

Physics 290 – Winter 2004

Assignment 5

Due February 12, 2004

1. An intravenous saline solution is “dripped” into a patient from a bag above the patient. Find the minimum height of the bag assuming the venous pressure of 10 mm Hg. Use $\rho = 1 \text{ gm/cm}^3$.
2. The percentge of O_2 in normal air at STP (20° C and 760 mm Hg) is 20%.
 - a.) Find the partial pressure and concentration (cm^3/l) of O_2 in mm Hg and Pa.
 - b.) Find the solubilty of O_2 in blood plasma if the concentration is $2.5 \text{ cm}^3/\text{liter}$.
3. Normal activity requires about 15 breaths per minute, and the inhaled and exhaled O_2 percentages are typically 20% and 16% respectively. Use this and the energy produced per liter of O_2 (from assignment 1) to estimate your Basal Metabolism Rate.
4. When you excercise (jog for example) your respiration and pulse rates might both double. Explain this in terms of O_2 uptake, O_2 saturation, energy expended, etc.
5. Lung diseases
 - a.) Diffusion of O_2 across the healthy lung parenchyma takes about 0.5 sec. Some lung diseases cause an increased thickness of this membrane. If the membrane thickness doubles, how will the difusion time change?
 - b.) Fibrotic lung diseases lead to a stiffening of the lungs normal elasticity. Describe how this would change normal ventilation.
 - c.) In premature births, some advanced respiratory diseases, and AIDS related lung disease, surfactant production is supressed. Describe how this would change normal ventilation.

Possible Final Paper Topics

Relation of basal metabolism to body mass	Artificial bones and joints
CT or PET	Radiation oncology
Radiation exposure risk assessment	Lung diseases
Artificial Hearts, valves, pacemakers	Ultrasound
Regional Cerebral Blood Flow	MRI/fMRI
Cochlear Implants	Localization of sound