

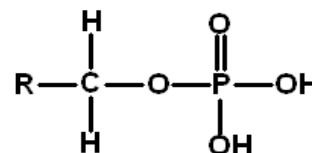
BIOLOGY 311C - Brand
Spring 2008

NAME (printed very legibly) _____ **KEY** _____ UT-EID _____

FINAL EXAMINATION

Before beginning, check to be sure that this exam contains 10 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 60 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 61 – 64 directly on this exam, in the spaces provided with the questions. Print letters corresponding to matching answers neatly. 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 your exam on or before 5:00.

1. The molecule whose structural formula is illustrated at right:
 - a. contains an acid anhydride bond.
 - b. is a dibasic phosphate.
 - c. is a diphosphate.
 - d.** is an organic phosphoric acid.
2. Which one of the following is true of a typical hydrogen bond?
 - a. It is stronger than a typical covalent bond.
 - b.** Its bond angle is 180°.
 - c. Its bond strength is 400 kJ/mole.
 - d. It links two nonpolar functional groups together.
3. According to the “black box” properties described in this course, the smallest unit of the living state is the:
 - a. single organism.
 - b.** single cell.
 - c. genome.
 - d. chromosome.
4. Which one of the following is not true of all living cells?
 - a.** They contain one or more mitochondria.
 - b. They are surrounded by a plasma membrane.
 - c. They contain genetic information (DNA).
 - d. They contain characteristic classes of organic molecules such as proteins, lipids and carbohydrates.
5. The diameters of smallest cells (except for cells that are parasites within other cells) are approximately:
 - a. 100 μm.
 - b. 100 nm.
 - c.** 0.5 μm.
 - d. 0.5 nm.



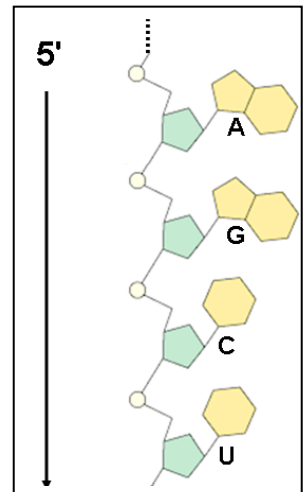
6. According to the three-domain system of classifying all living organisms, which one of the following is not a member of Eukaryota (the eukaryotes)?
- Fungi
 - Protists
 - Plants
 - d.** Archea
7. Which one of the following is not true of typical prokaryotes?
- They contain a single circular chromosome.
 - They contain 70S ribosomes.
 - c.** They contain microfilaments and microtubules.
 - Their envelope includes a plasma membrane and an outer membrane.
8. According to the definitions that were applied throughout this course, the cytoplasm of eukaryotic cells can be divided into two major components – the cytoplasmic matrix and:
- a.** membrane-bounded organelles.
 - the nucleus.
 - occlusions.
 - the plasma membrane.
9. A signal peptide that is produced during translation binds to a signal recognition particle, which then:
- inhibits the transcription of genes that code for proteins to be exported from the cell.
 - inhibits the enzymatic activity of the first enzyme of a metabolic pathway.
 - targets a functional polypeptide chain to the plasma membrane.
 - d.** targets the ribosome and its attached polypeptide chain to the endoplasmic reticulum.
10. Which one of the following is not a component of the endomembrane system of eukaryotic cells?
- A golgi body
 - b.** A mitochondrion
 - The plasma membrane
 - The nuclear envelope
11. Keratin and lamins are rather inert structural components of animal cells that are classified as:
- a.** intermediate filaments.
 - microfilaments.
 - cellulose microfibrils.
 - microtubules.
12. Basal bodies and centrioles of animal cells contain:
- intermediate filaments.
 - microfilaments.
 - cellulose microfibrils.
 - d.** microtubules.
13. Mature plant cells do not typically contain:
- plasmodesmata.
 - a thick cell wall.
 - a central vacuole.
 - d.** lysosomes.

