

BOT/MBIO/ZOO 1005 – Concepts in Biology

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

September 18, 2007

When the clicker says “TST:” enter “1” and then enter your answers.

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. Foods containing partially hydrogenated oils are a source of “trans” fats, which are unhealthy because they clog arteries.
2. One thing you will NOT consume in a 100% vegetarian diet (containing no animal products) is cholesterol.
3. 500 calories of fat contributes as much energy to your diet as 500 calories of sugar.
4. A solution with a pH of 2 is more acidic than a solution with a pH of 3.

Multiple choice / matching:

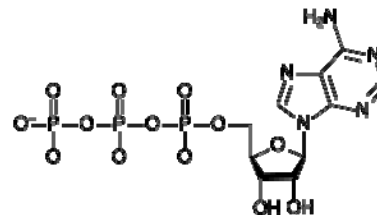
5. Which of the following statements is FALSE?
 - a. Before the 5-kingdom and 3-domain systems, people thought all life forms were either plants or animals.
 - b. A bond is nonpolar if the two atoms in the bond have equal attraction (“hogginess”) for electrons.
 - c. Olestra is a calorie-free fat substitute that you cannot digest because you don’t have enzymes that can break it down by hydrolysis.
 - d. The chemical structure of a phospholipid is very much like that of a fat molecule, except that one of the fatty acids is replaced by a phosphorus-containing group.
 - e. ATP is a type of cell, and a mitochondrion is an organelle inside the cell.
6. Which of the following statements about photosynthesis is true?
 - a. Plants use photosynthesis to generate ATP directly from energy in sunlight.
 - b. The overall reaction for photosynthesis is glucose + oxygen → carbon dioxide + water.
 - c. The reactions of photosynthesis occur in both the chloroplasts and mitochondria of plant cells.
 - d. Plants do not need respiration because they can carry out photosynthesis.
 - e. Your cells use the products of photosynthesis to carry out respiration.

A colleague of mine set up an experiment in which fish were assigned one of three ways to obtain information about potential mates (visual only, via interaction with males, and via interaction with both males and females). The objective was to find out whether the type of information the fish received would influence their choice of mates.

7. In the experiment described above, the way the fish received information is the:
 - a. control
 - b. standardized variable
 - c. independent variable
 - d. dependent variable
 - e. sample size
8. In the experiment described above, mate choice is part of the:
 - a. control
 - b. standardized variable
 - c. independent variable
 - d. dependent variable
 - e. sample size

9. The molecule at right is _____, and its function is to _____.

- a. a nucleotide ... build DNA.
- b. a phospholipid ... build the cell membrane.
- c. ATP ... provide energy for dehydration synthesis
- d. a steroid ... steer materials toward the Golgi apparatus
- e. a monosaccharide ... be the raw material for respiration



10. Sodium (Na) has an atomic number of 11, and chlorine (Cl) has an atomic number of 17. These two atoms form an ionic bond (to form NaCl) when:
- Na donates an electron to Cl
 - Cl donates an electron to Na
 - Na donates a proton to Cl
 - Cl donates a proton to Na
 - Na and Cl share a pair of electrons
11. Which of the following organelles is NOT matched correctly with its function?
- ribosome – where proteins are assembled
 - flagellum – helps move a cell
 - cell wall – protects plant cells
 - mitochondrion – where glucose is produced
 - nucleus – houses DNA
12. Which of the following is physically the largest?
- a mitochondrion
 - an enzyme
 - an amino acid
 - a water molecule
 - a phospholipid

I saw an ad on TV for a product called 5-hour energy (<http://www.5hourenergy.com>). Its ingredients include vitamins, amino acids, caffeine, and enzymes.

