BIOLOGY 311C - Brand Spring 2008

| NAME (printed very legibly) | Key | UT-EID |
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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 40 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 41 - 44 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 9:55 a.m.

- 1. Structural chemistry as applied to living cells is especially concerned with:
 - a. changes in the arrangements of atoms as they combine and dis-associate in various ways.
 - **b.** the arrangements of atoms within and between biological molecules.
 - c. the assembly of molecules into cellular structures such as membranes and occlusions.
 - d. the chemical mechanisms whereby cells are held together to form multicellular organisms.
- 2. In comparison to the bond strength of typical covalent bonds, hydrogen bonds:
 - a. are approximately 50 times as strong.
 - b. have approximately the same bond strength.
 - c. are approximately one-tenth as strong.
 - d. are approximately 0.02 % as strong.
- 3. Active cells contain which one of the following in highest abundance?
 - a. Water
 - b. Organic polymers
 - c. Small organic molecules
 - d. Inorganic ions
- 4. Of the atoms whose chemical symbol is shown below, which one is most electronegative?
 - a. C
 - **b.** O
 - c. P
 - d. N
- 5. A formula of a sugar may be written as $C_7H_{14}O_7$, which is a:
 - a. structural formula.
 - **<u>b.</u>** chemical formula.
 - c. stereo formula.
 - d. optical formula.

- Which one of the following functional groups would not be expected to form polar bonds with other 6. functional groups?
 - a. -CH₃
 - b. -OH
 - c. -NH₂
 - **d.** -CHO
- Which one of the kinds of atoms whose chemical symbol is shown below does not participate in hydrogen 7. bonds in biological molecules?
 - <u>a.</u> C
 - b. H
 - c. O
 - d. N
- Which one of the following is present in highest concentration in a glass of pure water at room 8. temperature?
 - **a.** H₂O
 - b. H₃O⁺
 - c. OH
 - d. H⁺
- The mitochondrial matrix of cells (pH above 9) contains a high 9. concentration of molecules with a functional group whose structure is illustrated at right. The number of electrical charges on these functional groups is:



- a. 0.
- b. 1.
- <u>c.</u> 2.
- d. 3.
- 10. Which one of the following functional groups would be expected to be an anion in cytoplasmic matrix of cells?
 - a. Alcohol
 - b. Sulfhydryl
 - c. Methyl
 - d. Carboxylic acid
- 11. Which one of the following functional groups serves as a good pH buffer in most compartments (including the cytoplasmic matrix) of eukaryotic cells?
 - **a.** Phosphate
 - b. Amine
 - c. Alcohol
 - d. Carboxylic acid

12. Ions which are especially important for balancing electrical charges on biological membranes are:

- a. Ca^{2+} and Na^+ . b. Fe^{2+} and Fe^{3+} .

- **<u>c.</u>** Mg^{2+} and K^{+} . d. Cu^{2+} and Zn^{2+} .
- 13. The molecule whose structure is shown at right is:

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- a. ADP
- b. a dinucleotide
- <u>c.</u> cyclic AMP
- d. RNA
- 14. When 3 20 monomers are connected together in dehydration reactions, the resulting product is called a(n):
 - a. polymer.
 - **<u>b.</u>** oligomer.
 - c. enantiomer.
 - d. protomer.
- 15. Which one of the following is <u>not</u> a carbohydrate?
 - a. Dihydroxyacetone
 - b. Maltose
 - c. Trisaccharide
 - <u>**d.**</u> Lysozyme
- 16. Which one of the following is a <u>polar</u> lipid?
 - a. Phospholipid
 - b. Triglyceride
 - c. Steroid
 - d. Isoprene
- 17. Alpha-helix and beta-sheet conformations are stabilized in polypeptide chains by:
 - a. covalent bonds.
 - **<u>b.</u>** hydrogen bonds.
 - c. electrovalent bonds.
 - d. hydrophobic bonding.
- 18. The amino acid sequence of a polypeptide chain is called its:
 - **a.** primary structure.
 - b. secondary structure.
 - c. tertiary structure.
 - d. quaternary structure.
- 19. The number of peptide bonds in a tripeptide is:
 - a. 0.
 - b. 1.
 - <u>c.</u> 2.
 - d. 3.
- 20. A polypeptide chain that does <u>not</u> have a pronounced tertiary structure is probably a:
 - <u>a.</u> fibrous protein.
 - b. globular protein.
 - c. oligomeric protein.
 - d. conjugated protein.

- 21. Which one of the following kinds of bonding within a polypeptide chain produces a disulfide bond in stabilizing the tertiary structure?
 - a. Hydrophobic bonding
 - b. A hydrogen bond
 - c. An electrovalent bond
 - <u>**d.</u>** A covalent bond</u>
- 22. Which one of the following does not contain protein?
 - a. Enzymes
 - b. Ribosomes
 - <u>**c.**</u> Cellulose
 - c. Chromatin
- 23. 2'-deoxyribose is a component of some:
 - a. amino acids.
 - **<u>b.</u>** nucleotides.
 - c. oligosaccharides.
 - d. nonpolar lipids.
- 24. Nucleotides differ from nucleosides in that nucleotides:
 - **<u>a.</u>** contain phosphate.
 - b. contain more than one nitrogen base.
 - c. contain 2-deoxypentose.
 - d. occur only in the cytoplasm of living cells.

25: Which one of the following kinds of bonding connects nucleotides together to form a polynucleotide chain?

