1. How does Hb change the amount of oxygen carried by the blood? Use words like solubility and think about Le Chatelier’s principle.

2. What effect does a decreased pH have on Hb binding of O2? What causes this decreased pH? (Mention 2 things) How is this effect beneficial?

3. Show the flow of CO2 and bicarbonate in the tissue cells on the following diagram and describe (See Handout)

   ![Diagram of Capillary and Tissue Cell]

4. How does this differ in the lungs? How does this differ for O2?

5. What serves as the actuating signal for the amount of O2 in the blood in the long term? What secretes this hormone? How does this hormone affect the amount of O2 in the blood?

6. What serves as the actuating signal for the amount of H+ in the blood in the short term? What effect will increasing H+ in the brain stem interstitial fluid have on central chemoreceptors?

#7-11 are from an old MCAT
7. Administration of a carbonic anhydrase inhibitor to the RBC’s would most likely cause an increase in the concentration of
   a. bicarbonate in the RBC’s
   b. carbonic acid in the RBC’s
   c. CO2 in the tissues
   d. H2O in the tissues

8. Would the Cl- concentration of the RBC’s be expected to be greater in the systemic veins or the systemic arteries?
   a. Veins, because the bicarbonate concentration is higher in veins than in arteries
   b. Veins, because there are fewer RBC’s in veins than in arteries
   c. Arteries, because the bicarbonate concentration is higher in arteries than in veins
   d. Arteries, because there are fewer RBC’s in veins than in arteries

9. O2 dissociates more readily from Hb in an acidic environment. This dissociation will therefore occur most readily when the PCO2 is:
   a. high, because the carbonic anhydrase reaction will make more carbonic acid, thus more bicarbonate.
   b. high, because the carbonic anhydrase reaction will make more CO2 and H2O from carbonic acid.
   c. Low, because the carbonic anhydrase reaction will make more carbonic acid, thus more bicarbonate.
   d. Low, because the carbonic anhydrase reaction will make more CO2 and H2O from carbonic acid.

10. Lung capillaries are so narrow that RBC’s must pass through them in single file. This feature aids respiration by:
    a. Increasing the production of CO2 in RBC’s
    b. Allowing the RBC’s to have direct contact with alveoli
    c. Giving maximum exposure of each RBC to diffusing gasses
    d. Making Hb available for CO2, but not O2 to bind

11. The transport of CO2 across biological membranes during cellular respiration is best accounted for by which of the following processes?
    a. Osmosis
    b. Simple diffusion
    c. Facilitated diffusion
    d. Active transport

Kidneys

12. Draw and label a nephron. Draw the blood supply and where each part is with respect to the cortex and medulla. (You should label about 12 things total)

13. Na+ causes the movement of five things across the luminal membrane of the epithelial cells. What are these 5 things, and in which direction does the Na+
move each? Which direction does the Na+ move? How is the Na+ gradient maintained?
14. What type of transport is used by each of the five things mentioned in #9.
15. What is the purpose of a tight junction?
16. Fill in chart. Name the channels and which type of aquaporin is used if applicable

<table>
<thead>
<tr>
<th>Part of Nephron</th>
<th>Reabsorbs (How and What?)</th>
<th>Is it regulated? If so, how?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximal Tubule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Descending Loop of Henle</td>
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<td></td>
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<tr>
<td>Ascending Loop of Henle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collecting Duct</td>
<td></td>
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</tr>
</tbody>
</table>

17. What type of receptor is the vasopressin receptor? How does it increase the amount of AQP2 in the membrane?
18. Draw the negative feedback loop for diabetes insipidus. Point out at least three distinct problems that lead to a possible disconnection.
19. What are two major categories of diabetes insipidus? What are the variations of each category? Which form can be treated successfully with medication? What type of medication? Which form is currently not successfully treatable with medication?