14. Which one of the atoms whose chemical symbol is shown below is most electronegative?
- a. H
 - b. P
 - c. N**
 - d. C
15. Which one of the following functional groups would not occur in an ionized form in the cytoplasmic matrix of living cells?
- a. Ketone**
 - b. Phosphoric acid
 - c. Carboxylic acid
 - d. Amine
16. Which one of the following is present in highest concentration in active living cells?
- a. H₂O**
 - b. Protein
 - c. Carbohydrate
 - d. Inorganic ions
17. Which one of the following is not true of a molecule that is described as α -D-glucose?
- a. It is in the straight form.**
 - b. It is a hexose.
 - c. It is an aldose.
 - d. It is a “simple” sugar.
18. Which one of the following carbohydrates is not a food source for most living organisms?
- a. Amylose
 - b. Amylopectin
 - c. Glycogen
 - d. Cellulose**
19. Which one of the following lipids is most polar?
- a. Steroid
 - b. Triglyceride
 - c. Isoprenoid
 - d. Phospholipid**
20. Fatty acids are chemically bonded to glycerol in cellular lipids through:
- a. acid anhydride bonds.
 - b. ester bonds.**
 - c. disulfide bonds.
 - d. hydrogen bonds.
21. Which one of the following is not true of most free amino acids in the cytoplasm of living cells?
- a. They contain at least one phosphoric acid (phosphate) functional group.**
 - b. They contain at least one asymmetric carbon atom (chiral center).
 - c. They carry at least one negative charge.
 - d. They carry at least one positive charge.

22. The secondary structure of a protein is stabilized by:
- disulfide bonds.
 - phosphodiester bonds.
 - hydrophobic bonding.
 - d.** hydrogen bonds.
23. A polypeptide chain that is correctly folded into its functional 3-dimensional shape is said to be:
- denatured.
 - b.** in its native conformation.
 - oligomeric.
 - conjugated.
24. The difference between the nucleotides GDP and 2'-deoxy-GDP is in:
- their phosphate functional group.
 - the number of hydrogen bonds they normally form.
 - c.** their sugar component.
 - their nitrogen base.
25. Which one of the following is not considered to be an information molecule in living cells?
- Protein
 - b.** Polysaccharide
 - DNA
 - RNA

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

26. The structure shown as “A” is a(n):
- phosphate
 - b.** purine
 - pyrimidine.
 - amino acid.
27. The number of hydrogen bonds that the “U” would form during complementary base pairing of this molecule is:
- 1.
 - b.** 2.
 - 3.
 - 4.



28. If a typical living human cell such as a red blood cell is immersed in pure water, then it is expected to:
- a.** swell up and burst.
 - shrink to a smaller volume.
 - remain nearly the same size.
 - first swell up, then shrink back to its original size after contractile vacuoles are synthesized.
29. The two components of a molecule identified as a glycoprotein are protein and:
- lipid.
 - nucleic acid.
 - c.** carbohydrate.
 - inorganic ion.

30. Which one of the following is not an important hydrogen-atom carrier in living cells?
- a. FAD
 - b. GTP**
 - c. NAD^+
 - d. NADP^+
31. A metabolic pathway that produces ATP and generates a final product that is more oxidized than the starting reactant is said to be:
- a. anabolic.
 - b. catabolic.**
 - c. exergonic.
 - d. endergonic.
32. Which one of the following is a product of the pyruvate dehydrogenase reaction (also called the pyruvate dehydrogenase metabolic pathway)?
- a. CO_2**
 - b. NADPH
 - c. Glucose
 - d. Lactate
33. The overall efficiency of photosynthesis (i.e. the percent of the light energy absorbed by chlorophyll that is captured as energy in sugar molecules) is approximately:
- a. 0.03 %.
 - b. 1.5 %.
 - c. 24 %.**
 - d. 98 %.
34. The function of cyclic electron flow in photosynthesis is to produce:
- a. ATP.**
 - b. NADPH.
 - c. O_2 .
 - d. H_2O .
35. An alternative reactant to CO_2 in the reaction catalyzed by RUBISCO, which causes photorespiration, is:
- a. H_2O .
 - b. triose phosphate.
 - c. O_2 .**
 - d. pyruvate.
36. A substance that is produced and secreted by one kind of cell (a donor cell) of a multicellular organism, and then moves through the body to elicit a response in another kind of cell of the same organism, is called a(n):
- a. vitamin.
 - b. enzyme.
 - c. cofactor.
 - d. hormone.**
37. G proteins and tyrosine kinases are directly involved in:
- a. signal transduction pathways.**
 - b. active transport across membranes.
 - c. primary charge separation in photosynthesis.
 - d. oxidative phosphorylation

