

## Review questions for Respiratory system lecture

### Multiple choice review questions

- 1) The cilia hairs and mucus of the conducting passages
  - A) filter impurities from the inspired air.
  - B) reduce pulmonary pressure.
  - C) reduce the surface tension in the alveoli.
  - D) keep the lungs moist so gas diffusion can occur.
  
- 2) The conducting passages of the respiratory system do not
  - A) warm the inspired air.
  - B) exchange gases with the blood.
  - C) clean the inspired air.
  
- 3) Alveoli are microscopic air sacs branching off the
  - A) bronchi.
  - B) bronchioles.
  - C) tracheary elements.
  - D) epiglottis.
  
- 4) The ability of the lung to return to its normal size after stretching is known as
  - A) resilience.
  - B) compliance.
  - C) capacitance.
  - D) elasticity.
  
- 6) A chest wound can introduce air into the pleura space, leading to a collapsed lung, a condition known as
  - A) intrapleural pressure.
  - B) respiratory distress syndrome.
  - C) pneumothorax.
  - D) decompression sickness.
  
- 7) Expansion of the lungs produces \_\_\_\_\_ pressure in the lungs.
  - A) positive
  - B) negative
  - C) constant
  - D) saturated

- 13) The diffusion of oxygen from the alveoli into the blood of the alveolar capillaries is rapid and involves diffusion across how many layers of cells?
- A) 2
  - B) 3
  - C) 4
  - D) 5
- 15) Bicarbonate ion ( $\text{HCO}_3^-$ ) and hydrogen ( $\text{H}^+$ ) ions result from a reaction of \_\_\_\_ with water.
- A) oxygen
  - B) hydrogen
  - C) carbon dioxide
  - D) carbon monoxide
- 16) Hypoventilation by a person with normal lung function tends to cause
- A) a rise in blood pH.
  - B) increased  $\text{CO}_2$  in the blood
  - C) increased  $\text{O}_2$  in the blood
  - D) acidosis.
  - E) both b and d
- 19) An increase in the amount of \_\_\_\_\_ in the blood will result in \_\_\_\_\_ ventilation.
- A)  $\text{H}^+$ ; increased
  - B) acid; decreased
  - C)  $\text{O}_2$ ; increased
  - D)  $\text{CO}_2$ ; decreased
- 20) Sensory neurons in the breathing control centers of the brain are where the blood is analyzed for
- A) Bicarbonate ion
  - B)  $\text{O}_2$
  - C)  $\text{H}^+$
  - D)  $\text{CO}_2$
- 21) The rate and depth of respiration are set by control centers located in the
- A) pleurae.
  - B) lungs.
  - C) brain stem.
  - D) diaphragm.
- 22) In response to acidosis, ventilation will \_\_\_\_\_. This change in ventilation is called \_\_\_\_\_.
- A) decrease; hypoventilation
  - B) decrease; hyperventilation
  - C) increase; hypoventilation
  - D) increase; hyperventilation

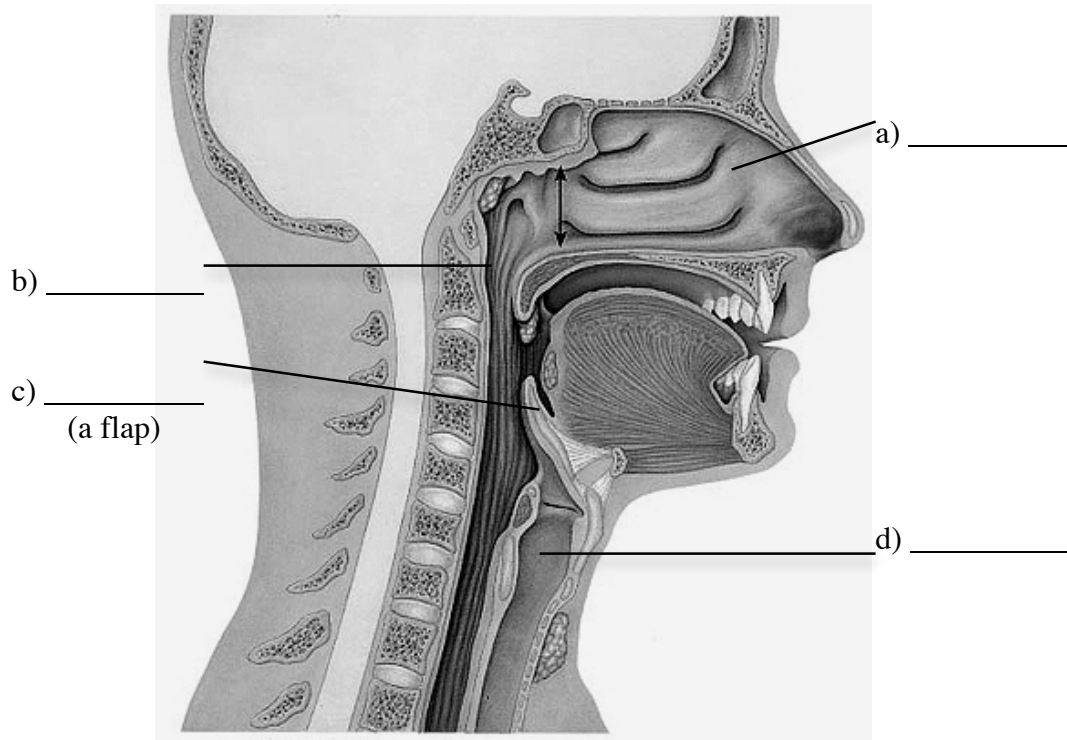
**Answers to multiple choice review questions:**

