Self Assessment – Module B Ventilation

1. A patient weighs 180 lbs. Calculate the range of normal tidal volume.

$$180\,lbs \times \frac{1kg}{2.2\,lbs} = \frac{180\,kg}{2.2} = 81.8\,kg$$

2. Define Flowrate ("). **Flowrate is change in volume per unit of time.**

3. If a patient has a tidal volume of 675 mL and the inspiratory time is 1.6 seconds, calculate the flowrate ("). $\frac{675\,mL}{1.6\,\text{sec}} = 422\,\frac{ml}{\text{sec}}$ $\quad 422\,\frac{ml}{\text{sec}} \times \frac{60\,\text{sec}}{\text{min}} = 25{,}320\,\frac{ml}{\text{min}}$

$25{,}320\,\frac{ml}{\text{min}} \times \frac{1L}{1000\,mL} = 25.3\,\frac{L}{\text{min}}$ (Either answer is OK **IF** you include units.)

4. Define pressure gradient. **A difference in pressure where gas flows from an area of higher pressure to an area of lower pressure.**

5. The pressure inside the alveoli is called the **alveolar (P_A)** pressure.

6. The difference in pressure between the Airway Pressure (P_{aw}) and the Intrapulmonary pressure (P_{alv}) is called **Transrespiratory Pressure**.

7. The difference in pressure between the intrapulmonary pressure and the intrapleural pressure is called **Tran pulmonary Pressure**.

8. Which lung pressure is always subatmospheric? **Intrapleural**

9. How is intrapleural pressure measured? **Estimated with an esophageal balloon.**

10. Normal breathing is based on which gas law? **Boyle's Law**

11. Explain the 5 steps that occur during normal inspiration

    A. **Inspiratory muscles contract and the diaphragm moves downward.**
    B. **Thoracic volume increases.**
    C. **Subatmospheric pressure is generated in intrapleural space and alveoli (P_{pl} & P_{alv}).**
    D. **A pressure gradient results.**
    E. **Gas flow begins (mL/sec) and continues until the pressure is again atmospheric at the end of inspiration ($P_{alv} = P_{bs}$).**

12. The airway is referred to as a passageway from the **larynx** down to the **alveoli**.

13. Explain what is being measured for each of the units listed below

A. ml/cm H_20: **Milliliters of volume per centimeter of water pressure.**

B. L/cm H_20 **Liters of volume per centimeter of water pressure.**

C. mL **Milliliters of volume.**

D. L **Liters of volume.**

E. L/min **Liters per minute of flow (volume per unit of time).**

F. mL/sec **Milliliters per second of flow (volume per unit of time).**

14. 500 mL = **0.5** L

15. 8 L = **8,000** mL

16. Compliance involves measurement of the

A. Elastic properties of the lung   B. Inelastic properties of the lungs

17. Airway Resistance involves the measurement of the

A. Elastic properties of the lung   B. Inelastic properties of the lungs

18. What is the normal values for the following

A. Compliance of the lungs? **0.2 L/cm H_2O**

B. Compliance of the thorax? **0.2 L/cm H_2O**

C. Total Compliance **0.1 L/cm H_2O**

19. Write the formula for compliance **Change in Volume divided by Change in Pressure**

$$\frac{\Delta V}{\Delta P}$$

20. Based on the compliance formula, if tidal volume stays the same and pressure increases, compliance will

A. Increase   B. Decrease   C. Stay the same

21. An L:S ratio of 2:1 indicates

A. Lung maturity   B. Lung immaturity   C. Transitional

22. Surfactant is produced from which cells **Alveolar Type II**.

23. When is surfactant usually present in sufficient quantities to support extrauterine life?

35 weeks of gestation

24. Write LaPlace's law.

$$P = \frac{2 \times SurfaceTension}{Radius(r)}$$

25. What is the normal total lung compliance? **0.1 L/cm H_2O**

26. Which of the following L:S ratio's indicate lung immaturity
A. 1:2
B. 1:1
C. 2:1
D. 3:1

27. If lung compliance decreases than

A. Elastance will: a. Increase b. Decrease c. Stay the same

B. Pressure will: a. Increase b. Decrease c. Stay the same

28. Write Poiseuille's Law

$$\dot{\vee} = \frac{\Delta P \times r^4 \times \pi}{8 \times \ell \times \upsilon} \quad \Delta P = \frac{\dot{\vee} \times 8 \times \ell \times \upsilon}{r^4 * \pi}$$

29. Patients with emphysema will have
A. High compliance B. Low compliance C. Normal compliance

30. Compliance is defined as $\frac{\Delta V}{\Delta P}$.

31. During which phase of breathing does the alveolar pressure = atmospheric pressure (More than one answer - Circle all that apply)

A. End of inspiration
B. Inspiratory phase
C. End of exhalation
D. Expiratory phase

32. Whose law states that when 1 unit of force or pressure acts upon an elastic body, the elastic body will stretch 1 unit of length or volume? **Hooke's Law**

33. Boyles law states that if temperature is held constant, and pressure increases, volume will **inversely**.

34. If the tidal volume is 700 mL and the pressure necessary to push in 700 mL is 25 cm H_20, the compliance would be **0.028 mL/cm H_2O**.

