

Study Guide Chapter 22
The Respiratory System & Pulmonary Ventilation

1. In physiology we recognize that the word respiration has three meanings. What are the three “types” of respiration?
2. List seven functions performed by the respiratory system?
3. What are the principal organs of the respiratory system? Describe the patterns of flow within the lungs and list the different segments.
4. What is the difference between the conducting division and the respiratory division of the respiratory system? What is the difference between the upper and lower respiratory tract?
5. What is the histology of the cells that line the nasal cavity? What is the function and structure of the olfactory mucosa? What accessory structures associated with the nasal cavity are found in the lamina propria?
6. What is the structure of the erectile tissue associated with inferior concha and explain the function of this tissue? Why is it important?
7. Describe two conditions which might result in epistaxis?
8. What two structures define the superior and inferior margins of the pharynx? What are the three regions within the pharynx? Indicate prominent structures:
9. What happens to the larynx and epiglottis when you swallow?
10. What is the relative relationship between the vestibular folds and the vocal cords? What is the vocal cords and the opening between them called?
11. The common term used to describe the trachea is the “windpipe”.
 - a. How long is the trachea?
 - b. What is the function of the hyaline “C” rings?
 - c. What is the histology of the lining of the trachea?
 - d. What is the mucociliary escalator?
12. You will study in detail the anatomy of the lung in lab. Note:
 - a. What is the hilum?
 - b. How many lobes are in the right and left lung?
 - c. What is the cardiac impression?

- d. What is the inferior end of the trachea called?
13. List all the segments of the bronchial tree between the primary bronchi and the alveolus.
 14. The bronchial tree:
 - a. In which bronchi is aspirated foreign objects more likely to lodge?
 - b. When do you see the absence of C-shaped hyaline cartilages?
 - c. What is the difference between secondary and tertiary bronchi?
 - d. How do pulmonary arteries make their way through the lungs spongy parenchyma?
 - e. What artery provides nutrients to the bronchial tree?
 - f. What is a pulmonary lobule?
 - g. How does the histology change between the terminal bronchioles and the respiratory bronchioles?
 - h. What is the relationship between an alveolar duct and alveolar sacs?
 15. Each human lung is composed of 150 million alveoli which provide about 70 square meters of surface area for diffusion.
 - a. What type of cell form the walls of the alveolus?
 - b. What is pulmonary surfactant?
 - c. Where do you find alveolar macrophages?
 - d. How many alveolar macrophage die in a day and where do they end up?
 - e. What is the respiratory membrane?
 16. What is the difference between the parietal and visceral pleurae?
 - a. What is the pleural cavity?
 - b. What is the function of the pleural fluid?
 17. What defines a respiratory cycle? What is the difference between quiet and forced respiration? What do you need for pulmonary ventilation? (inspiration and expiration)
 18. What type of muscle do you have “in the lungs”? Where within the lungs do you find this muscle? What is the function of this muscle? (smooth muscle / around air conducting pathways / provide resistance to airflow)
 19. Study figure 22.13 to identify the respiratory muscles:
 - a. What type of muscle is responsible for pulmonary ventilation?
 - b. What is the prime mover of pulmonary ventilation? Describe this muscle’s position when at rest.
 - c. What muscles are synergists to the prime mover of pulmonary ventilation?
 - d. What is the function of an accessory muscle of respiration?
 - e. What accessory muscles contract during deep inspiration? Explain their function.

- f. What accessory muscles contract during forced expiration? Explain their function.
19. What is the Valsalva maneuver? What does this maneuver aid?
 20. How is the lung's rhythmic cycle different than the rhythmic cycle of the heart?
 21. How would you describe breathing: voluntary or involuntary?
 22. Study Figure 22.14 to identify the three respiratory control centers and associated structures which influence pulmonary respiration:
 - g. Where is the dorsal respiratory group located?
 - i. What are these neurons called?
 - ii. What happens when these nerves fire?
 - iii. For how long are these nerves fired?
 - iv. What are the target muscles and how do these signals reach the targets?
 - v. What happens when the DRG stop firing?
 - vi. How long before the DRG starts to discharge another signal?
 - vii. How long is a complete cycle?
 - viii. How many times do you "breathe" in a minute while at rest?
 - h. Where is the ventral respiratory group located?
 - i. What types of neurons are in the VRG?
 - ii. What is the primary function of these neurons?
 - i. Where is the pneumotaxic center located?
 - i. What does this center regulate?
 - ii. What happens when there is a strong output from the PC?
 - j. What is the role of the spinal integrating centers
 - k.
 23. Pain, anxiety and other emotions can influence the respiratory centers. The origin of these events are said to be of a "higher" order within the brain. Where do these events originate?
 24. Central and peripheral receptors monitor different types of stimuli and send this information to the brainstem respiratory centers.
 - l. List four different type of receptors and explain their mechanism of action.
 25. Where is the voluntary control of breathing located? Can you hold your breath until you die? What role does the corticospinal tract play in voluntary breathing?
 26. What factors influence respiratory airflow? What does one atmosphere measure? What happens when intrapulmonary pressure is greater or less than the atmospheric pressure?