- |      |       |       |
|------|-------|-------|
| 1) A | 7) B  | 20) C |
| 2) B | 13) A | 21) C |
| 3) B | 15) C | 22) D |
| 4) D | 16) E |       |
| 6) C | 19) A |       |

**Fill-in-the-blank review questions**

- 1) The lungs are normally kept clean because \_\_\_\_\_ located in the \_\_\_\_\_ remove particles and debris from the air that is inspired.
- 2) \_\_\_\_\_ means to breathe in, while \_\_\_\_\_ refers to breathing out.
- 3) The "Adam's apple" refers to the largest cartilage of the \_\_\_\_\_.
- 4) The \_\_\_\_\_ is another term for the windpipe, a sturdy tube supported by rings of cartilage.
- 5) The casual phrase 'voice box' refers to the \_\_\_\_\_.
- 6) At the top of the larynx, the \_\_\_\_\_ acts as a flexible flap that prevents food from entering the larynx.
- 7) The structure on the neck commonly called the Adam's apple is the \_\_\_\_\_.
- 8) The trachea, or windpipe, descends from the larynx into the \_\_\_\_\_ body cavity, where it ends by dividing to give rise to the \_\_\_\_\_.
- 9) The posterior wall of the trachea adjoins the anterior wall of another tube passing through the thoracic cavity, the \_\_\_\_\_, which carries food downward to the stomach.
- 10) Lungs have the property of \_\_\_\_\_ which is the tendency to return to its initial size after being distended (stretched); This property assists in pushing air out of the lungs during expiration.

11) Label the parts of the upper respiratory tract. Use the correct anatomical terms.



12) Bronchi continue to branch until they form \_\_\_\_\_, the smallest conducting passages in the lungs.

13) Bubble-like structures called \_\_\_\_\_ (singular: \_\_\_\_\_) are the only lung structures in which gas exchange with the blood occurs. Air in the bronchi and bronchioles cannot exchange gases with the blood.

14) In the blank spaces after the respiratory system structures below, write a number (from 1 – 8) to show the order that you would encounter them if you were an inhaled molecule of O<sub>2</sub>.

- Bronchiole \_\_\_\_\_
- Epiglottis \_\_\_\_\_
- Pharynx \_\_\_\_\_
- Alveoli \_\_\_\_\_
- Bronchi \_\_\_\_\_
- Trachea \_\_\_\_\_
- Larynx \_\_\_\_\_
- Capillary \_\_\_\_\_

15) Air enters the lungs during inspiration because the pressure in the lungs is \_\_\_\_\_ than the atmospheric air pressure outside the lungs.

