

BOT/MBIO/ZOO 1005 – Concepts in Biology

Midterm 1 (100 points) -- Form 1 (Green)

February 13, 2007

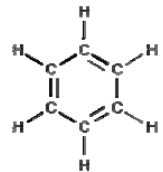
Part I: Multiple choice, true-false, and matching (50 points). Choose the single best answer.

True-false (mark T for true, F for false):

1. All organisms contain carbon.
2. Phospholipids, nucleotides, ATP, and amino acids are all good sources of phosphorus.
3. The chemical reaction that links fatty acids to glycerol to form a fat molecule is the same as the chemical reaction that links monosaccharides together to form a polysaccharide.
4. Neither Olestra (“fake fat”) nor Nutrasweet (a pair of amino acids joined by a covalent bond) are molecules that humans can digest, so both molecules pass through the body without being absorbed in the intestines.

Multiple choice / matching:

5. Which of the following is the **primary** component of the membranes that make up the endoplasmic reticulum?
a. cholesterol b. DNA c. phospholipid d. glucose e. fat
6. The molecule at right is benzene. Which of the following statements about this molecule is/are true?
a. It is an organic molecule. d. a, b, and c are true
b. It is a monosaccharide. e. only a and c are true
c. It is hydrophobic.



In an experiment designed to test the hypothesis that earthworms help protect tomato plants from harmful fungi, researchers at the Connecticut Agricultural Experiment Station set up test plots infested with fungi. They introduced earthworms to some plots, but not others, then measured the size and tomato yield of the plants in each plot.

7. What is the control group in this study?
a. all of the tomato plants d. plots that yielded the most tomatoes
b. all of the earthworms e. the researchers who were testing the hypothesis
c. plots that did not receive earthworms
 8. What is the independent variable in the experiment?
a. the size of the tomato plants in each plot
b. the researchers who were testing the hypothesis
c. the presence or absence of earthworms in the plots
d. whether or not the plots were infested with fungi
e. all of the earthworms
-
9. What do fungi and protista have in common?
a. Both groups have AT LEAST SOME unicellular representatives.
b. Both groups consist entirely of eukaryotic organisms.
c. Both groups consist of organisms whose cells contain DNA.
d. all of the above are correct
e. only b and c are correct

10. For most organisms, freezing a cell is harmful because:
- water shrinks as it freezes, making the cell too small to sustain life
 - water expands as it freezes, rupturing the cell membrane
 - freezing destroys the hydrogen bonds in water, so the molecules can't stick together anymore
 - freezing makes the hydrogen bonds in water stronger, destroying the water molecules
 - freezing makes the water molecules hydrophobic, causing the cell to lose all of its water
11. A hydrogen atom has one electron. How many bonds can hydrogen form?
- 0
 - 1
 - 2
 - 3
 - 4
12. Why is water considered a polar molecule?
- one hydrogen occurs between two oxygen atoms
 - the negatively charged oxygen atom attracts the positively charged electrons
 - it remains liquid, even at very low temperatures
 - its electrons spend more time with oxygen than with either hydrogen atom
 - both oxygen atoms are at one end of the molecule, and hydrogen is at the other end
13. Whittaker's contribution to the study of biological diversity was that he proposed that there are:
- two types of life: plants and animals
 - three types of life: plants, animals, and bacteria
 - five types of life: monera, protista, plants, animals, and fungi
 - three types of life: bacteria, archaea, and eukarya
 - two types of people: those that stop and ask for directions and those that don't
14. Photosynthesis contributes to plant growth by:
- taking in oxygen and making wood
 - taking in CO₂ and making carbohydrates
 - synthesizing CO₂ and making cellulose
 - converting sugar to O₂ and H₂O
 - releasing the energy in cellulose to make new leaves and roots
15. The best biological definition for the word "metabolism" is:
- chemical reactions that convert simple compounds to more complex compounds
 - the rate at which cells use energy
 - the rate at which cells release heat
 - chemical reactions that convert complex compounds to simpler compounds
 - all of the chemical reactions that occur inside cells
16. Which of the following is an autotroph?
- human
 - mushroom
 - pine tree
 - fish
 - porcupine
17. Plant cells:
- do not need chloroplasts because their mitochondria meet their energy needs.
 - have chloroplasts and mitochondria.
 - use CO₂ but do not use O₂.
 - do not need mitochondria because their chloroplasts meet their energy needs.
 - do not need a cell membrane because they have a cell wall.

