Self Assessment: RSPT 2350 Module E

1. Given the following ABG, calculate the amount of dissolved oxygen in the blood
pH 7.36, $PaCO_2$ 43 mm Hg, PaO_2 88 mm Hg, HCO_3^- 26 mEq/L

88 x 0.003 = 0.26 mm Hg

2. The oxygen saturation is a good indicator of the amount of total oxygen carried in the blood.
A. A. True B. False

3. Explain, given the following ABG, if tissue hypoxia could be present.
pH 7.25, $PaCO_2$ 20 torr, HCO_3^- 14 mEq/L, PaO_2 98 mm Hg, SaO_2 97%
The patient is exhibiting a metabolic acidosis, which could be lactic in origin (tissue hypoxia). Assessment of other causes of hypoxia (including anemic and histotoxic) is needed.

4. If we graphically expressed the relationship of PaO_2 and the amount of dissolved oxygen in the blood we would see a
A. Linear shaped curve
B. Square shaped curve
C. Sigmoidal shaped curve

5. List factors that will shift the oxygen dissociation curve to the left

A. **Decreased hydrogen ions (Increased pH)**
B. **Decreased 2,3 DPG levels**
C. **Decreased temperature**
D. **Increased Carboxyhemoglobin levels**
E. **Increased Methemoglobin**

6. A left shift in the oxygen dissociation curve is normally seen in the **LUNGS.**

7. A right shift in the oxygen dissociation curve is normally seen at the **TISSUES.**

8. Name two factors that will decrease oxygen affinity at the tissue level and help oxygen unloading.

A. **Increased $PaCO_2$**
B. **Reduced pH**

9. The effect of CO_2 on the oxygen dissociation curve is called the **Bohr Effect**.

10. If you have 100 binding sites for oxygen, and 60 sites are occupied, the oxygen saturation would be **60%**.

11. If you have 50 binding sites for oxygen, and 25 sites are occupied, the oxygen saturation would be **50%**.

12. Performing a tracheostomy on a patient will result in a change in (circle all that apply)
A. Anatomic V_d B. Alveolar V_d C. Physiological V_d D. Mechanical V_d

13. Oxygen hooks to: (circle all that apply)
A. beta chains of the globin molecule
B. alpha chains of the globin molecule
C. the heme portion of the molecule
D. the same site as CO

14. The normal P_{50} is **27 mm Hg**

15. Given the following, calculate the $\dot{V}/\dot{Q}$ ratio and indicate if it is high, low or normal. Then indicate the type of $\dot{V}/\dot{Q}$ relationship that is present.

A. Alveolar Ventilation ($\dot{V}_A$) is 0 L/min, Cardiac Output ($\dot{Q}_t$) is 4 L/min
$\dot{V}/\dot{Q}$ ratio is **0**. $\dot{V}/\dot{Q}$ relationship is **True Shunt**.

B. Alveolar Ventilation ($\dot{V}_A$) is 2 L/min, Cardiac Output ($\dot{Q}_t$) is 5 L/min
$\dot{V}/\dot{Q}$ ratio is **0.4**. $\dot{V}/\dot{Q}$ relationship is **Relative Shunt**.

C. Alveolar Ventilation ($\dot{V}_A$) is 3 L/min, Cardiac Output ($\dot{Q}_t$) is 0 L/min
$\dot{V}/\dot{Q}$ ratio is ∞. $\dot{V}/\dot{Q}$ relationship is **True Deadspace**.

D. Alveolar Ventilation ($\dot{V}_A$) is 0 L/min, Cardiac Output ($\dot{Q}_t$) is 0 L/min
$\dot{V}/\dot{Q}$ ratio is **Zero**. $\dot{V}/\dot{Q}$ relationship is **Silent Unit**.

E. Alveolar Ventilation ($\dot{V}_A$) is 4 L/min, Cardiac Output ($\dot{Q}_t$) is 5 L/min
$\dot{V}/\dot{Q}$ ratio is **0.8**. $\dot{V}/\dot{Q}$ relationship is **Normal**.