- 16) Normal expiration is caused by the \_\_\_\_\_ of the lung tissue and relaxation of the \_\_\_\_\_ and \_\_\_\_\_.
- 18) An unforced, or quiet, inspiration results primarily from the contraction of the \_\_\_\_\_ muscle and the \_\_\_\_\_ muscles, which expand the volume of the lungs.
- 19) Contraction of the diaphragm causes it to move \_\_\_\_\_, resulting in a(n) \_\_\_\_\_ in the size of the thoracic cavity and a(n) \_\_\_\_\_ in pressure within the lungs.
- 20) Contraction of the \_\_\_\_\_ elevates the ribs and sternum, resulting in an increase in the size of the thoracic cavity and a(n) \_\_\_\_\_ in pressure within the lungs.
- 21) Many organs in the body (such as the heart, lungs, and digestive organs) are surrounded by a fluid-filled membrane. What is the term for any fluid filled membrane in the body? \_\_\_\_\_
- 22) Answer the following questions about the serosa that surrounds the lungs.
- a) What is the name of the serosa that surrounds the lungs? \_\_\_\_\_
  - b) The side of the lung serosa that attaches to the lungs is called its \_\_\_\_\_ face.
  - c) The side of the lung serosa that attaches to the walls of the thoracic cavity is called its \_\_\_\_\_ face.
- 23) Pulmonary function tests evaluate respiratory function using a \_\_\_\_\_ to measure respiratory volumes and capacities.
- 33) In the systemic loop, CO<sub>2</sub> moves out of/into (circle one) the blood and oxygen moves out of/into (circle one) of the blood.
- 34) In the pulmonary loop, CO<sub>2</sub> moves out of/into (circle one) the blood and oxygen moves out of/into (circle one) of the blood.
- 35) The partial pressure (concentration) of carbon dioxide in the alveoli is higher/lower (circle one) than in the pulmonary loop arteries.
- 36) The partial pressure of carbon dioxide in the tissue fluid is always higher/lower (circle one) than in the systemic loop arteries.

37) One of the functions of the blood is to transport  $O_2$  from the lungs to the other tissues. Answer the following questions about how the blood carries the oxygen.

a) The blood cell that carries  $O_2$ : \_\_\_\_\_

b) The protein in (a) above that carries  $O_2$ : \_\_\_\_\_

c) The metal atom on (b) above that carries  $O_2$ : \_\_\_\_\_

39) Each molecule of hemoglobin can carry \_\_\_\_\_ (how many?) molecules of oxygen.

40) Most of the carbon dioxide in the blood is transported as \_\_\_\_\_ ion; conversion of carbon dioxide to this ion dramatically increases the amount of  $CO_2$  that the blood can transport because the ion dissolves better in the blood than  $CO_2$ .

42) The chemical reaction that forms carbonic acid is: \_\_\_\_\_.

43) Carbonic acid dissociates to form \_\_\_\_\_ and \_\_\_\_\_. The chemical equation for this reaction is written as \_\_\_\_\_.

44) The carbonic acid, bicarbonate ion, and  $H^+$  in the blood come from  $CO_2$  that is made by the cells. The cells make  $CO_2$  as a waste product of the process of \_\_\_\_\_, which is a process cells use to produce energy for themselves.

45) The breathing control centers are located in the \_\_\_\_\_ region of the body (be as specific as possible).

46) The sensory neurons that monitor the  $O_2$  content of the blood are located in two blood vessels: The \_\_\_\_\_ and the \_\_\_\_\_.

47) When the blood levels of  $CO_2$  rise above normal, the pH of the blood \_\_\_\_\_.

48) Hypoventilation would cause the  $CO_2$  levels to rise in the plasma producing a(n) \_\_\_\_\_ in  $H^+$  concentration.

49) In alkalosis, the blood's pH is \_\_\_\_\_ and the blood's  $H^+$  concentration is \_\_\_\_\_.

50) When the sensory neurons in the breathing control center sense a decrease in the pH of the blood, they signal the inspiratory muscles to \_\_\_\_\_ the breathing rate.

51) When blood pH decreases, breathing rate must be \_\_\_\_\_ to help return the pH to its normal value.

52) When blood pH increases, breathing rate must be \_\_\_\_\_ to help return the pH to its normal value.

53) You are taking care of two patients in the respiratory ward of the hospital. One of your patients has emphysema and the other has chronic bronchitis.

- a) What activity did both patients probably engage in that caused these diseases?
- b) What part of the respiratory system is damaged in emphysema?
- c) What part of the respiratory system is damaged in chronic bronchitis?
- d) Which patient would be able to inhale easier than they would be able to exhale?
- e) Which patient would have equal difficulty inhaling and exhaling?

54) Which two respiratory system disorders that we discussed in class are characterized by inflammation of the bronchi?

\_\_\_\_\_ & \_\_\_\_\_

Circle the one that is usually related to smoking.

55) As of the year 2000, one third of all cancer deaths are due to \_\_\_\_: only one in ten affected individuals is a non-smoker, highlighting the contribution of smoking to the development of the disease.