13. Your body will use the amino acids in the drink to assemble:
- DNA
 - proteins
 - lipids
 - polysaccharides
 - starch
14. The enzymes in the drink are probably active at around pH 7 or 8. The pH of the stomach is about 2. Are the enzymes in the drink likely to stay active after entering the stomach?
- Yes, each enzyme is active at any pH.
 - No, because enzymes are specialized cells that would be ruined at a pH of 2.
 - No, because enzymes are proteins that would probably be denatured at a pH of 2.
 - Yes, because enzymes are specialized cells, and their buffers would protect them at a pH of 2.
 - Yes, because enzymes are essential elements that can't be ruined by exposure to acid.
15. Which of the following statements about the vitamins in the drink is/are true?
- The vitamins are inorganic molecules.
 - The vitamins help the body's enzymes do their job.
 - Your body can synthesize all vitamins by itself, but it saves energy to consume them in the drink.
 - Only a and b are true.
 - a, b, and c are true.
16. The drink also says it contains "no net carbs," which most likely means that:
- there is no sugar, starch, or fiber in the drink
 - the drink contains zero calories
 - the drink contains only inorganic substances
 - both a and b are true
 - a, b, and c are true

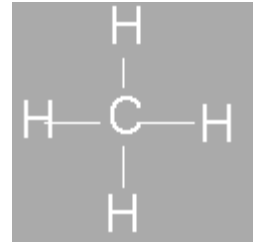


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17. A recent zoology seminar was entitled "An isotopic approach to bird migration." The scientist was using different isotopes of hydrogen to study where migrating birds spend their winters. These different isotopes of hydrogen differ from each other in the number of ___ they contain:
- protons
 - covalent bonds
 - neutrons
 - electrons
 - ionic bonds
18. Assume that a bird's feathers are made entirely of keratin, a protein. If you wanted to chemically analyze the elements in a feather, HOW MANY of the elements on the following list would you expect to find?
C, H, O, N, P
- one
 - two
 - three
 - four
 - five

19. The main difference between an acid and a base is:
- a. the number of bonds they “like” to make
 - b. acids are organic, and bases are inorganic
 - c. acids are molecules, and bases are cells
 - d. acids influence pH, and bases do not
 - e. acids release H^+ into solution, and bases do not

20. An individual of a species named *Dryadella lilliputiana* consists of multiple cells that each contain a nucleus. It is an autotroph. Based on this information, the organism is most likely to belong to:
- a. domain Archaea and kingdom Plantae
 - b. domain Eukarya and kingdom Plantae
 - c. domain Plantae and kingdom Protista
 - d. domain Eukarya and kingdom Monera
 - e. domain Bacteria and kingdom Monera

21. The molecule pictured at right is methane (CH_4). Which of the following statements about methane is FALSE?
- a. All of the atoms in this molecule have formed their “preferred” number of bonds.
 - b. Each of the lines connecting C with H represents one shared pair of electrons in a covalent bond.
 - c. It is possible for methane molecules to stick together by forming hydrogen bonds with one another.
 - d. The C-H bonds in methane are nonpolar.
 - e. Methane is an organic molecule.



22. A hydrogen bond is ___ a covalent bond.
- a. stronger than
 - b. weaker than
 - c. equally strong as
23. “Frostbite” occurs when your tissues freeze. It is logical to conclude that freezing kills your cells because:
- a. DNA cannot exist at below-freezing temperatures.
 - b. the water inside your cells expands as it freezes, causing the cell membrane to break.
 - c. the sugars that your cells require for energy turn into CO_2 at below-freezing temperatures.
 - d. your cell’s proteins are digested (by hydrolysis) too rapidly at low temperatures.
 - e. too much water becomes converted to acid at below-freezing temperatures.
24. Which of the following is NOT a correct match?
- a. phospholipid: both hydrophobic and hydrophilic
 - b. steroid: hydrophobic
 - c. glucose: hydrophilic
 - d. soap: both hydrophobic and hydrophilic
 - e. polysaccharide: hydrophobic
25. How many double bonds would you expect to find between carbon atoms in the fatty acids of a SATURATED fat?
- a. 2 or more
 - b. 1
 - c. none
26. What color is your test form? (0 points)
- a. green
 - b. pink

NOTE: If you noticed anything at all unusual happening to your clicker during the exam, please describe what happened:

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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) _____

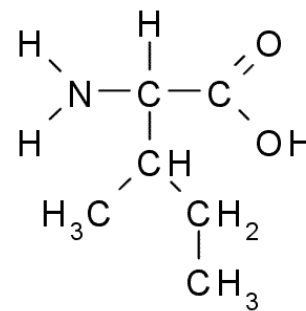
Score (this page) _____ / 13 points

Part II: Short answer (50 points)