F. Alveolar Ventilation ($\dot{V}_A$) is 6 L/min, Cardiac Output ($\dot{Q}_t$) is 2 L/min
$\dot{V}/\dot{Q}$ ratio is **3.0**. $\dot{V}/\dot{Q}$ relationship is **Relative Deadspace**.

G. Alveolar Ventilation ($\dot{V}_A$) is 10 L/min, Cardiac Output ($\dot{Q}_t$) is 4 L/min
$\dot{V}/\dot{Q}$ ratio is **2.5**. $\dot{V}/\dot{Q}$ relationship is **Relative Deadspace**.

H. Alveolar Ventilation ($\dot{V}_A$) is 4 L/min, Cardiac Output ($\dot{Q}_t$) is 10 L/min
$\dot{V}/\dot{Q}$ ratio is **0.4**. $\dot{V}/\dot{Q}$ relationship is **Relative Shunt**.

16. Given the following, indicate the shift in the oxygen dissociation curve
A. PaO_2 40, SaO_2 80% **LEFT**

B. PaO_2 60, SaO_2 85% **RIGHT**

C. PaO_2 27, SaO_2 50% **NORMAL**

D. PaO_2 250, SaO_2 100% **NORMAL**

17. Given Alveolar Ventilation of 10 L/min and a cardiac output of 5 L/min, the " /# ratio would be **2.0** indicating which type of " /# ratio? **RELATIVE DEADSPACE**.

18. How much desaturated Hemoglobin must be present in the blood for cyanosis to be seen? **5 grams**

19. Calculate the amount of desaturated Hb given the following:
SaO_2 82%, Hb 22 gms%, SvO_2 65%

$$\frac{(Hb \times ArterialDesaturation)+(Hb \times VenousDesaturation)}{2} = \frac{(22 \times .18)+(22 \times .35)}{2} =$$

$$\frac{3.96+7.7}{2} = \frac{11.6}{2} = 5.83$$

A. Would the patient be cyanotic? **YES**

20. pH 7.20, PaCO2 80, HCO3 26, PaO2 77, FIO2 .40. The patient is

i. Hypercarbic
ii. Hypocarbic
iii. Eucapnic
iv. Normal

B. The patient would be described as:

i. Hyperventilating
ii. Tachypneic
iii. Bradypneic
iv. Hypoventilating

21. Given the following information, determine if the patient is hyperventilating or hypoventilating: f 28/min, weight 156 lbs, V_t 400 mL, CO_2 production 290 mL. Patient using his accessory muscles to breath.

$$V_{d_{anat}} = 156mL \quad \dot{V}_A = (V_t - V_d) \times f = (400mL - 156mL)28 = 6{,}832mL/\min = 6.832L/\min$$

$$PaCO_2 = \frac{VCO_2 \times 0.863}{\dot{V}_A} = \frac{290mL/\min \times 0.863}{6.832L/\min} = 36.6mmHg$$ **The patient is neither hyperventilating nor hypoventilating.**

Calculate the PaO_2 if the barometric pressure is 3 atm at 100% oxygen and the patient has a normal A-a gradient of 60 torr.

$$P_{Baro} = 760 \times 3 = 2{,}280torr \quad PaO_2 = PAO_2 - 60torr = [(P_{Baro} - 47)1.0] - (PaCO_2 \times 1.25)$$

$$[(2280 - 47)1.0] - \frac{36.6}{0.8} = 2233 - 45.8 = 2188$$ **This assumes a normal RQ of 0.8.**

22. When placing a patient in a hyperbaric chamber to treat COHB% poisoning, the goal of therapy is to **Increase PAO_2 (and therefore PaO_2) by increasing barometric pressure**.

