

Bi 253, Principles of Biology
Exam 1 sample questions, Spring 2007

Ch 41

1. Homeostasis may be achieved without active participation of an animal, that is, without any physiological regulatory mechanism.
 - a. True
 - b. False

Answer: a; see text pg 945

2. A cell, say from the liver of an endothermic animal will have more mitochondria in it than a liver cell from an ectothermic animal of the same size.
 - a. True
 - b. False

Answer: a; as the level of oxidative metabolism is greater so is the need for mitochondria.

3. Which of the following sequences of complexity levels is most correct?
 - a. Cellular -> system -> organ
 - b. Molecular -> system -> organ -> tissue
 - c. Molecular -> cellular -> tissue
 - d. Tissue -> organ -> organism

Answer: c; see text page 941

4. What is the advantage of brown adipose tissue (BAT)?
 - a. BAT stores lipids as chylomicrons that are more rapidly released into the blood.
 - b. The insulation factor of BAT is much greater than regular adipose tissue.
 - c. Only BAT adipocytes can engage in replication, so an animal with this sort of tissue can make many more cells to store energy.
 - d. BAT has a greatly increased number of mitochondria per cell, and so can produce waste heat at a faster rate than normal adipose tissue.

Answer: d. Recall image from text, also presented in lecture, showing BAT adipocytes crammed with mitochondria.

Ch42

5. Sodium chloride has a molecular weight of 58, so if I put a little less than 12 grams of NaCl in a liter of water, the expected osmotic strength of the solution (in milliosmols) would be about...
- 5
 - 12
 - 200
 - 400
 - 700

Answer: d. From basic chemistry 58 grams would be a mole of the salt, and 12 grams is about 1/5 of a mole, or 200 mM. Since the salt dissociates in aqueous solution, there are twice as many osmotically active molecules, or 400 mOsm.

6. In the shark rectal gland, the ultimate driving force moving sodium into the lumen of the gland (empties to the outside) is:
- A sodium gradient
 - An electrostatic gradient
 - A proton pump
 - A basolateral ram-jet
 - a & b

Answer: e. There is a concentration gradient driving Na⁺ to the outside, but also an electrical gradient due to Cl⁻ accumulation to the outside, attracting the Na⁺.

7. For every molecule of uric acid eliminated four nitrogen atoms are lost, compared with only two for urea. So why don't all terrestrial animals use uric acid?
- To produce uric acid special de-nitrifying gut bacteria are needed.
 - Since uric acid is not very soluble, more water is required to expel it.
 - Many more bonds must be made to produce uric acid, so it is a metabolically costly molecule.
 - Uric acid precipitates easily and not all animals have evolved the peristaltic nephridiostomes needed to eject the precipitate.

Answer: c; covered in the text and in lecture.

8. Water reabsorption by the kidney is variable, depending on an animal's state of dehydration and amount of dietary salt ingested. Which parts of the kidney are adjustable, in terms of the amount of water that can be reabsorbed?
- Proximal tubule
 - Descending loop of Henle
 - Collecting tubule (duct)
 - a & b
 - a & c

Answer: c; as this is where variable numbers of aquaporins are inserted into the membrane.

Ch43

9. In addition to changes in teeth, the mode of action of jaws and associated muscle attachment points correlates with diet.
- True
 - False

Answer: a; as per the text and the lecture slide showing the scissors vs the pliers.

10. The stomach has multiple layers of muscle. Why?
- The muscle protects the stomach from HCl.
 - The muscle is important in driving food out of the stomach.
 - Stomach muscle is used to churn food, mechanically breaking down large chunks.
 - Stomach muscle attaches at the top of the stomach and links to the diaphragm, preventing the heavy stomach contents from collapsing onto the intestine.
 - All of the above

Answer: c; from the text page 987.

11. How come you can't digest cellulose?
- Only carbohydrates, proteins, fats and nucleic acids can be digested, and cellulose is not in these categories.
 - Cellulose is acid-stable, so stomach enzymes that gain access to other molecules when they unfold in low pH conditions cannot attack cellulose.
 - A minor bond rotation between sugar monomers is different in cellulose compared to starch, which means that amylase cannot recognize the bond.
 - Cellulose forms cross-linkages with lignin, and the latter molecule denatures digestive enzymes.

Answer: c; from the lecture notes.

12. Protein is broken down in the stomach by pepsin, but there are a number of other proteolytic enzymes also used for protein digestion in the small intestine.

- a. True
- b. False

Answer: a; see the text figure 43.7.