35. Name the 4 factors in Poiseuille's Law that have an effect on airway resistance.

A. **The pressure applied to deliver the breath**
B. **The flow of the gas**
C. **The radius of the tube**
D. **The viscosity of the gas**
E. **The length of the tube**

36. Name two artificial surfactants that are given to babies born prematurely
A. **Survanta**
B. **Exosurf**
C. **Curosurf**
D. **Infasurf**

37. Patient A
V_t 500 mL
Pressure to inflate the lungs is 50 cm H_20

Patient B
V_t 500 mL
Pressure to inflate the lungs is 15 cm H_20

A. Which one has the lower lung compliance? **Patient A**
B. Calculate the lung compliance for patient A and B

I. Patient A: $\frac{\Delta V}{\Delta P} = \frac{0.5L}{50cmH_2O} = 0.01\frac{L}{cmH_2O}$

II. Patient B: $\frac{\Delta V}{\Delta P} = \frac{0.5L}{15cmH_2O} = 0.0\overline{33}\frac{L}{cmH_2O}$

38. The complete absence of spontaneous ventilation is called **APNEA**.

39. An increased rate and depth of breathing associated with metabolic disturbances such as diabetes is called **KUSSMAUL'S BREATHING**.

40. Define Flow. **CHANGE IN VOLUME PER UNIT OF TIME**

41. Given a V_t of 600 mL and an inspiratory time (T_i) of 0.7 seconds, calculate the flowrate.
$\dot{V} = \frac{600mL}{0.7\sec} = 857\frac{mL}{\sec}$

42. Given a flow ($\dot{V}$) of 300 mL/sec and an inspiratory time (T_i) of 1.5 seconds, calculate the V_t.
$300\frac{mL}{\sec} \times 1.5\sec = 450mL$

43. Define Compliance and give the normal value for total lung compliance. $\frac{\Delta V}{\Delta P}$, **0.1L/cm H_2O**

44. Given a V_t of 500 mL and a pressure of 60 cm H_20, calculate the compliance.

$$\frac{\Delta V}{\Delta P} = \frac{500mL}{60cmH_2O} = \frac{0.5L}{60cmH_2O} = 0.008\,{}^{L}\!/_{cmH_2O}$$

45. What is the reciprocal of compliance? **ELASTANCE**

46. Does compliance measure the elastic or inelastic properties of the lung? **ELASTIC**

47. If pressures increase and Vt stays the same, then compliance will
A. Increase B. Decrease C. Stay the same

48. Give examples of high and low compliance.
   A. **HIGH COMPLIANCE WOULD BE FOUND WITH EMPHYSEMA.**
   B. **LOW COMPLIANCE WOULD BE FOUND IN PREMATURE BABIES.**

49. Define Airway Resistance and give the normal value.
THE INELASTIC PROPERTY THAT IMPEDES LUNG EXPANSION.
THE NORMAL VALUE IS 0.5 to 2.5 cm H_2O/L/sec

50. Given a transairway pressure of 30 cm H_20, and a flowrate of 1.2 L/sec, calculate the R_{aw}.

$$R_{aw} = \frac{\Delta P}{\dot{V}} = \frac{30 cmH_2O}{1.2 L/\text{sec}} = 25 \, cmH_2O / L/\text{sec}$$

51. What is the reciprocal of resistance? **CONDUCTANCE**

52. Does resistance measure the elastic or inelastic properties of the lung? **INELASTIC**

53. If flowrate stays the same and the radius of the airway decreases by ½, pressure to breath must (increase or decrease) **16** times?

54. If pressure stays the same and the radius of the airway decreases by ½, flow will (increase or decrease) **16** times?

55. An increased f is called **TACHYPNEA**.

56. Difficulty breathing in a lying down or supine position is called **ORTHOPNEA**.

57. How do you assess the presence of hyperventilation and hypoventilation? **ASSESS ARTERIAL BLOOD GASES FOR ABNORMAL CARBON DIOXIDE LEVELS.**

58. Normal spontaneous breathing is called **EUPNEA**.