23. The ABG results from a patient in ICU are: pH 7.56, $PaCO_2$ 18, PaO_2 80 torr on FiO_2 of .50. Based on this information, the P_{50} would be
    A. Less than 25 mm Hg **Leftward shift**
    B. Greater than 27 mm Hg
    C. Between 25-27 mm Hg

24. ABG data provides us with information on three physiologic processes. They are

    A. **Ventilation**
    B. **Acid-Base Balance**
    C. **Oxygenation**

25. List the composition of the atmosphere and the 4 major gas concentrations. **Nitrogen (78.08%), Oxygen (20.93%), Carbon Dioxide (0.03%), and Argon (0.9%)**

26. What is the partial pressure of oxygen 2 miles above sea level? **760-2(120)=760-240=520 mm Hg**.

27. Name two ways to treat CO poisoning **100% Oxygen & Hyperbaric Therapy**.

28. What is the relationship between PaO_2 and mean airway pressure (MAP). **Direct**

29. List the 3 formulas derived from Dalton's Law of partial pressure

    A. **Alveolar Air Equation**

    B. **PiO2**

    C. **$P(A\text{-}a)O_2$**

30. Write Fick law of Diffusion. $\boldsymbol{Diffusion} \propto \frac{\boldsymbol{Area} \times (\boldsymbol{P_2} - \boldsymbol{P_1}) \times \boldsymbol{DiffusionCons}\,\mathrm{tan}\boldsymbol{t}}{\boldsymbol{Thickness}}$

31. An increased capillary transit time means that there is
    A. More time for oxygen diffusion
    B. Less time for oxygen diffusion

32. The partial pressure of oxygen (PaO_2) is a good indicator of the total amount of oxygen carried in the blood.
    A. True
    B. False

33. The oxygen saturation of oxygen (SaO_2) is a good indicator of the total amount of oxygen carried in the blood.
    A. True
    B. False **It is better, but CaO_2 is the best.**

34. If you have 100 binding sites for oxygen, and 80 sites are occupied, the oxygen saturation would be **80%**.

35. Performing a tracheostomy on a patient will result in a change in (circle all that apply):
    A. Anatomic V_d
    B. Alveolar V_d
    C. Physiological V_d
    D. Mechanical V_d

36. List the factors that shift the curve to the right.
    A. **Acidosis**
    B. **Hypercarbia**
    C. **Hyperthermia**
    D. **Increased levels of 2,3 DPG**

37. Why is the presence or absence of cyanosis unreliable in detecting tissue hypoxia?
    Anemic patients may not have enough circulating hemoglobin to have 5 gms desaturated.

38. Name the two factors that enhance oxygen unloading at the tissue level.
    A. **Acidosis**
    B. **Hypercarbia**

39. Which of the following is the best indicator of tissue hypoxia
    A. SaO_2
    B. PvO_2
    C. Hb levels
    D. PaO_2
    E. CaO_2

40. Indicate three situations which will decrease venous values
    A. **Reduced arterial oxygen levels**
    B. **Increased oxygen consumption**
    C. **Decreased cardiac output**

41. Write the Fick Equation solving for Cardiac Output.

$$CO = \frac{VO_2}{C\left(a - \bar{v}\right)O_2}$$

42. Write the Fick Equation solving for VO_2.

$$VO_2 = CO \times C\left(a - \bar{v}\right)O_2 \times 10$$

43. Assuming oxygen consumption stays the same, if CO decreases, what happens to the Ca-vO_2? **It increases (more is extracted – slower truck)**

44. When oxygen demand exceeds oxygen supply (delivery), then **anaerobic metabolism** results.

45. Venous oxygenation indices should not be used to assess tissue hypoxia under what two clinical situations?
    A. **Cyanide Poisoning**
    B. **ARDS**
    C. **Septic Shock**

47. When evaluating an ABG, you note that the PaO_2 is 40 mm Hg and the SaO_2 is 60%. What does this indicate to you? **Rightward shift of the OHDC**

