood cells, which prevents the exchange of gases during external respiration.

14.

How Increased Waste Product from Cellular Respiration (Not Oxygen Concentration) during Strenuous Exercise Increases Inspiratory Reserve Volume and Rate of Breathing



Note: Low oxygen concentration in the blood is not the stimulus that increases breathing rate during strenuous exercise.

15. Swimmers and divers hyperventilate to remove as much carbon dioxide gas from their body as possible. They can stay underwater longer because it takes longer for the carbon dioxide levels to build up to the point where breathing is triggered.

16. (a) The Heimlich manoeuvre puts upward pressure on the diaphragm, and this decreases the volume of the thoracic cavity. This would help to force air out of the lungs, and the air may push the food out of the person's trachea.

(b) Giving water to a choking individual would not be a good idea because drinking water would not open the airway. Water will compound the choking problem, as the digestive system and respiratory system share a common opening called the pharynx. You would now have to clear the airway of the food and the water!

(c) Normal air is 21% oxygen and 0.04% carbon dioxide; respirator air is 95% oxygen and 5% carbon dioxide. Oxygen is given to treat patients with insufficient oxygen in the blood. Patients should initially be given a high concentration to restore the concentration of oxygen in the blood. The 5% carbon dioxide medical gas mixture is to stimulate respiration after a period of reduced airflow into the lungs.

17. (a) The smoker's cough is caused by the paralysis of the cilia lining the trachea and bronchial tubes. This allows the build-up of tar and mucus in the lungs. When cilia are covered with pollutants, they do not remove the mucus and contents of the cigarette smoke effectively from the airway. This build-up irritates the lungs, and the smoker has to cough in an attempt to clear the tar and mucus out of the lungs and airways.

(b) You would expect a smoker to cough up mucus as well as the tar and other chemicals found in cigarette smoke.

(c) Students could identify emphysema or lung cancer as possible diseases caused by smoking. Emphysema is an obstructive respiratory disorder in which the walls of the alveoli break down and lose their elasticity. This reduces the surface area for gas exchange and causes oxygen shortages in the tissues. Exhaling becomes difficult because of the loss of elasticity, so breathing is laboured.

Lung cancer is the uncontrolled and invasive growth of abnormal cells in the lungs. The abnormal cells multiply and form malignant tumours or carcinomas. The tumours reduce the surface area available for gas exchange and may stop air from entering the bronchioles. Growing tumours may damage tissue or produce toxins that are harmful to lung cells.

Answers to Making Connections Questions

18. Respiratory disorders that are linked to the environment include emphysema, lung cancer, chronic bronchitis, and asthma. Students should link the disorder to a suspected environmental cause or trigger. Smoking, air pollution, and allergens are three examples that students may include in their answer.

19. Taking frequent, shallow breaths would be better than taking deep breaths because this reduces the respiratory efficiency of the lungs. As a result, less polluted air will diffuse across the alveolar membrane and into the blood.

- 20. (a)** When air enters directly into the trachea through the tracheotomy, the warming, moisturizing, and cleaning effects of the nose and turbinate bones is lost.
- (b)** The tracheal cover may be fitted with a small filter to clean the air, moisture (water vapour) may be added to the air, and / or the air may be warmed.
- 21. (a)** The parts of the respiratory system affected by pharyngitis are the pharynx, nasal passages, and trachea.
- (b)** The symptoms of this disease are a sore throat, a runny nose, and a cough.
- sore throat—the pharynx is the common opening of the respiratory and digestive system. An infection will result in swelling and irritation of the membranes lining the pharynx.
 - runny nose—inflammation and the production of extra mucus occur in the mucus membranes lining the nasal passages
 - cough—a cough is a protective mechanism that helps clear the extra mucus and other irritants from the airway.