

General information:

- 40 points total.
- You are responsible for all information in the Ventilation, Enzyme, and Rat Heart chapters of the lab manual. In addition, you are responsible for techniques and predictions learned in the lab.
- Note that questions similar to the ones on lab write-ups and weekly quizzes could also show up on the exam.
- Be prepared for concepts, definitions, procedures, predictions, broad themes, minor facts, diagrams/graphs/traces, calculations, hands-on with computer or apparatus, etc.
- Be prepared for all types of questions: fill-ins, brief essay, true/false, multiple choice, etc.
- Check for additional Web resources at <http://www.colorado.edu/intphys/iphy3435/>.

Study questions

- Below I have given for each lab a list of skills and knowledge areas to think about. Keep in mind that this is not an exhaustive list.

Enzyme lab

- List the general characteristics of all enzymes.
- Explain the effect of enzymes on activation energy.
- Know the main ways that enzymes are inhibited in living cells.
- What do "MDH" and "LDH" stand for?
- Write out the chemical reactions we studied and explain how they fit into the context of metabolic pathways. (*Note: In the Krebs Cycle, malate and oxaloacetate are the only intermediates you need to know.*)
- List the three types of skeletal muscle fiber, and compare their characteristics. Know these abbreviations: type I, IIa, IIb, IIc.
- Explain the expected MDH and LDH activities, and the expected MDH/LDH ratio, for each tissue we studied.
- Explain the significance of the lactate shuttle.
- Understand significance of: $\Delta\text{ABS}/\Delta t$, activity/mL supernatant, activity/mg protein.
- Explain why, and how, we measured total protein concentration.
- Be able to perform a simple regression in SPSS and know how to use the regression equation properly in converting between optical density and protein concentration.

Ventilation lab

- Be able to calculate tidal volume, breathing rate, and pulmonary ventilation (mL/min) from a Chart trace.
- Be able to calculate *alveolar* ventilation. (Remember how to determine the Anatomical Dead Space when given the subject's weight in pounds.)
- Know the anatomical structures involved in ventilation (e.g. epiglottis, external intercostals, etc.) and its regulation (e.g. medullary centers).
- Which gas is more important in the regulation of ventilation, in normal conditions? **Why?** Understand the relationship between CO₂, carbonic acid, bicarbonate, pH, etc.

- Is ventilation usually increased by changing tidal volume, or breathing rate? Why?
- Be able to calculate the pO_2 if given the $\%O_2$. (Or pCO_2 from the $\%CO_2$.)
- Know the typical values of pO_2 and how these relate to the oxygen-hemoglobin dissociation curve.
- Understand why certain factors affect the shape of the oxygen-hemoglobin dissociation curve.
- Know how to do the spirometer “zeroing” procedure in Chart.
- Understand why hyperventilation and exercise affect the duration of subsequent breath-holding.
- Know the various components of total lung volume (figure 7).

Rat Heart lab

- Know how to calibrate a force transducer, and how to adjust the range and axis settings to get a good reading!
- Understand the meanings/reasons/purposes of the various lab procedures and equipment, such as: heating pad, pinching feet, glass probes, hemostats, saline solution, ligatures, cannula, ventilator.
- Be able to identify (on a photograph or model) the major anatomical structures that were discussed in the dissection, such as salivary glands, sternomastoid muscles, jugular veins, carotid arteries, trachea, bronchi, vagus nerve, site of hook attachment, site of cannulation, left and right atria and ventricles, lungs, liver, diaphragm.
- What effect(s) does the *sympathetic* nervous system have on the heart? What chemical messengers are involved? What parts of the heart are affected? What is the cellular basis for these effects?
- What effect(s) does the *parasympathetic* nervous system have on the heart? What chemical messenger is involved? What parts of the heart are affected? What is the cellular basis for these effects?
- Explain the predicted effect(s) of stimulating the vagus nerves. Explain the predicted effect(s) of cutting the vagus nerves.
- What is the purpose of the “saline” treatment?