PAL Worksheet
Week 6 Problem Set 1

RESPIRATORY ANATOMY

While eating a bowl of large seedless grapes, Scott got distracted and "inhaled" one of the grapes. Immediately, he started coughing and trying to dislodge the grape.

1) Given the structural differences between the right and left primary bronchi, in which primary bronchus is the grape most likely lodged in?

- What structure should have prevented the grape from going down "the wrong tube" in the first place?

2) Assuming the grape is completely blocking one of the primary bronchi, will air exchange be taking place in the lung supplied by that blocked bronchus? Why or why not?

- How about in the other lung? Why or why not?

3) Answer the following questions regarding the lung supplied by the blocked primary bronchus:

- What will happen to the amount of O_2 entering the alveoli of that lung compared to normal?

- What will happen to Scott's alveolar PCO_2 level as a result of the blockage?

- What will happen to Scott's systemic arterial blood O_2 and CO_2 levels as a result of this blockage?

COMPARING THE CARDIOVASCULAR AND RESPIRATORY SYSTEMS

1) Using your white board, show what happens to the diameter and number of airways as the primary bronchi enter the lungs:

- How is this similar to the vascular system, especially regarding the blood vessels between the aorta and systemic capillaries?

2) How is the arrangement of the <u>arteriolar</u> and <u>bronchiolar</u> walls similar?

3) Briefly describe the mechanism behind vasoconstriction/dilation and bronchoconstriction/dilation and name several factors/chemicals that can accomplish this.

Surface Area for Exchange

1) How is the concept of total capillary surface area similar to that of total alveolar surface area?

- What is the importance of these arrangements? Why do we have so many small capillaries and small alveoli, instead of one big vessel or one huge air sac?

2) Draw the endothelial cells of the capillaries and type I alveolar cells. What is the importance of having this type of epithelium, given the events that take place across the walls of these two cells?

Effect of Hypoxia on Pulmonary and Systemic Blood Vessels:

1) In response to hypoxia, pulmonary vessels _____ (constrict/ dilate). Why does this make sense?

2) In response to hypoxia, systemic arterioles _____ (constrict/ dilate). Why does this make sense?

3) What effect does sympathetic NS activity have on the diameter of bronchioles? Why does this make sense?

4) What effect does sympathetic NS have on the diameter of arterioles? Why does this make sense?

Draw a concept map that illustrates these ideas

Effect of CO_2 on Pulmonary Bronchioles and Systemic Blood Vessels:

Like arteriolar smooth muscle cells, the smooth muscle cells of the bronchioles also respond to local metabolites such as CO_2.

1) High CO_2 relaxes the bronchiolar smooth muscle cells, dilating the airways and therefore, _____ (increasing/decreasing) airway resistance.

2) High CO_2 relaxes arteriolar smooth muscle cells, therefore, _____ (increasing/decreasing) resistance to the flow of blood by causing _____ (vasoconstriction/vasodilation).