

PHYL 422 Review Questions

Set 2

1. Which of the following statements are true about FRC?
 - a. At FRC, the transmural pressure of the respiratory system is 5 cm H₂O.
 - b. $FRC = ERV + RV$
 - c. Between breaths, the intrapleural pressure is about -5 cm H₂O at FRC.
 - d. At FRC, the inward recoil of the lungs matches the outward recoil of the chest wall.
 - e. FRC can be measured by simple spirometry.
 - f. $TLC - VC = FRC$
 - g. FRC is decreased in an individual with emphysema.

2. Which of the following statements are true about alveolar pressure?
 - a. Alveolar pressure is lower than atmospheric pressure during inspiration.
 - b. Alveolar pressure is greater than atmospheric pressure during expiration.
 - c. Alveolar pressure is the sum of intrapleural pressure and the alveolar elastic recoil pressure.
 - d. Alveolar pressure equals atmospheric pressure at the end of a normal tidal expiration.
 - e. During inspiration, the drop in alveolar pressure exceeds the drop in intrapleural pressure.

3. Which of the following statements is true about normal quiet breathing?
 - a. The transpulmonary pressure increases during inspiration.
 - b. Expiration is due to the elastic recoil of the lungs and the contraction of the expiratory muscles.
 - c. Inspiration is initiated by the recruitment of the diaphragm and the scaleni.
 - d. Intrapleural pressure is negative (sub-atmospheric) during inspiration.
 - e. Intrapleural is positive (above-atmospheric) during expiration.

4. The meaning of the terms compliance, distensibility, elastance, elasticity and elastic recoil are often confusing to the student. Determine the statements that use these terms correctly.
 - a. In emphysema, there is a loss of lung elastic tissue and the lungs are less compliant and more distensible than normal.
 - b. Patients with stiff lungs have an increase in the elastic recoil of their lungs and show a reduction in the static compliance of their lungs.
 - c. In an old individual, the loss of elastic tissue in the lungs results in an increase in the compliance of the lungs and a decrease in the elastic recoil pressure of the lungs.
 - d. The pressure-volume curve of the lungs shows the lungs as relatively compliant structures at a high lung volume (near TLC) compared to a low lung volume (near FRC).
 - e. A stiff lung has relatively high elastance compared to a normal lung.

5. Which of the following conditions can decrease the static compliance of the lungs?
- A newborn with insufficient pulmonary surfactant
 - A person with fibrosis of the lung
 - A person who has undergone surgical removal of their right lung
 - A healthy 80 year old
 - A person with pulmonary edema
 - A person with bronchitis
6. The respiratory muscles would have to work harder in all of the following conditions. For each condition, determine the physical factor altered [compliance or resistance] and the structure involved [lungs, chestwall, airways].
- A person with chronic bronchitis
 - A person with scoliosis
 - A person with cystic fibrosis
 - An infant with neonatal distress syndrome
 - A person with emphysema
7. Two patients have the following measurements:
Patient A: $V_T = 600$ ml; respiratory rate = 10/min; $PaCO_2 = 35$ mmHg
Patient B: $V_T = 600$ ml; respiratory rate = 10/min; $PaCO_2 = 45$ mmHg
- The reason these two patients have different $PaCO_2$ values can be explained by the following statement(s).
- Their CO_2 production is different.
 - They are different ages, and $PaCO_2$ is age dependent.
 - One is a man, one is a woman and $PaCO_2$ is gender dependent.
 - Their minute ventilation is different.
 - They have a difference in dead space ventilation.
8. According to the alveolar air equation, which of the following statements is true?
- A decrease in $F_{I}O_2$ results in a decrease in alveolar PO_2 .
 - As $PaCO_2$ goes up, alveolar PO_2 goes down.
 - A decrease in barometric pressure will result in a decrease in alveolar PO_2 .
 - An increase in the respiratory exchange ratio will result in an increase in alveolar PO_2 .
 - A person hyperventilating will decrease their alveolar PO_2 .

9. Blood with a partial pressure of 50 mmHg [oxygen content =16ml/100ml] is separated from a reservoir of saline with partial pressure of 500 mmHg [oxygen content=1.5 ml/100ml] by a gas-permeable membrane. Which of the following statements are true?
- Reducing the thickness of the gas permeable membrane will decrease the rate of oxygen transfer across the membrane
 - Increasing the surface area of the gas-permeable membrane will improve the rate of oxygen transfer
 - Oxygen will diffuse from the blood into the saline reservoir.
 - If the partial pressure of oxygen in the blood is increased, the rate of oxygen transfer across the membrane will decrease.
10. The following relate to the mechanics of ventilation. Determine whether the statements a-f are true or false.
- The change in the lung volume of the lung with pressure is the compliance.
 - The total compliance of the respiratory system is determined solely by the compliance of the lungs.
 - The recoil of the lungs assists inspiration.
 - At FRC, TLC and RV the elastic recoil of the lungs is balanced by the elastic forces tending to expand the chest
 - The compliance of the lungs is determined by mainly by the elastic tissues of the lung parenchyma and to a lesser degree by the surface tension forces in the alveoli .
 - At all lung volumes, pulmonary surfactant maintains a constant surface tension in the alveoli.
11. A subject is trained to breathe at a series of tidal volumes without hyperventilating. From the data in the table shown below calculate the dead space for each value of tidal volume (to two decimal spaces). Assume that alveolar CO₂ remains constant at 5.2%. What conclusions can be drawn from these data?

<u>Tidal volume (liters)</u>	<u>FECO₂</u>
0.50	3.46
1.10	4.49
1.56	4.50
2.45	4.60

Answers

1. b,c,d
2. a,b,c,d
3. a,d
4. b,c,e
5. a,b,c,e
6. a) the resistance of the airway is increased
b) the compliance of the chest wall is decreased
c) the resistance of the airways is increased
d) the compliance of the lungs is decreased
e) the compliance of the lungs is increased
7. a, e
8. a,b,c,d
9. b,d
10. The compliance of the respiratory system is determined by that of the chest wall and the lungs. Lung recoil assists expiration not inspiration. The inward recoil of the lungs is balanced by the outward recoil of the chest wall only at FRC. The compliance of the lungs is dependent equally on the alveolar surface tension and elasticity of the lung parenchyma. Pulmonary surfactant reduces the work of breathing by lowering the surface tension of the air-liquid interface in the alveoli. The surface tension is related to the degree of lung inflation: the more the lungs are expanded, the higher the surface tension. a. True; b. False; c. False; d. False; e. False; f. False
11. The values for dead space are 0.17, 0.15, 0.21, 0.28 liters, so that dead space increases as tidal volume increases. This is caused by the connective tissue of the lung parenchyma pulling on the airways and causing them to dilate.