Review for Respiration

General Overview
- Understand what each part of the Fick Equation represents and how changing each can alter rates of diffusion.
- Compare and contrast the environmental constraints that confront air and water breathers. Address: gas contents, viscosity, mass, diffusion rates of gases in each medium.
- What is Dalton’s Law of partial pressures.
- What is the greatest partial pressure of oxygen that has ever existed on earth?
- How does the partial pressure of a gas change with increases in altitude?
- How is the solubility of gas in water affected by temperature? salinity? atmospheric pressure?
- Compare solubility of the oxygen-nitrogen-carbon dioxide in water?
- List other factors that influence oxygen content of a body of water.
- What are the 3 basic components of a respiratory system and briefly describe the function of each?

Respiration in Water
- What is the basic design of the gill? How does this design maximize gas exchange (use Fick’s flux equation in your answer)?
- What does the amount of surface area of the gill of a fish indicate to you as a physiologist?
- What would be a disadvantage of a concurrent blood flow in the gills?
- What is advantage of a counter current blood flow?
- Aspects of the respiratory that enhance gas exchange also enhance what other types of exchanges that are detrimental to the animal?
- How does a fish ventilate its gills? What is buccal pump/operculum pump? What types of forces (pumping/sucking) does each generate, what is the consequence?
- What is a ventilation/perfusion ratio (V/Q) and what is its significance?
- Besides gills how else might an animal/vertebrate respire in a water environment?

Why can’t mammals breathe water? Why do mammals drown if they attempt to “breath” water?

Respiration in Air
- List some physical properties of air that make air breathing a less metabolically taxing job. What anatomical feature of mammals attests to the fact that breathing air is not hard work?
- What is the basic anatomy of the respiratory system?
- How does the architecture of the lung change between amphibian-reptile-mammal?
- What are the components of the respiratory membrane? Approximately how thick is it?
- What are the two basic types of tidal ventilation? Give an example of each.
- How is ventilation regulated in birds and mammals, in fish? Why must the stimulus to
  breath be different in these animals
- Compare the volume of the lung / kg of body mass of a tree squirrel to an African
  elephant. Compare the respiratory frequency of these two animals. How does this
  relate to the animal's metabolic rate?
- Briefly describe the respiratory system of a pigeon. What components of this system
  make a bird a very efficient air breather? (Your answer must address each component
  of the flux equation)
- A cricket does not have lungs but does have a very effective respiratory apparatus.
  Describe it. What are the two aspects of this system that make it so effective?
- Compare and contrast the architecture of the blood flow of a gill—an avian lung— a
  mammalian lung. What is the consequence of this particular type of architecture,
  relate this to the metabolic demands of the animal.

Transport of Gases
- Why do complex multicellular animals (that includes you) have respiratory pigments?
- Give examples of respiratory pigments and the color they impart to blood.
- List some of the properties of hemoglobin that make it a great oxygen carrier.
- In the mammalian lung how does the PO$_2$ in the alveolus compare to PO$_2$ of room air?
  the PO$_2$ of expired air? What is the physiological basis of this?
- What happens to the partial pressure of oxygen as you ascend Mt. Rainier? What affect
do this have on your respiratory system?
- Understand the oxygen dissociation curve for hemoglobin. What does the curve
  represent, What is the significance of the shape of the curve.
- Is the O$_2$ affinity of hemoglobin the same for every animal? What types of factors could
  account for differences?

If you found a lung of a dinosaur, what would you measure to determine if this animal
was an ecototherm or endotherm? (defend your answer)

What could account for the difference in respiratory frequency of birds and mammals
seen in figure 1.8 of Schmidt-Nelson?
What can you learn from looking at the picture and reading the figure legend of insect
tracheoles on page 53?