

## PAL Worksheet

### Week 12 Problem Set 1

#### Acid Base Balance

1. Amanda has cystic fibrosis, a condition in which thick mucus accumulates in the respiratory passageways. Shown below are the results for tests run on Amanda's blood:

Arterial blood sample results:

	<u>Amanda</u>	<u>Normal</u>
pH	7.30	7.4 +/- 0.05
pCO <sub>2</sub>	57 mmHg	40 mmHg
pO <sub>2</sub>	55 mmHg	90-100 mmHg
Hemoglobin-O <sub>2</sub> Sat.	45%	94-100%
HCO <sub>3</sub> <sup>-</sup> concentrat.	24 meq/L	24 meq/L

- A. Explain the difference between respiratory acidosis, metabolic acidosis, respiratory alkalosis, and metabolic alkalosis.
- B. Why can a change in body pH be disastrous for the body?
- C. Based on the above table, classify Amanda's acid/base status.
- D. How does cystic fibrosis cause this acid/base imbalance?
- E. Is there any compensation via the respiratory system? Why or why not?
- F. How would the kidneys try to compensate?
- G. List some other conditions that might cause this type of acid-base disturbance.
- H. Why do you think Amanda has been feeling tired? Review modes of transport for O<sub>2</sub> and CO<sub>2</sub> in the blood. What do we need O<sub>2</sub> for?
- I. Red blood cells contain the protein hemoglobin, which is capable of binding to oxygen molecules and transporting them to cells where they are released. The reaction between Hb and O<sub>2</sub> can be represented by the following equation:  
$$\text{Hb} + \text{O}_2 \rightleftharpoons \text{HbO}_2$$
  - (a) In the lung (where there is a high concentration of O<sub>2</sub>), which direction is the equilibrium favored?
  - (b) In the tissues (where there is a low concentration of O<sub>2</sub>), which direction is the equilibrium favored?
- J. Review normal values for PO<sub>2</sub> and PCO<sub>2</sub> in the atmosphere, lung, pulmonary and systemic circulation. How are those values different for Amanda?
- K. Using the values from the table above, draw a normal Hb-O<sub>2</sub> saturation curve. Discuss how this curve is different for Amanda.

2. For all of the following, indicate the acid base disturbance (metabolic or respiratory, acidosis or alkalosis) and indicate whether compensation is occurring.
  - A. A patient with a severe myocardial infarction
  - B. A patient with bulimia (self-induced vomiting)
  - C. A patient with a severe asthma attack
  - D. A person who is on the atkins diet (no carbs)
  - E. Self-induced hyperventilation causing hypocapnia (decreased CO<sub>2</sub>)
  
3. Indicate where on the Davenport diagram the following would fall:
  - A. A patient with diabetes mellitus
  - B. Someone who is hypoventilating as a compensation
  - C. Someone with a metabolic alkalosis
  - D. Someone with respiratory acidosis