



5. Insulin is a protein hormone and estrogen is a steroid hormone.
- (6 points) Describe in general terms the differences between their modes of action.
  
  
  
  
  
  
  
  
  
  
  - (4 points) Which of these two molecules is the most challenging to make into a drug? Why?
6. a. (4 points) Explain why this statement is false: The left ventricle is a stronger pump than the right ventricle because more blood is needed to supply the body tissues than to supply the lungs.
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- (4 points) What is wrong with this statement? Repeated contraction and relaxation of the heart muscle leads to flow of blood through the circulatory system.
7. (6 points) Phospholipids can assemble into stable structures, such as bilayer membranes. Explain why these structures are stable, and what chemical features of phospholipids are important in this behavior.

8. (6 points) You swallow a smart pill, that remains within the lumen of your intestines, and transmits information as it passed through your intestinal tract. During transit, is that pill inside or outside of your body? Justify your answer.

9. (6 points) Define the concept of “selection” in cell culture. How can the plastic surface of a Petri dish be used to “select” for cells of interest?

10. a. (6 points) What is hybridization of a nucleic acid? What chemical forces are responsible?

b. Describe one practical application of nucleic acid hybridization.

**MULTIPLE CHOICE (3 points each, Total=30 points)**

Read the questions carefully.

**CIRCLE ALL OF THE CORRECT ANSWERS.****Write "NONE" if appropriate.****If you are unsure, use the area at the right of each question to explain your answer.**

1. The production of an mRNA polymer from a DNA template is:
  - A. an essential step in the synthesis of a gene product.
  - B. called translation.
  - C. called transcription.
  
2. Osmosis is
  - A. the movement of ions
  - B. the movement of proteins
  - C. the movement of water
  - D. essential for proper function of the circulatory system
  
3. Cell culture
  - A. was first reported in 1950
  - B. can be initiated from human biopsy samples
  - C. are often created from rodent cells
  - D. are always immortal
  - E. are one of the most important tools of medical research
  
4. The plasma membrane
  - A. includes lipids and proteins
  - B. is deformable
  - C. permits selective transport of ions
  
5. An organelle is
  - A. a membrane-bound structure found in the cytoplasm of eukaryotic cells
  - B. a collection of cells with a common function
  - C. an explant culture of cells
  
6. Attenuated viruses:
  - A. sometimes occur naturally
  - B. sometimes can be produced in the laboratory
  - C. cause immune responses but not disease
  - D. have never been used in humans

7. A secondary antibody response (i.e. the response to a second exposure to antigen)
- A. has higher antibody production when compared to the primary response
  - B. has a short lag period before antibody production begins
  - C. is exploited in immunization by “booster” shots
8. Pluripotent
- A. refers to the use of more than one vaccine to activate the immune system
  - B. indicates the variety of mechanisms the kidney uses to concentrate urine
  - C. refers to a stem cell's ability to differentiate down multiple paths, resulting in different cell phenotypes
9. Metaphase
- A. the resting period between mitotic events
  - B. describes the gap junctions between cells
  - C. used to describe the extracellular matrix
10. Biomedical engineering is
- A. the development of technologies to improve human health
  - B. the use of engineering analysis and methods to understand human biology
  - C. the development of technology for examining human function

12. (4 points) Describe one element of biomedical engineering that you expected to hear about in this course, but has not appeared on the syllabus or been discussed in class.