#### BIOLOGY 311C - Brand Spring 2010

NAME (printed very legibly)	Key	UT-EID	
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#### **EXAMINATION II**

Before beginning, check to be sure that this exam contains 8 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 (<u>not</u> your social security number) on the front of the Answer Sheet in the spaces provided. The first 43 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 44 - 46 directly on this exam, in the spaces provided with the questions. Write in complete sentences if an explanation is required and <u>print</u> neatly if your handwriting is likely to be difficult to read. Turn in <u>both</u> 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 your exam on or before 9:55 a.m.

- 1. Which one of the following is not an information molecule of living cells?
  - a. DNA
  - b. RNA
  - c. polysaccharide
  - d. polypeptide
- 2. Approximately what portion of the dry weight of a typical living cell consists of organic molecules? a. 0.35%
  - b. 1 %
  - c. 70%
  - **d.** 99%
- 3. The bond angle of a molecule of water is closest to which one of the following?
  - a. 180°
  - **b.** A tetrahedral angle
  - c. The angles of a regular hexagon
  - d. A right angle
- 4. Polar bonding causes a hydrogen atom that is covalently bonded to a nitrogen atom to be most strongly attracted to which one of the following?
  - a. A negatively-charged surface of a nearby membrane
  - b. A positively-charged domain of a nearby protein molecule
  - c. A methyl functional group on a nearby lipid
  - d. A sulfhydryl functional group on the same molecule that contains the hydrogen bonded to nitrogen
- 5. Consider the molecule whose partial structure is illustrated at right. How many electric charges would this structure be expected to carry at pH 5.0?
  - a. 0
  - **b.** 1
  - c. 2
  - d. 3

∥ R—О—Р—ОН |

- 6. Which one of the following is shown in the molecule whose partial structure is illustrated at right?
  - a. A peptide bond
  - b. Hydrophobic bonding (interaction)
  - **<u>c.</u>** A hydrogen bond
  - d. A carboxylic acid functional group
- 7. In pure water at pH 7, the [OH ] is:
  - a. approximately 0.
  - b. approximately 14.
  - **<u>c.</u>** equal to the  $[H_3O^+]$ .
  - d. a measure of the molecular weight of water.
- 8. The kind of molecule that best resists rapid changes in environmental conditions such as temperature in living cells is:
  - a. inorganic phosphate.
  - b. proteins.
  - c. polysaccharides.
  - <u>d.</u> water.
- 9. Which one of the following inorganic ions typically occurs at highest concentration within living cells?
  - <u>a.</u> K<sup>+</sup>
  - b.  $H_3O^+$
  - c. Ca<sup>2+</sup>
  - d. Fe<sup>2+</sup>
- 10. An inorganic ion that is temporarily allowed to leak rapidly and briefly into nerve cells in order to conduct nerve impulses is:
  - a. K<sup>+</sup>.
  - **<u>b.</u>** Na<sup>+</sup>
  - c.  $Mg^{2+}$
  - d.  $Ca^{2+}$ .



- **<u>a.</u>** a simple sugar.
- b. a modified sugar.
- c. glycerol.
- a. a glycerol molecule that is esterified to three fatty acids.
- 12. The total number of glyceride bonds in a disaccharide is:
  - <u>a.</u> 0.
  - b. 1.
  - c. 2.
  - d. 3.
- 13. The 3-dimensional shape of a biological molecule, determined by the way it is rotated around its covalent bonds, is called its:
  - a. primary structure.
  - b. isomeric form.
  - c. configuration.
  - <u>d.</u> conformation.