48. COHb, MetHB and Fetal Hb all shift the oxygen dissociation curve to the **LEFT**.

49. Indicate the Respiratory Quotient for the following substrate metabolism:

    A. Carbohydrate: **1.0**
    B. Protein: **0.8**
    C. Fat: **0.7**

50. Given the following information, which of the following clinical conditions would you most expect? pH 7.27, $PaCO_2$ 55 torr, PaO_2 87 torr, FiO_2 .28, HCO_3^- 26, $P_{ET}CO_2$ 25 torr
    A. Pneumonia
    B. Atelectasis
    C. Pulmonary edema
    D. Pulmonary embolism **Note the $P_{ET}CO_2$ to $PaCO_2$ gradient**
    E. Mucous plugging

51. You are caring for an asthmatic patient on mechanical ventilation. As you enter the room, you notice the patient is more anxious and her respiratory rate has increased from 16/min to 30/min. You notice that the end tidal monitor was reading 36 and is now reading 20 resulting in a widened CO_2 gradient. The likely explanation is that: (Circle all that apply)
    A. She is developing shunting from mucous plugging.
    B. She is air trapping and developing auto PEEP.
    C. She is developing a high V/Q ratio in the blood. **All will cause deadspace**
    D. She is developing a low V/Q ratio in the blood.
    E. Her blood flow is increasing in relationship to ventilation.

52. When is cyanosis more easily seen?
    A. Polycythemia
    B. Anemia
    C. Normal RBC and Hb levels

53. List clinical situations which will increase oxygen consumption. **Fever, Shivering, Exercise**

54. A type of hypoxia in which cellular uptake of oxygen is abnormally decreased resulting from cyanide poisoning is called **histotoxic hypoxia**.

55. Normal oxygen delivery is **1,000 mL/min**.

56. Which of the following occurs with methemoglobinemia?

i. The Fe++ is reduced
ii. The Fe++ is oxidized
iii. Iron is in the ferric state
iv. Iron is in the ferrous state

B. i and iii ONLY
C. ii only
D. ii and iv
E. ii and iii ONLY
F. iv ONLY

57. Increased **mixed** venous values may result from which of the following:
A. PAC migration
B. Decreased " O_2
C. Increased O_2 supply
D. Increased CO
E. All the above

58. If you wanted to evaluate venous values, name two ways to obtain/monitor these values
Mixed venous sampling from PA catheter, indwelling S% O_2 catheter

59. Arterial blood gases tell us about **the pulmonary system** and mixed venous blood gases tell us about **balance of oxygen supply and demand**.

After placing a patient on PEEP, you notice that the CvO_2 level decreases. Explain what this means to you. **Reduced oxygen delivery.**

60. The accuracy of the pulse oximeter is
A. ± 2%
B. ± 3% **The error can be larger depending on sensor used.**
C. ± 4%
D. ± 5%
E. ± 10%

61. Which $\frac{V_d}{V_t}$ ratio will result a widened gradient between the $P_{et}CO_2$ and the $PaCO_2$?
Deadspace

62. What is the effect of shunting on the CO_2 gradient? **It usually has little effect.**

63. Draw the capnograph and label the four phases **SKIP. We will cover this at the end of the semester**

64. What is Point of Care Testing? What are some advantages to doing Point of Care Testing? **Point of care testing is testing that is done at the bedside. There are ABG machines that are portable and can be taken to the bedside for analysis.**

65. How does deeply pigmented skin affect the SpO_2 reading? **SKIP. We will cover this at the end of the semester**

66. When a patients respirations result in a variation in the pulse oximeter waveform this often implies **SKIP. We will cover this at the end of the semester**

67. How does COPD change the shape of the CO_2 capnogram? **SKIP. We will cover this at the end of the semester**

68. Name two clinical situations in which the end tidal CO_2 would be reading 0. **SKIP. We will cover this at the end of the semester**. **The answer is cardiac arrest (or massive loss of perfusion) and loss of airway.**

69. ABG do not tell us about tissue oxygenation
    A. True **One could argue though that VBGs do!**
    B. False