**Answers to fill-in-the-blank review questions.**

- |  |  |
|--|--|
| 1) Mucus and cilia<br>Conducting passages                            | 12) Bronchioles  |
| 2) Inspiration<br>Expiration   | 13) Alveoli<br>Alveolus                                  |
| 3) Larynx  | 14) 6<br>2   |
| 4) Trachea   | 1  |
| 5) Larynx  | 7  |
| 6) Epiglottis  | 5  |
| 7) Thyroid cartilage   | 3  |
| 8) Thoracic<br>Bronchi   | 4<br>8   |
| 9) Esophagus   | 15) Lower  |
| 10) Elasticity   | 16) Elastic recoil<br>Diaphragm<br>External intercostals |
| 11) A = Nasal cavity<br>B = Pharynx<br>C = Epiglottis<br>D = Trachea | 18) Diaphragm<br>External intercostals                   |

- 19) Down  
Increase  
Decrease
- 20) External intercostals  
Decrease
- 21) Serosa (serous membrane)
- 22) a) Pleura  
b) Visceral pleura  
c) Parietal pleura
- 23) Spirometer
- 33) Into  
Out of
- 34) Out of  
Into
- 35) Lower
- 36) Higher
- 37) Red blood cell  
Hemoglobin  
Iron
- 39) Four
- 40) Bicarbonate ion  $\text{HCO}_3^-$
- 42)  $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$
- 43) Hydrogen ion
- Bicarbonate ion  
 $\text{H}_2\text{CO}_3 \rightarrow \text{H}^+ + \text{HCO}_3^-$
- 44) Cellular aerobic respiration
- 45) Pons and medulla oblongata  
(or the brain stem)
- 46) Aorta  
Carotid arteries
- 47) Decreases
- 48) Increase
- 49) Increased  
Decreased
- 50) Increase
- 51) Increase
- 52) Decrease
- 53) a) Smoking  
b) Walls of the alveoli  
c) Bronchi and Bronchioles  
d) Emphysema  
e) Chronic bronchitis
- 54) Asthma  
Chronic bronchitis (circled)
- 55) Lung cancer

### Short answer review questions:

1) Explain briefly (3-4 sentences) how the respiratory conducting passages keep the lungs free of bacteria and dust. Explain all aspects of this process.

2) A friend of yours, who is into body piercings, says she wants to get her epiglottis removed (because cool people everywhere are doing it!). What lifestyle changes would she have to do if she did have it removed?

3) Your cool body piercing friend now says she wants to get the folds in the inner wall of her larynx removed. What lifestyle changes would she have to do if she did have them removed?

6) What are two functions of the serosa that surrounds the lungs?

7) What is the condition called when the pleura to a lung is punctured (as might happen from a stab wound to the chest)? \_\_\_\_\_. Describe briefly (2 –3 sentences) what happens to the lung when the pleura is punctured and explain why it happens.

8) What is the condition called when too little pleural fluid is made? \_\_\_\_\_. Describe briefly (2 –3 sentences) what happens if too little pleural fluid is made and why it happens.



9) Describe the major symptoms if a person...

- a) Stopped making pleural fluid.
- b) Stopped making conducting passage mucus.
- c) Had their epiglottis stuck in the closed position.

10) In the pulmonary loop,  $\text{CO}_2$  exits the blood and  $\text{O}_2$  enters the blood, whereas in the systemic loop  $\text{CO}_2$  enters the blood and  $\text{O}_2$  exits the blood. What ensures that each gas molecule moves in the proper direction (exiting vs. entering the blood) in each loop?

11) Explain briefly exactly why lack of iron in the diet causes low energy:

12) Use a chemical equation to show how carbonic acid and bicarbonate ion are formed from carbon dioxide entering the blood.

13) Why does holding your breath cause the blood to get acidic?

14) Describe the effects of hyperventilation on blood  $\text{CO}_2$ , blood  $\text{O}_2$ , and blood pH.

15) Describe the effects of hypoventilation on blood  $\text{CO}_2$ , blood  $\text{O}_2$ , and blood pH.

16) If some evil person injected you with a strong acid, one of the ways your body would react would be to hyperventilate. Explain why this would occur. Your answer must include which part of the body and which chemicals in the body regulate breathing rate.

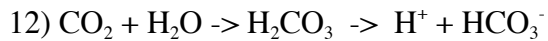
17) Briefly explain (3 or 4 sentences) How hyperventilation causes a increase in blood pH. (Your explanation must include a certain chemical equation we discussed in lecture.)

18) Define the term alkalosis and the term acidosis. Your definitions should include exact pH values.

19) Compare asthma and emphysema in terms of what parts of the respiratory system are not functioning correctly.