1. A veterinarian named Dr. Fox writes a column that appears in the *Norman Transcript*. On Aug. 23, 2007, he answered a reader's question about a 1-year-old cat that meows all the time. His response said: "Kittens like yours must surely wonder about the meaning of life ... my theory is that your cat's meowing could well be the cry of a lost soul. I suggest you get her a compatible and healthy kitten as a companion and prove my theory right."
 - a. From a scientific point of view, what is the problem with Dr. Fox's "theory"? (2 points)
 - b. Would the companionship of a kitten really "prove his theory right"? Why or why not? (2 points)
2. Your cousin is an elementary school student who is looking for a possible science fair project. She comes across the following sample hypothesis: "Bread mold does not need light for reproduction on white bread." Help her design an experiment to test her hypothesis. Include the independent variable, dependent variable, control, and two variables to standardize (5 points).
3. Use your knowledge of covalent bonds to explain why butter does not dissolve in iced tea (which is mostly water). (3 points)
4. Birds that migrate over long distances have to stockpile a lot of energy to fuel them for their long trip. Which energy storage molecule stores the most calories per gram: fat or sugar? (1 point)

5. a. Magnesium is an element with atomic number 12 and mass number 24. If you were to draw an atom of magnesium, you would put _____ protons and _____ neutrons in the atom's nucleus (2 points total).
- b. Draw the electron shells of a magnesium atom (2 points).
- c. Predict magnesium's "behavior" if it were to form an ionic bond, and explain your prediction (3 points).

6. a. What type of molecule appears at right? (2 points)



- b. Circle the entire R group on this molecule (2 points).

- c. Do you predict this R group is hydrophobic or hydrophilic? Explain your answer (3 points).

7. Draw four water molecules as you might find them in a "snapshot" of liquid water. Label one covalent bond, one hydrogen bond, one area with a partial positive charge (δ^+), and one area with a partial negative charge (δ^-) (4 points).

8. Give one specific reason that microorganisms cannot spoil dry foods such as crackers (something more than "because all organisms require water"). WHY can't they live without water? (2 points)

9. In the list below, circle all of the structures that are part of the cells of both bacteria AND fungi (3 points):

ribosomes
nucleus
cell membrane

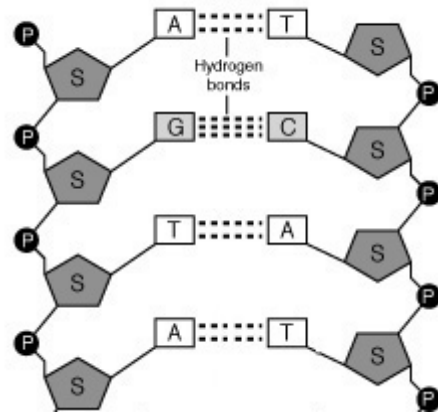
mitochondria
chloroplasts
Golgi apparatus

10. I found a website that makes this claim: “Despite US FDA approval as a 'safe' food additive, aspartame is one of the most dangerous substances ever to be foisted upon an unsuspecting public.” Aspartame is the artificial sweetener called Nutrasweet, which is composed of two amino acids. Using what you know about aspartame, do you think the statement above is likely to be true? Justify your answer (3 points).

11. a. What is the name of the polymer at right? (2 points)

- b. What is the name of the monomer that makes up this polymer? (2 points)

- c. How many monomers are pictured in this polymer? (2 points)



- d. What is the relationship between the monomers in this polymer and the chemical reaction called dehydration synthesis? (2 points)

12. Cells are so small that you need a microscope to examine them. Why are they so small? Hint: Remember that a living cell must constantly interact with its surrounding environment (3 points)

13. ***EXTRA CREDIT!*** Potatoes and cotton are both derived from plants. You can eat all the French fries you want, but you cannot eat your 100% cotton t-shirt. Explain this difference (2 points)

Please turn off your clicker once you have completed your exam.