СНО \_\_\_\_\_ СН₂ОН

- 14. Which one of the following is a completely indigestible polysaccharide?
  - a. Keratin
  - **b.** Cellulose
  - c. Amylopectin
  - d. Amylose

15. Which one of the following is not defined by characteristic kinds of functional groups?

- a. Carbohydrate
- b. Lipid
- c. Polypeptide
- d. Polynucleotide
- 16. The <u>difference</u> between a polar lipid and a nonpolar lipid is that a polar lipid:
  - a. is soluble in water.
  - b. is not soluble in water.
  - **<u>c.</u>** has a polar portion of the molecule.
  - d. has a high molecular weight and is typically a polymer.
- 17. The molecule whose structure is illustrated at right is a:
  - a. fatty acid.
    - b. pyrimidine.
    - c. purine.
    - <u>d.</u> steroid.



- 18. Which one of the following do biologists call a high-energy bond?
  - a. A phosphate ester bond
  - b. A phosphodiester bond
  - **<u>c.</u>** An acid anhydride bond
  - d. A glycosidic bond
- 19. The R groups of the amino acids within a protein are most important for:
  - a. bonding to other molecules, and not for stabilizing the conformation of the protein.
  - b. stabilizing the primary structure of the protein.
  - c. stabilizing the secondary structure of the protein.
  - **<u>d.</u>** stabilizing the tertiary structure of the protein.
- 20. Which one of the following could best be described as an oligopeptide?
  - a. A molecule consisting of 15 simple sugars bonded together
  - b. A molecule consisting of 60 simple sugars bonded together
  - **<u>c.</u>** A molecule consisting of 15 amino acids bonded together
  - d. A molecule consisting of 60 amino acids bonded together
- 21. A feature of an oligomeric protein that is not a feature of a monomeric protein is:
  - a. a tertiary structure.
  - **<u>b.</u>** a quaternary structure.
  - c. the presence of a domain.
  - d. The presence of a prosthetic group.

The following two questions pertain to the molecule whose structure is illustrated at right.

22. It is a(n):

- **<u>a.</u>** amino acid.
- b. fatty acid.
- c. purine.
- d. pyrimidine.
- 23. Assuming that R does not carry any electric charges, how many total electric charges does this molecule have at pH 7.
  - a. 0
  - b. 1
  - <u>c.</u> 2
  - d. 3

The next four questions pertain to the molecule whose structure is illustrated at right.

- 24. This molecule is best described as a:
  - a. simple molecule.
  - b. complex molecule.
  - c. polymer.
  - **<u>d.</u>** conjugated molecule.



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- 25. The sugar of this molecule is best described as in the:
  - **<u>a.</u>**  $\alpha$  form.
  - b.  $\beta$  form.
  - c. chair form.
  - d. boat form.

26. How many carbon atoms does the sugar component of this molecule contain?

- a. 5
- <u>b.</u> 6
- c. 8
- d. 9
- 27. The most appropriate name of this molecule would be a:
  - a. liposaccharide.
  - b. lipopeptide.
  - <u>c.</u> glycolipid.
  - d. oligonucleotide.
- 28. The reverse of a hydrolysis reaction is a(n):
  - **<u>a.</u>** dehydration reaction.
  - b. esterification reaction.
  - c. protonation.
  - d. oxidation.

29. The total number of different kinds of amino acids that occur in proteins is:

- a. 3.
- b. 4.
- <u>c.</u> 20.
- d. several hundred.

30. Which of of the following cellular molecules contains the most monomers?

- <u>a.</u> DNA
- b. RNA
- c. Protein
- d. Phospholipid

31. Disulfide bonds of a polypeptide chain contribute to its:

- a. peptide bonds.
- b. primary structure.
- c. secondary structure.
- **<u>d.</u>** tertiary structure.

32. An active site and a regulatory site on different portions of an enzyme are described as separate:

- a. polypeptide chains.
- **<u>b.</u>** domains.
- c. prosthetic groups.
- d. secondary structures.