### Answers to short answer review questions:

- 1) The air we breathe in contains many contaminating particles (such as dust, soot, spores, pollen, etc.). The conducting passages are lined with a sticky mucus that traps most of the particles before they reach the lungs. To remove the mucus, the cells that line the passages have cilia (small hair-like extensions) that slowly push the mucus upward where it is eventually swallowed.
- 2) She would not be able to eat or drink because the epiglottis keeps food and beverages from entering the windpipe!
- 3) These folds are the vocal cords. Their vibrations are what allow us to say words and make sounds. If they were removed, the person would no longer be able to speak. (Aside: Some dog owners have their dog's vocal cords removed to stop incessant barking).
- 6) The serosa that surrounds the lungs keeps the lungs attached to the wall of the thoracic cavity and the serosa also allows the lungs to slide and expand as we breathe in and out.
- 7) Pneumothorax is the condition where the pleura has been punctured. Pneumothorax causes the lung to collapse. This occurs because the pleural fluid (the fluid that fills the pleura) is required to keep the lungs attached to the wall of the thoracic cavity. When the pleura is punctured, air enters the pleura and replaces part of the fluid. The air can't keep the lung attached to the cavity all so the lungs collapses.
- 8) Pleurisy is the condition where too little pleural fluid is made. Pleurisy causes painful breathing because one function of the pleural fluid is to lubricate the lungs as they slide inside the thoracic cavity during breathing. The lungs scrape against the inner thoracic cavity with every breath if not enough pleural fluid is present.
- 9)
  - a) Painful breathing
  - b) Increased lung infections from inspiration of bacterial and fungal spores.
  - c) Asphyxiation (suffocation) because a closed epiglottis block the windpipe.
- 10) Diffusion ensures that all gas molecules move in the proper direction (exiting vs. entering the blood) in each loop. All dissolved molecules spontaneously move from areas where they are at a high concentration to areas where they are at a low concentration. In the pulmonary loop, CO<sub>2</sub> is at a higher concentration in the blood than in the alveoli of the lungs, therefore it spontaneously diffuses out of the blood. Oxygen, on the other hand, is at a higher concentration in the alveoli than in the blood. This causes it to diffuse into the blood. In the systemic loop the situation is reversed. CO<sub>2</sub> is a higher concentration in the tissues than in the blood, so it enters the blood. Oxygen is at a higher concentration in the blood than in the tissues, so it exits the blood.
- 11) Iron is used by hemoglobin protein to carry oxygen in the blood. If a person has below normal levels of iron in the blood, their cells will receive less oxygen. Since cells use oxygen to make energy for themselves (by the process of cellular aerobic respiration) an iron shortage leads to an energy shortage in the body. This series of events is called iron-poor anemia.



13) One function of breathing is to remove carbon dioxide from the blood. If a person holds their breath,  $\text{CO}_2$  levels in the blood will therefore increase. Because  $\text{CO}_2$  reacts with the water in the blood to form  $\text{H}^+$  (acid), an increase in blood  $\text{CO}_2$  leads to an increase in the blood's acidity.

14) Hyperventilation will decrease blood  $\text{CO}_2$ , increase blood  $\text{O}_2$ , and decrease blood  $\text{H}^+$ .

15) Hypoventilation will increase blood  $\text{CO}_2$ , decrease blood  $\text{O}_2$ , and increase blood  $\text{H}^+$ .

16) Being injected with acid would cause an increase in the blood's  $\text{H}^+$  concentration. The breathing control centers in the brain stem monitor the blood's  $\text{H}^+$  concentration to set breathing rate. An increase in  $\text{H}^+$  concentration causes the breathing control center to increase the breathing rate (hyperventilation).

17) One function of breathing is to remove carbon dioxide from the blood. The faster a person breathes, the more  $\text{CO}_2$  is removed from the blood.  $\text{CO}_2$  reacts with the water in the blood to form  $\text{H}^+$  (acid):



Removing more  $\text{CO}_2$  from the blood (by hyperventilation) therefore also removes  $\text{H}^+$  from the blood. Removing  $\text{H}^+$  from any liquid will increase that liquid's pH.

18) Alkalosis is blood that is more basic than normal blood. The normal pH of blood is 7.4, so alkalosis means blood above pH 7.4. Acidosis is blood that is more acidic than normal blood. The normal pH range of blood is 7.4, so acidosis means blood below pH 7.4.

19) In asthma, the conducting passages (especially the bronchi and trachea) are inflamed and swollen. In emphysema, the alveoli in the lungs are damaged.