18. Which of the following has the **highest** concentration of H^+ ?
- coffee (pH 5.0)
 - blood (pH 7.4)
 - soap (pH 10.0)
 - ammonia (pH 12.0)
 - bleach (pH 12.8)
19. The element mercury (Hg) has an atomic number of 80. Suppose a particular atom of Hg has a mass number of 200. From this information, you know that:
- every atom of mercury has 80 protons
 - every atom of mercury has 80 neutrons
 - a neutral (uncharged) atom of mercury has 120 electrons
 - a neutral (uncharged) atom of mercury has 200 electrons
 - two of the above are correct
20. The difference between an autotroph and a heterotroph is:
- whether the organism's cells undergo respiration or not
 - whether the organism's cells contain DNA or not
 - whether the organism creates its own food or eats other organisms
 - whether the organism's cells are prokaryotic or eukaryotic
 - whether the organism requires water or not
21. Which of the following organelles and structures is NOT correctly paired with its function?
- chloroplast – contains pigments that capture light energy in photosynthesis
 - cell wall – provides physical support for animal cells
 - mitochondrion – generates ATP in eukaryotic cell
 - ribosome – site of protein synthesis in prokaryotic and eukaryotic cells
 - nucleus – contains DNA in eukaryotic but not prokaryotic cells
22. ATP's main function in the cell is to:
- make photosynthesis possible
 - provide energy for the cell's energy-requiring reactions, including dehydration synthesis
 - denature (activate) the cell's enzymes
 - encode the amino acid sequence that make up the cell's proteins
 - protect the cell from the hydrolysis of water
23. Coming soon to a drugstore near you: over-the-counter sales of Orlistat, a weight loss drug that blocks your small intestine from absorbing about 25% of the fat you consume in your food. Instead, the digested fat just passes out of your body. Which of the following statements about Orlistat and fat digestion is true?
- A gram of fat contains more calories than a gram of carbohydrates, so Orlistat is a more efficient way to reduce calorie intake than blocking carbohydrate absorption would be.
 - Because fats and polysaccharide molecules have the same shape, Orlistat will probably also result in the buildup of polysaccharides in the small intestine.
 - Orlistat's mode of action is probably to block the formation of covalent bonds that join adjacent amino acids to each other.
 - Orlistat probably inhibits fat digestion by adding hydrogen to saturated fats.
 - One likely side effect of Orlistat is that it prevents the intestine from absorbing water-soluble vitamins.

24. I have a T-shirt made of cotton, which is a plant product that is not digestible. Cotton absorbs water really well (that's why we make towels out of it too). Based on this information, what are cotton fibers made of?
- a. starch
 - b. cellulose
 - c. lipid
 - d. glycogen
 - e. sucrose
25. Which of these discoveries is most closely associated with Charles Darwin?
- a. structure of DNA
 - b. populations form communities
 - c. all life is made of cells
 - d. natural selection
 - e. life's molecules are organic
26. What color is your test form? (0 points)
- a. green
 - b. pink

Name _____ ID# _____

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Part I: _____ / 50

Part II: _____ / 50

TOTAL: _____ / 100

On my honor, I affirm that I have neither given nor received inappropriate aid in the completion of this exam.

(signed) _____

Score (this page) _____ / 12 points

Part II: Short answer (50 points)

1. The table at right shows data from an experiment reported in my *Organic Gardening* magazine.

a. What is most likely hypothesis that the researchers were testing? Use a full sentence (2 pts).

	Germination Rates	
Seed type	With Heat Mat	Without Heat Mat
Basil	100%	0%
Broccoli	100%	100%
Chard	100%	100%
Lettuce	25%	100%
Parsley	100%	0%
Tomato	100%	100%

b. What is the dependent variable in the experiment? (1 point)

c. Name two variables that should have been standardized in this experiment, and explain why it is important to standardize those particular conditions (4 pts).

2. Explain why it is so difficult to test a hypothesis like “doughnuts are bad for you” or “pizza cures cancer” (2 points).

3. Some types of flowers produce nectar, a fluid that contains mostly sugar and water. Nectar is an important food source for many insects and other animals.

a. What is the name of the process that plants use to produce glucose? (1 point)

b. Given that nectar consists mostly of sugar and water, do you think nectar is a good source of dietary nitrogen for a nectar-eating animal? Explain (2 points).