38. Consider a segment of DNA that is used to code for the synthesis of a protein. A 3-nucleotide sequence of the minus (non-coding) strand is: 5'---A-C-C---3'. The mRNA codon that corresponds to this sequence is:
- 3'---G-G-T---5'.
 - 3'---G-G-U---5'.
 - 5'---T-G-G---3'.
 - d.** 5'---A-C-C---3'.
39. The DNA in cells of eukaryotes is replicated in which one of the following phases of the cell cycle?
- G₁
 - b.** S
 - G₂
 - M
40. How many high energy phosphate bonds are hydrolyzed for each nucleotide that is inserted into a growing polynucleotide chain during DNA replication?
- 0
 - 1
 - c.** 2
 - 3
41. Which one of the following is the function of the enzyme called primase during DNA replication?
- It unwraps the two strands of DNA prior to replication.
 - b.** It synthesizes a short strand of RNA.
 - It ligates two pieces of DNA together.
 - It repairs replication errors that result from insertion of an incorrect nucleotide into the growing polynucleotide chain.
42. A structural gene is a segment of DNA that:
- a.** is a template for the synthesis of complementary RNA.
 - regulates the rate of transcription.
 - occurs at an origin of replication.
 - always remains in a tightly coiled double helix conformation.
43. Transcription takes place in eukaryotic cells within:
- the cytoplasmic matrix.
 - b.** the nucleus.
 - the endoplasmic reticulum.
 - ribosomes.
44. An anticodon is a component of:
- an amino acid.
 - mRNA.
 - c.** tRNA.
 - rRNA.
45. The addition of the modified G cap to an mRNA molecule is an example of;
- transcription.
 - translation.
 - c.** post-transcriptional processing.
 - post-translational processing.

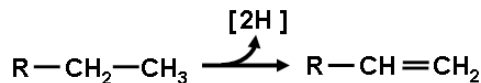
46. The covalent attachment of a phosphate functional group to an amino acid R-group of a previously synthesized polypeptide chain is an example of:
- transcription.
 - translation.
 - post-transcriptional processing.
 - d.** post-translational processing.
47. A primary transcript is a:
- a.** recently synthesized molecule of RNA that has not been processed.
 - double-stranded molecule of RNA.
 - polypeptide chain that has not yet folded into its functional 3-dimensional structure.
 - molecule of eukaryote RNA that has been processed.
48. The two enzymes that hydrolyze high energy bonds to drive transcription are RNA polymerase and:
- a.** pyrophosphatase.
 - ligase.
 - hexokinase.
 - helicase.
49. The end of a polypeptide chain that is synthesized first during translation is called the:
- carboxylic acid terminal end.
 - 5' end.
 - c.** amino-terminal end.
 - 3' end.
50. Segments of a molecule of mRNA that are removed by spliceosomes prior to translation are called:
- a.** introns.
 - exons.
 - polyA tails.
 - transcription factors.
51. The molecules that covalently bond to, and activate, amino acids prior to assimilation into a growing polypeptide chain are:
- mRNA.
 - rRNA.
 - double-stranded RNA.
 - d.** tRNA.
52. The total number of high energy phosphate bonds required to activate and insert each amino acid into a growing polypeptide chain is:
- 2.
 - 3.
 - 4.
 - d.** 5.

53. Chaperonins are structures within cells that:
- a.** help proteins fold properly.
 - b. process RNA into a functional conformation.
 - c. modify nitrogen bases on tRNA.
 - d. hydrolyze proteins to individual amino acids.
54. Which one of the following is an example of bulk transport across a biological membrane?
- a. Active transport
 - b.** Endocytosis
 - c. Facilitated diffusion
 - d. Osmosis
55. A typical diameter of a virus is:
- a. 1 nm.
 - b.** 50 nm.
 - c. 1 μm .
 - d. 50 μm .
56. A bacterial virus whose DNA integrates into host cell DNA is called a:
- a. lytic virus.
 - b.** lysogenic virus.
 - c. budding virus.
 - d. virulent virus.
57. The membrane that surrounds animal viruses such as the HIV virus is derived from the host cell:
- a.** plasma membrane.
 - b. nuclear envelope.
 - c. endoplasmic reticulum.
 - d. mitochondria.
58. One characteristic of retroviruses is that they all:
- a. attack plant cells.
 - b. are capable of synthesizing RNA from a polypeptide chain template.
 - c. contain tail fibers.
 - d.** contain RNA as their genetic information.
59. An example was presented in class that demonstrated the potential for a bacteriophage to be beneficial to a population of bacteria by carrying useful genetic information. This benefit required the virus to:
- a. be a budding virus.
 - b.** be a temperate virus.
 - c. be spherical in shape.
 - d. carry RNA as its genetic information.
60. Which one of the following is not a component of the HIV virus?
- a.** DNA
 - b. membrane coat
 - c. protein
 - d. reverse transcriptase

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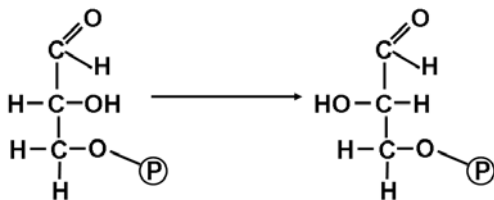
61. For each chemical reaction shown below, select from the list at right the name that best describes the type of reaction, and write the corresponding letter in the space provided.

