Self Assessment – Module D Name: **ANSWER KEY**

1. Hypoxia should be assumed whenever the PaO_2 is below **45 mm Hg**.

2. Name some clinical conditions that will result in hyperventilation (respiratory alkalosis). What should be your first concern????? **Hypoxemia/Hypoxia (first), pain, fever**

3. You are weaning a patient from mechanical ventilation. The strain on the cardiovascular system results in CHF. What are the clinical signs/symptoms that you would observe while assessing your patient? **Increased ventilating pressure (reduced compliance), increased respiratory rate, anxious, restless, crackles, possible reduced urine output.**

4. For external respiration to occur effectively, you need three parameters. They are:

   a. **Ventilation**
   b. **Ventilation/Perfusion**
   c. **Diffusion**

5. Name the two sets of peripheral chemoreceptors.

   a. **Aortic Bodies**
   b. **Carotid Bodies**

6. The peripheral chemoreceptors are stimulated when the PaO_2 drops to less than **60** mm Hg and become suppressed when the PaO_2 drops below **30** mm Hg.

7. When a low PaO_2 is sensed by the carotid bodies, impulses are sent to the medulla via the **IX** cranial nerve which is the **Glossopharyngeal**.

8. When a low PaO_2 is sensed by the aortic bodies, impulses are sent to the medulla via the **X** cranial nerve which is the **Vagus**.

9. You are noticing lower oxygen saturations in your patient with left lower lobe pneumonia. How would you position the patient to improve oxygenation? **Place patient on right side (Left Lung up/Good lung down)**

10. West characterized Zone III of the lung as an area in which P_A is greater than P_a or P_v.
    a. True
    b. False

11. Name two ways to assess overdistension of the alveoli that may result in increased VD ventilation (wasted ventilation) and a high V/Q ratio. **Overdistension on Pressure-Volume Loop, AutoPEEP, Reduced compliance**

12. High V/Q ratios may result from (increased or decreased) ventilation and (increased or decreased) perfusion.

    How will performing a tracheostomy on a patient affect the alveolar minute ventilation and $PaCO_2$ level? **Increased $\dot{V}_A = (V_t - V_d) \times f$; Increased $\dot{V}_A$, Decreased $PaCO_2$**

13. What is the symbol for cardiac output? **$\dot{Q}_T$**

14. Lung compliance is defined as:

    a. $C = \frac{\text{Volume}}{\text{Transrespiratory Pressure}}$

    b. $C = \frac{\text{Volume}}{\text{Transthoracic Press}}$

    c. $C = \frac{\text{Volume}}{\text{Intrapleural Pressure}}$

    d. $C = \frac{\text{Volume}}{\text{Transairway Pressure}}$

    e. $C = \frac{\text{Volume}}{\text{Transpulmonary Pressure}}$ **$P_{ALV} - P_{PL}$**

15. When does airway pressure = alveolar pressure during normal spontaneous respiration? **During periods of no flow: End of inspiration, end of expiration**

16. Given an alveolar pressure of 0 and an intrapleural pressure of –10, calculate the transpulmonary pressure. **$P_L = P_{ALV} - P_{PL}$ $P_L = 0 - {}^{-}10 = {}^{+}10$**

17. At residual volume, more gas entering the lung goes to the lung apices

    a. True
    b. False

18. At **FRC**, which of the following statements is true? (Circle all that apply)

    a. Intrapleural pressure is more subatmospheric at the top of the lung.
    b. Compliance is lower at the top of the lung.
    c. Elastance is higher at the top of the lung.
    d. Transpulmonary pressure is higher at the top of the lung.
    e. A higher V/Q ratio is found at the bottom of the lung.

19. Name the four types of deadspace.

    a. **Anatomic**
    b. **Alveolar**
    c. **Mechanical**
    d. **Physiologic**

20. High V/Q ratios result in which of the following:

a. Shunt
b. Deadspace
c. Silent unit
d. Diffusion defect

21. Assuming there is no alveolar deadspace, correlate the minute ventilation with the $PaCO_2$

Minute Ventilation	$PaCO_2$
a. 5 L/min	**40 mm Hg**
b. 10 L/min	**30 mm Hg**
c. 20 L/min	**20 mm Hg**

22. How can you assess at the bedside, when your patient has increased V_D ventilation? (wasted ventilation?) **Increased minute ventilation ($\dot{V}_E$) with low or normal $PaCO_2$ levels. Increased $PaCO_2$ – $PETCO_2$ gradients.**

23. Distribution of ventilation in the lung depends on regional differences in **Compliance** & **Resistance**.

List the normal values for the following:

24. A-a gradient on room air **5 to 20 mm Hg**

25. a/A ratio **Greater than 0.75 (75%) on any FiO_2**

26. PaO_2/FIO_2 **400 to 500 mm Hg;**

27. A-a gradient on 100% **25 to 65 mm Hg**

28. Write the classic shunt equation.

$$\frac{Cc'O_2 - CaO_2}{Cc'O_2 - CvO_2},$$ **where $Cc'O_2$ is equal to (Hb x 1.34) + (PAO_2 x 0.003)**

29. Write Fick's law of diffusion.

Diffusion = $$\frac{A \times D \times (P_1 - P_2)}{Thickness}$$

30. Why do true diffusion defects rarely cause hypoxemia?
Cardiac output usually can provide adequate transit time.

31. The normal capillary transit time is **0.75 seconds**.

32. The normal amount of time necessary for oxygen diffusion is **0.25 seconds**.

33. Exercise and septic shock result in increased capillary transit time.

    a. True
    b. False

34. How is the diffusion constant calculated? **Skip this question. It is a combination of Molecular size, Solubility coefficient of the gas, and Graham's Law.**

35. Oxygen diffuses faster than CO_2 in a gaseous medium.
    a. True
    b. False

36. CO_2 diffuses 20 times faster than O_2 in a liquid medium.
    a. True
    b. False

37. The units for $D_{L_{CO}}$ are **ml/min/mm Hg**.

38. Emphysema is considered a
    a. deadspace disease.
    b. shunt disease

39. Relative shunts may result from
    a. increased ventilation or increased perfusion.
    b. decreased ventilation or increased perfusion.
    c. increased ventilation or decreased perfusion.
    d. decreased ventilation or decreased perfusion.

40. A cardiac shunt is an example of a
    a. true/absolute shunt.
    b. relative shunt.
    c. silent unit.

41. What is the surface area of the lung in meters square? **70 sq meters**

42. The driving pressure of oxygen across the alveolar capillary membrane is **$PAO_2 - PaO_2$**.

43. How can you assess a true shunt at the bedside without having to do a shunt equation? **Place patient on a 100% oxygen and evaluate for significant improvement in PaO_2. Also use PaO_2/PAO_2 ratio or the PaO_2/FiO_2 ratio**.

44. Given an alveolar ventilation of 2 L/min, and a cardiac output of 5 L/min,
    a. calculate the V/Q ratio **0.4**.

    b. What type of V/Q ratio is this **Shunt (relative)**?

    c. What formula is used to assess this situation? **Classic Shunt Equation**
    _____

    d. What would the blood gas findings be? **Refractory hypoxemia, possible respiratory alkalosis.**

    e. While assessing the patient, what would indicate this type of V/Q ratio? **Refractory hypoxemia**

    f. What is the treatment? **Alveolar recruitment strategies.**