Name _____ ID# _____

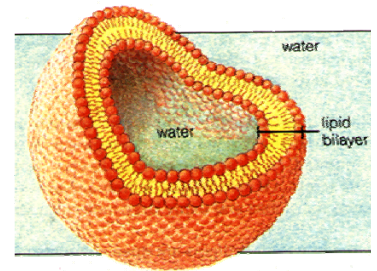
Score (this page) _____ / 20 points

4. a. List two differences between a prokaryotic and a eukaryotic cell (2 points).
- (1)
- (2)
- b. Name an example of a prokaryotic organism and a eukaryotic organism (2 points).
- (1) prokaryotic: _____ (2) eukaryotic: _____
5. a. In the space below, draw four water molecules as they would be likely to interact in liquid water. Label at least one covalent bond, one hydrogen bond, one area of partial positive charge (δ^+), and one area of partial negative charge (δ^-). (4 points)
- b. What is cohesion, and how do hydrogen bonds contribute to this property of water? (3 points)
- c. How is cohesion important to plants? (1 point)
- d. Name two ways that plants are important to animals (2 points).
6. A grain of wheat contains a baby (embryonic) plant, but most of the grain is made of starch. When the seed absorbs water, it triggers the embryo to release an enzyme (amylase) that digests the starch.
- a. Name the organic molecule that is the breakdown product of starch (1 point).
- b. Give an example of a specific process or structure in which the embryo might use that breakdown product (2 points).
- c. What class of organic molecules does the amylase enzyme belong to? (1 point)
- d. How does heating (cooking) the grain destroy the amylase enzyme? (2 points)

7. What inorganic molecule is the source of all of a plant's carbon atoms? (1 point) _____
8. Sodium (Na) has an atomic number of 11. Are two sodium atoms likely to bond with each other, forming the molecule Na-Na? Explain your answer (2 points)
9. **List** the four classes of organic molecules that occur in cells, and **circle** the names of those that are considered polymers (long chains of monomers). (6 points)

- (1) _____ (3) _____
- (2) _____ (4) _____

10. a. The figure at right depicts a cell membrane. Draw a clear, unambiguous arrow to the hydrophobic part of the membrane (1 point).
- b. A real membrane also contains proteins. Name one function of a cell membrane protein (2 points).



11. a. Name each of the molecules at right (5 points total):

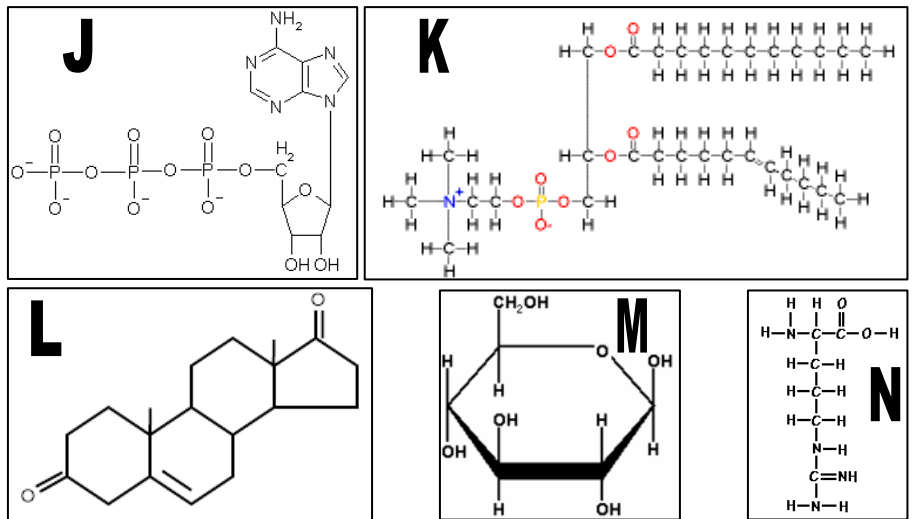
J: _____

K: _____

L: _____

M: _____

N: _____



- b. In molecule "N," draw a clear, unambiguous arrow to any POLAR covalent bond (1 point).

12. **EXTRA CREDIT!** Why do dehydrated (dried) apples spoil much more slowly than fresh apples? (2 points)