- 27 To understand inspiration and expiration you need to review the anatomy of the pleural cavity.
- What is the relationship between the visceral and parietal pleura?
 - What is between the two membranes?
 - What is intrapleural pressure?
 - What is intrapulmonary pressure?
 - How does body temperature influence inspiration?
- 28 Relaxed expiration is a passive process.
- What tissue type makes relaxed expiration passive?
 - Where do you find this tissue?
 - How do the phrenic nerves modify expiration? What is this called?
- 29 Define pneumothorax and atelectasis and the underlying mechanisms that cause these conditions.
- 30 Explain how resistance influences airflow:
- How do epinephrine and the sympathetic nerves (norepinephrine) influence pulmonary resistance?
 - How do histamine and parasympathetic nerves (acetylcholine) influence pulmonary resistance?
 - How do tuberculosis and black lung disease influence pulmonary resistance?
 - What role do hydrogen bonds play in pulmonary resistance?
 - What is surfactant?
- 31 Study Figure 22.17 to learn the different respiratory volumes and their associated volumes.
- What is the alveolar ventilation rate? How do you determine AVR?
 - What is the difference between anatomical and physiological dead space?
 - What is the difference between restrictive and obstructive disorders?
 - What is the difference between minute respiratory volume and maximum voluntary ventilation? Under what condition would you experience maximum voluntary ventilation?
- 32 Study Table 22.3 to learn the variations in the respiratory rhythm:
- 33 How is a cough different than a sneeze?
- 34 What are the “four” main gases in inspired air?
- 35 What does the partial pressure of a gas indicate?
- 36 What is alveolar gas exchange and where does it occur?

- 37 What variables affect gas exchange?
- 38 Ventilation-perfusion coupling is an important concept in respiratory physiology.
- When an area of the lung is well ventilated, what happens to the associated capillaries?
 - When mucus obstructs a bronchiole and prevents an area of the lung from being ventilated, what happens to the capillaries in this area? How does this compare to hypoxia and the local control of the capillary network in the systemic circulation?
- 39 We have already studied the role that RBCs and hemoglobin play in the transport of oxygen.
- What percent of oxygen is transported by hemoglobin?
 - How many oxygen molecules can one hemoglobin molecule carry?
 - What is the difference between oxyhemoglobin and deoxyhemoglobin?
 - Why is carbon monoxide a dangerous poison?
- 40 How is carbon dioxide transported? Be able to “rank” the three different transport methods.
- 41 How do the events differ during systemic gas exchange and alveolar gas exchange? Be able to associate these terms with your explanation: (carbonic anhydrase, chloride-bicarbonate exchanger, chloride shift, venous reserve) See Figures 22.24 and 22.25
- 42 Ultimately, pulmonary ventilation is adjusted to maintain the pH of the brain (p884).
- If hydrogen ions don't cross the blood brain barrier, then where does the “acid” come from that drives the chemoreceptors in the medulla oblongata?
- 43 How is acidosis and alkalosis related to hypercapnia and hypocapnia?
- What are the corrective homeostatic responses to acidosis and alkalosis?
- 44 Under normal conditions, the partial pressure of oxygen has little effect on respiration. What conditions would result in the partial pressure of oxygen becoming the main driver of respiration? What is this condition called?
- 45 What is hypoxia? What is an indicator of hypoxia? Define the following : (hypoxemic hypoxia, ischemic hypoxia, anemic hypoxia, histotoxic hypoxia)
- 46 What is chronic obstructive pulmonary disease?
- What are the three most common COPDs?