- a. Phosphate anhydride bonds
- **b.** Phosphodiester bonds
- c. Glycosidic bonds
- d. Carboxylic acid ester bonds
- 26. A stem-loop structure is a common feature of:
 - a. proteoglycans.
 - b. polypeptides.
 - <u>c.</u> RNA.
 - d. oligosaccharides.
- 27. The hydrogen-atom carrier molecules of cells, which undergo reversible oxidation and reduction reactions, are:
 - a. oligopeptides.
 - b. nonpolar amino acids.
 - c. dinucleotides.
 - d. lipoproteins.
- 28. The basic structure of biological membranes is based on the structural organization of:
 - <u>a.</u> phospholipids.
 - b. steroids.
 - c. peripheral proteins.
 - d. oligosaccharides.

- 29. Which one of the following would cause a biological membrane to become more fluid?a. Decrease the chain length of its fatty acid chains.
 - b. Add hydrogen atoms to its fatty acid chains so they are saturated.
 - c. Lower the temperature of its environment.
 - d. Add transmembrane proteins.
- 30. Which one of the following passes rapidly through biological membranes without damaging the membrane and without requiring any transmembrane proteins?
 - a. C₃ sugars
 - b. H₂O
 - $c. \ K^+$
 - <u>**d.**</u> O₂
- 31. Which one of the following is true of transmembrane proteins of biological membranes?
 - a. They easily flip over so that either face may project from both faces of the membrane.
 - b. They are easily removed from the membrane since they are held in place only by hydrophobic bonding.
 - **<u>c.</u>** They are much more important than lipids in conferring specific functions to the membrane.
 - d. All biological membranes contain almost identical transmembrane proteins.
- 32. Which one of the following is a component of membranes that is soluble in water?
 - **<u>a.</u>** Peripheral membrane proteins
 - b. Transmembrane proteins
 - c. Phospholipids
 - d. Cholesterol
- 33. Which one of the following is <u>not</u> true of active transport of a molecule such as a simple sugar across a biological membrane?
 - **a.** It facilitates transport in both directions across the membrane, but requires energy for transport in one direction only.
 - b. It requires a permease.

c. It is highly selective in recognizing only one specific kind of molecule to transport across the membrane.

d. It transports the molecule in only one direction across the membrane.

The following two questions relate to the molecule whose structural formula is shown at right.

- 34. To which one of the following classes does this molecule belong?
 - a. Hexasaccharide
 - b. Amino Acid
 - c. Nucleoside
 - <u>**d.</u> Simple sugar**</u>



- 35. The arrangement of atoms shown around carbon atom number 5 indicates that this molecule is a(n):
 - a. alpha (α) form.
 - b. beta (β)form.
 - <u>**c.**</u> D form.
 - d. L form.

- 36. Due to the base pairing rules of polynucleotides, the number of dA nucleosides in a molecule of DNA would be expected to be equal to the number of:
 - a. dG.
 - b. dC.
 - <u>**c.**</u> dT.
 - **d**. **d**U.

The following three questions relate to the molecule whose structural formula is shown at right.

- 37. Which one of the following is this molecule?
 - a. A simple sugar
 - b. A monoglyceride
 - **<u>c.</u>** An amino acid
 - d. A nitrogen base used to construct nucleosides



- 38. How many asymmetric carbon atoms does this molecule contain?
 - a. 0
 - <u>b.</u> 1
 - c. 2
 - d. 3
- 39. The number of electrical charges that this molecule would be expected to carry in the cytoplasmic matrix of cells is:
 - a. 0
 - b. 1
 - c. 2
 - <u>d.</u> 3
- 40. The molecule whose structure is shown at right is a(n):
 - a. fatty acid.
 - b. isoprenoid.
 - c. monoglyceride.
 - <u>**d.**</u> steroid



- 41. Fill in the blank spaces to complete the description of a simple sugar.
 - a. Simple sugars generally contain somewhere between <u>3</u> and <u>7</u> carbon atoms.
 - b. One of the carbon atoms occurs as an **___aldehyde**____ or a **___ketone**_____ functional group.
 - c. Each of the other carbon atoms occurs as a(n) _____alcohol_____ functional group.
 - d. <u>**Hydrogen**</u> atoms are attached to all other positions on the carbon atoms in order to satisfy their valencies.

- 42. Recall that "ATP" is the abbreviated name of a compound that carries useful energy in cells. Then using that same abbreviated terminology, write in the provided spaces the abbreviated name of:
 - a. **_dCMP** (or 5'dCMP)_ the nucleotide that contains (1) the nucleoside "C", (2) the sugar 2-deoxyribose, and (3) one phosphate group bonded to the 5th carbon atom of the sugar.
 - b. **_GDP** (or 5'GDP)_ the nucleotide that contains (1) the nucleoside "G", (2) the sugar ribose, and (3) two phosphate groups bonded to the 5th carbon atom of the sugar.
- 43. For each of the following, write a word in the space provided that best fits the corresponding description.
 - a. **__glycolipid**_____ The name of a conjugated molecule that contains a small carbohydrate component and a larger lipid component.
 - b. **___aquaporin**_____ The name of the transmembrane protein that facilitates rapid transport of water across biological membranes.
- 44. The illustration shown in the box at left represents short segment of a molecule of DNA. Write information in the spaces corresponding to letters a through f in the illustration, as specified below.

In the space next to letter "a", write the word or number that indicates the terminal end of the molecule that would be reached by continuing upward along the polynucleotide chain at the left side of the illustration.

In the space next to letter "b", write the word or number that indicates the terminal end of the molecule that would be reached by continuing downward along the polynucleotide chain at the left side of the illustration.

In the spaces labeled c - f, write the correct abbreviation for the adjacent nucleoside, assuming that all nucleotides are correctly base-paired.