i. A

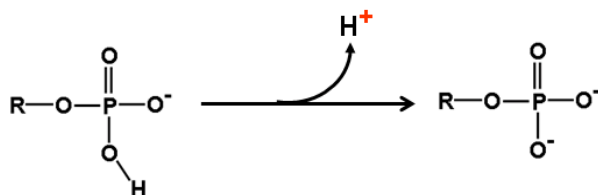


- A.** oxidation
B. reduction
C. hydrolysis
D. dehydration
E. protonation
F. de-protonation
G. isomerization
H. none of the above

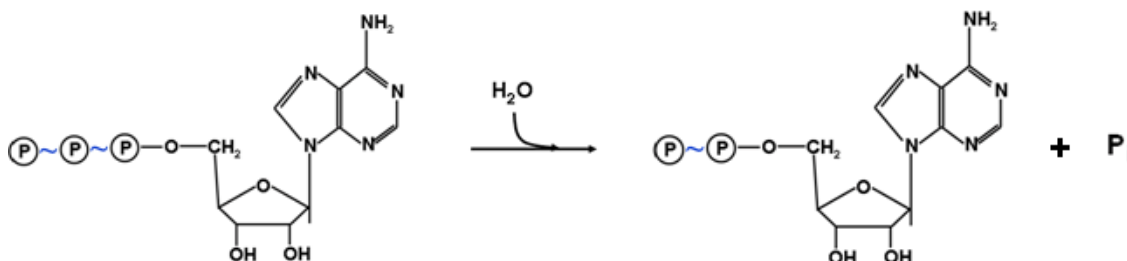
ii. G



iii. F



iv. C



62. For each name or description listed below, select from the list at right the metabolic pathway or process that is most closely associated with it, and write the corresponding letter in the space provided. Items at right may be used more than once.

i. E RUBISCO

ii. H Ribosomes are required

iii. D NADP^+ is a reactant

iv. G Uses RNA polymerase

v. A Pyruvate is a product

vi. E A C_3 or C_6 sugar is the important product for plants

vii. B Acetyl Co-A and FAD are reactants

viii. F Requires topoisomerase, single-strand-binding (ssb) protein and helicase

ix. B , C (two answers) Occurs in mitochondria of eukaryotes

x. C , D (two answers) Produces ATP through a proton gradient across a membrane

- A.** glycolysis
B. Krebs (citric acid) cycle
C. mitochondrial electron transport and oxidative phosphorylation
D. light reactions of photosynthesis
E. Calvin Cycle (dark reactions of photosynthesis)
F. DNA Replication
G. transcription
H. translation

63. For each name or description listed below, select from the list at right the class of molecule with which it most closely corresponds, and write the corresponding letter in the space provided. Answers at right may be used more than once. Items at right may be used more than once.

- A.** monosaccharide
- B.** polysaccharide
- C.** amino acid
- D.** polypeptide
- E.** triglyceride
- F.** phospholipid
- G.** nucleotide
- H.** nucleic acid

- i. **B** Contains glycosidic bonds
- ii. **G** Consists of one nitrogen base, one sugar, and phosphate
- iii. **F** The main structural component of biological membranes
- iv. **H** RNA is an example
- v. **A** A simple sugar
- vi. **C**, **D** (two answers) Contains one or more ionizable carboxylic acid functional groups
- vii. **A**, **B** (two answers) Carbohydrate
- viii. **E**, **F** (two answers) Lipid
- ix. **D**, **H** (two answers) An information molecule
- x. **F**, **H** (two answers) Contains one or more phosphodiester bonds

64. For each name or description listed below, select from the list at right the eukaryotic cellular component with which it is most closely associated, and write the corresponding letter in the space provided. Items at right may be used more than once.

- A.** nucleus
- B.** plasma membrane
- C.** mitochondrion
- D.** lysosome
- E.** endoplasmic reticulum
- F.** ribosome
- G.** peroxysome
- H.** microtubule
- I.** microfilament
- J.** plastid

- i. **G** Destroys hydrogen peroxide
- ii. **D** A very acidic compartment
- iii. **J** Does not occur in animal cells
- iv. **E** Site of membrane lipid and protein synthesis
- v. **A** Contains pores that let ribosomal subunits through
- vi. **C** Site of most ATP synthesis in animal cells
- vii. **F** Site of cytoplasmic protein synthesis
- viii. **B** Target site for insulin and many other hormones
- ix. **H**, **I** (two answers) Component of the cytoskeleton
- x. **A**, **C**, **J** (three answers) Surrounded by a double-membrane envelope