#### BIOLOGY 311C - Brand Spring 2007

# KEY

NAME (printed very legibly)

UT-EID

#### **EXAMINATION II**

Before beginning, check to be sure that this exam contains 7 pages (including front and back) numbered consecutively, and that you have been provided with a clean Answer Sheet. Then immediately print your name and UT-EID legibly at the top of this page. Also print and bubble in your name and your UT-EID (not your social security number) on the front of the Answer Sheet in the spaces provided. The first 32 questions are "multiple choice", with only one correct answer. Mark the letter corresponding to the correct answer to each of these questions in the appropriate location on the Answer Sheet, using a No. 2 pencil. Write answers to Questions 33 - 38 directly on this exam, in the spaces provided with the questions. Write in complete sentences if an explanation or a description is required. Print neatly if your handwriting is likely to be difficult to read. Turn in both this exam and the Answer Sheet after checking to be sure that your name is clearly written in both places and all questions have been answered in the appropriate locations. You must turn in you exam on or before 9:50 a.m.

- 1. Which one of the following features of water does not contribute to its polarity?
  - a. Its bond angle makes it an asymmetrical molecule.
  - b. Its oxygen atom is much more electronegative than its hydrogen atoms.
  - **<u>c.</u>** Its 3-dimensional shape makes it a hydrophobic molecule.
  - d. Two lone pairs of electrons on the oxygen project away from the hydrogen atoms.
- 2. Which one of the following would not be expected to bond with an aldehyde functional group through a hydrogen bond?
  - a. An amine functional group
  - **b.** A sulfhydryl functional group
  - c. Water
  - d. A disaccharide
- 3. Which of the following would not be expected to ionize in living cells?
  - **<u>a.</u>** An alcohol functional group
  - b. A carboxylic acid functional group
  - c. A phosphoric acid functional group
  - d. An amine functional group
- 4. Which one of the following cell compartments is best at utilizing carboxylic acid functional groups as a pH buffer?
  - a. Mitochondrial matrix
  - b. Cytoplasmic matrix
  - c. Peroxysome
  - <u>d.</u> Lysosome
- 5. At pH 7 in cells, a carboxylic acid functional group may form an electrovalent bond with which one of the following?
  - a. A phosphoric acid functional group
  - **b.** An amino acid
  - c. A hydrocarbon
  - d. A triglyceride

- 6. What percent of a typical animal cell is water?
  - a. 0.1 1 %
  - b. 15 30 %
  - <u>**c.**</u> 60 90 %
  - d. Over 99.9 %
- 7. Which one of the following is an inorganic ion that often serves as an electrical bridge, holding two charged ions in close proximity?
  - <u>**a.**</u> Mg<sup>2+</sup>
  - b. K<sup>+</sup>
  - c. OH-
  - d. Cl<sup>-</sup>
- 8. A C<sub>6</sub> carbohydrate that contains an amino functional group is expected to be a(n):
  - a. simple sugar.
  - **<u>b.</u>** modified sugar.
  - c. oligosaccharide.
  - d. polysaccharide.
- 9. When the straight-chain form of D-glucose (an aldohexose) converts to a ring form, then:
  - a. the number of asymmetric carbon atoms does not change.
  - b. none of the carbon atoms remain asymmetric.
  - **<u>c.</u>** the number of asymmetric carbon atoms is increased by 1.
  - d. the number of asymmetric carbon atoms is decreased by 1.
- 10. A molecule that contains 3 20 subunits, each bonded to the molecule in a characteristic kind of bonding, is called a(n):
  - a. monomer.
  - **<u>b.</u>** oligomer.
  - c. polymer.
  - d. isomer.
- 11. Which one of the following pairs of molecules would have identical chemical properties?
  - a.  $\alpha$ -D-glucose and  $\beta$ -D-glucose (ring forms)
  - **<u>b.</u>** D-glucose and L-glucose (straight-chain forms)
  - c. D-glucose and D-ribose (straight-chain forms)
  - d. D-Ribose and 2-deoxy-D-ribose (ring forms)
- 12. A major form of food and energy transport between cells of multicellular organisms is:
  - **<u>a.</u>** monosaccharides and oligosaccharides.
  - b. nucleoside diphosphates and triphosphates.
  - c. amino acids and oligopeptides.
  - d. inorganic ions.
- 13. An unsaturated fatty acid differs from a saturated fatty acid in that an unsaturated fatty acid:
  - a. is partially soluble in water.
  - b. is attached to glycerol.
  - c. has at least 18 carbon atoms.
  - **<u>d.</u>** contains at least one double bond.