### 33. Which one of the following does not contain 2-deoxy-D-ribose?

- a. dTMP
- b. dC
- <u>**c.**</u> UMP
- d. dADP

34. Cyclic AMP, a "second messenger in cells, is classified as a:

- a. cyclic oligopeptide.
- b. nucleoside
- <u>c.</u> nucleotide.
- d. nitrogen base.
- 35. The basic building units of biological membranes are:
  - **<u>a.</u>** phospholipids.
  - b. steroids.
  - c. transmembrane proteins.
  - d. extrinsic membrane proteins.
- 36. When they become shorter and less saturated, fatty acid tails generally make biological membranes and liposomes:
  - a. more rigid.
  - **<u>b.</u>** more fluid.
  - c. less stretchable.
  - d. less permeable.

37. Typical biological membranes contain what percentage of transmembrane protein.

- a. 0.1 %
- b. 2 %
- <u>c.</u> 30%
- d. 98 %
- 38. Which one of the following is most destructive to membranes when exposed to the membrane surface at high concentration?
  - a. Inorganic ions
  - b. Gas molecules such as  $O_2$  and  $N_2$
  - c. Polymers such as polysaccharides
  - **<u>d.</u>** Small nonpolar molecules
- 39. The cytoplasmic content of living cells is approximately isotonic with respect to:
  - a. pure water.
  - **b.** sea water.
  - c. the contents of freshwater lakes.
  - d. a saturated solution of glucose.
- 40. Plant and bacterial cells do not swell and burst in their normal environment because they:
  - **<u>a.</u>** contain a strong cell wall.
  - b. contain contractile vacuoles.
  - c. contain a central vacuole that becomes filled with glycerol.
  - d. are isotonic with respect to their environment.
- 41. When a specific kind of molecule is moved across the membrane in one direction only, with the expenditure of energy, the process:
  - a. is accomplished with a gated channel.
  - b. requires an ionophore.
  - c. is a kind of bulk transport.
  - **<u>d.</u>** is called active transport.
- 42. The expulsion of viruses from a cell by budding is a kind of:
  - a. active transport.
  - b. facilitated diffusion.
  - **<u>c.</u>** bulk transport.
  - d. non-specific transport.
- 43. Which one of the following is not a characteristic of typical transmembrane proteins?
  - a. Alpha-helices of these proteins are aligned across the membrane.
  - b. Each kind of membrane carries a unique set of these proteins.
  - **<u>c.</u>** They flip over frequently in the membrane so both ends of these proteins are exposed to both sides of the membrane.
  - d. Many of these proteins are capable of enzymatic activity.

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- 44. Questions a d below relate to the molecule whose abbreviated structure is shown at right. Answer each question in the space provided.
  - a.  $\underline{2}$  How many asymmetric carbon atoms does this molecule contain?

b. **\_\_alcohol\_\_\_\_** What is the name of the functional group of carbonatom 4.

c.  $\mathbf{D}$  Is the molecule shown here in a D configuration or is it in an L configuration?

d. \_\_\_\_\_ketopentose\_\_\_\_\_ Write the generic name of this molecule that indicates its total number of carbon atoms, the functional group that distinguishes it from other molecules in the same class, and the class of molecules to which it belongs.

45. The illustration below represents a portion of a polymer, with A representing monomers and B representing the bonding arrangement that links the monomers together. Then for each class of biological molecule listed below, give the name of the monomer and the name of the bonding arrangement in the space provided.



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CH<sub>2</sub>OH

C=0

HĊ-OH

CH<sub>2</sub>OH

HO-CH

- 46. Answer the following questions pertaining to the molecule whose structure is illustrated at right by placing the correct number in each provided space. Answers may be 0 or any positive integer.
  - a. <u>1</u> How many nucleotides are contained in this molecule?
  - b. <u>1</u> How many ester bonds are contained in this molecule?
  - c. \_\_\_\_0\_\_\_ How many phosphodiester bonds are contained in this molecule?
  - d. <u>2</u> How many acid anhydride bonds are contained in this molecule?
  - e. \_\_\_\_\_ How many pyrimidines are contained in this molecule?

# end of exam