- 14. Which one of the following is not a component of a typical phospholipid?
  - **<u>a.</u>** Sulfhydryl functional group
  - b. Phosphodiester bond
  - c. Ester bond
  - d. Glycerol

Questions 16 and 17 refer to the molecule whose structural formula is shown at right

- 15. This represents a(n):
  - a. amino acid.
  - **b.** dipeptide.
  - c. steroid.
  - d,. fatty acid.

16. The group of atoms shown within the oval represents a(n):

- a. glycosidic bond.
- b. ester bond.
- c. hydrogen bond.
- **<u>d.</u>** peptide bond.

17. The  $\beta$ -sheet conformation of a polypeptide chain is a kind of:

- a. primary structure.
- **<u>b.</u>** secondary structure.
- c. tertiary structure.
- d. quaternary structure.
- 18. The sequence of amino acids in a polypeptide chain is called the:
  - **<u>a.</u>** primary structure of the polypeptide chain.
  - b. secondary structure of the polypeptide chain.
  - c. tertiary structure of the polypeptide chain.
  - d. quaternary structure of the polypeptide chain.

19. The tertiary structure of a molecule of <u>RNA</u> is determined especially by:

- a. phosphodiester bonds.
- **<u>b.</u>** stem-loop structures.
- c. disulfide linkages.
- d. hydrophobic bonding.

20. The thickness of typical biological membranes is approximately:

- <u>a.</u> 8 nm.
- b. 36 nm.
- c. 1.5 µm.
- $d. \quad 24 \ \mu m.$

21. The phospholipid molecules of a biological membrane are held in the membrane by:

- a. hydrogen bonds.
- b. electrovalent salt bridges.
- **<u>c.</u>** hydrophobic bonding.
- d. phosphodiester bonds.



- 22. When a biological membrane in a living cell is cooled, it may:
  - **<u>a.</u>** change from a fluid state to a gel state.
  - b. change from a gel state to a fluid state.
  - c. disassemble (come apart) into individual molecules.
  - d. fuse with other membranes to form a larger membrane.
- 23. Which one of the following passes through membranes rapidly without the assistance of any proteins?
  - a. Glucose
  - <u>**b.**</u> O<sub>2</sub>
  - c. K<sup>+</sup>
  - d. Oligonucleotide
- 24. The R-groups of amino acids that form alpha-helices of transmembrane proteins are:
  - <u>a.</u> nonpolar.
  - b. cationic.
  - c. anionic.
  - d. polar but not charged.
- 25. Which one of the following membrane components is soluble in water?
  - a. Transmembrane protein
  - **b.** Peripheral protein
  - c. Cholesterol
  - d. Phospholipid
- 26. The function of aquaporins in biological membranes is to:
  - a. slow the flow of water across the membrane.
  - b. bind water to the surface of the membrane.
  - **<u>c.</u>** allow rapid movement of water across the membrane.
  - d. prevent nonpolar molecules in the membrane from dissolving in water.
- 27. The function of contractile vacuoles in the cells of small eukaryotic organisms is to:
  - **<u>a.</u>** resist osmosis by expelling excess water from the cell.
  - b. store food and energy that is captured from the environment.
  - c. isolate and store toxic wastes produced by the cell.
  - d. move sources of energy from one part of the cell to another.
- 28. The cytoplasm of living cells is approximately isotonic with respect to:
  - a. pure water.
  - b. the contents of a typical freshwater lake.
  - **<u>c.</u>** the ocean.
  - d. a saturated solution of a sugar.
- 29. Transport across a biological membrane through a "gated channel" is an example of:
  - a. nonspecific transport.
  - **<u>b.</u>** facilitated diffusion.
  - c. active transport.
  - d. bulk transport.
- 30. Phosphodiester bonds occur in which one of the following?
  - a. Starch
  - b. Monoglyceride
  - c. Nucleotide
  - d. Polynucleotide
- 31. Endocytosis and exocytosis across a biological membrane are examples of:

- a. nonspecific transport.
- b. facilitated diffusion.
- c. active transport.
- **<u>d.</u>** bulk transport.
- 32. Molecules in cells that protect polypeptides during their synthesis so that these polypeptides properly fold into functional proteins are called:
  - a. collagens.
  - b. ribonucleoproteins.
  - c. proteosomes.
  - <u>d.</u> chaperonins.
- 33. Complete each statement below with the correct word(s) or number.
  - a. If one end of a polypeptide chain is called its <u>amino-terminal end</u>, then the other end of the polypeptide chain is called its \_\_\_\_\_\_.
  - b. If one end of a polynucleotide chain is called its <u>5'end</u>, then the other end is called its <u>3' end</u>.
  - c. A specific region of a protein that performs a defined function is called a <u>domain</u> of the protein.
  - d. The three-letter designation of the molecule <u>adenosine-5'-monophosphate</u> is \_\_\_\_\_AMP \_\_\_\_\_.
  - e. The backbone of a polynucleotide chain consists of alternating sugar (pentose) and

phosphate .

- 34. The questions below pertain to the molecule whose structural formula is shown at right.
  - a. \_3 \_\_\_\_ How many asymmetric carbon atoms (chiral centers) does this molecule contain?
  - b. *D form* Is this molecule in the "D" form or is it in the "L" form?
  - c. <u>*Yes*</u> Would this molecule be capable of forming a covalently bonded ring structure? (yes or no)



d. \_\_\_*alcohol* \_\_\_\_\_ Write the name of the functional group formed by carbon atom number 4 of this molecule.

e. <u>aldopentose</u> Write the generic name of this molecule (a single word) that indicates (1) how many carbon atoms it contains, (2) the name of its key functional group, and (3) the class of molecule to which it belongs.

35. The following questions refer to the molecule



whose abbreviated structural formula is shown at right.

- a. **\_27** \_ How many carbon atoms does this molecule contain.
- b. <u>steroid</u> Based on its ring structure, to what class of molecule does this molecule belong?
- 36. List two chemical features of DNA and RNA that allows them to be distinguished from each other. *for example:* 
  - a. Feature of DNA:

## Polynucleotide chains of DNA contain 2'-deoxy-D-ribose.

Contrasting feature of RNA:

Polynucleotide chains of RNA containD-ribose.

b. Feature of DNA:

## Polynucleotide chains of DNA contains the nucleoside T.

Contrasting feature of RNA:

# Polynucleotide chains of RNA contains the nucleoside U.

- 37. The following questions pertain to the molecule whose structural formula is shown at right. [an answer of "0" is possible.]
  - a. \_1 \_\_\_ How many nitrogen bases does this molecule contain?
  - b. **\_0** \_\_ How many phosphodiester bonds does this molecule contain?
  - c. <u>I</u> How many "high energy" phosphate bonds does this molecule contain?



- d.  $\_0$  \_\_\_\_ How many amino acids occur in this molecule?
- e. \_\_ADP \_\_\_ Write the three-letter abbreviated name of this molecule. [It contains the nucleoside whose abbreviated name is "A".]



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### A Lipid B Carbohydrate

- 38. For each kind of biological molecule listed below, select the class of molecule to which it belongs from the list at right, and place the corresponding letter in the space provided. Select only one letter for each space.
  - a. \_\_ C \_ Hemoglobin
  - b. \_\_A \_ Triglyceride
  - c. \_\_ *C*\_ Antibody
  - d. \_\_**D**\_UTP
  - e. \_\_**B**\_Cellulose
  - f. \_\_\_ *C*\_\_ Ionophore
  - g. A Isoprenoid
  - h. \_\_**B**\_2-deoxyribose
  - i.  $\_B$  \_\_ Name that begins with "glyco-"