

BIOLOGY 205
FINAL EXAM - 14 June 2007
(120 points total)

Name _____

Make sure to answer section I (questions 1 through 33) on side 2 of your scantron sheet.
Section I: Multiple choice questions – 3 points each (single best answer for each; 2 free wrong answers).

1. The evolutionary biology concept of “rust the crust” refers to the idea that:
 - A. Iron is necessary for the cytochromes in the respiratory chain
 - B. Iron gets used in hemoglobin
 - C. Iron had to get oxidized before oxygen could exist in the atmosphere
 - D. Iron is needed for the biosynthesis of polymers
 - E. Iron is the fourth most abundant element on Earth

2. Microtubules provide an avenue for the movement of organelles within the cell. Which of the following is the “motor” protein that provides the mechanism for this movement towards the negative end?
 - A. Kinesin
 - B. Dynein
 - C. Actin
 - D. Myosin
 - E. Keratin

3. In Eucarya (aka Eukaryotic) cells, where are proteins that eventually contain covalently attached sugar residues translated?
 - A. In the nucleus
 - B. On the Golgi apparatus
 - C. In the mitochondria
 - D. On the endoplasmic reticulum
 - E. In the cytoplasm

4. Ribosomes are a collection of:
 - A. small proteins that function in translation
 - B. proteins and rRNAs that function in translation
 - C. proteins and tRNAs that function in transcription
 - D. proteins and mRNAs that function in translation
 - E. mRNAs and tRNAs that function in translation

5. Oxygen is used (reduced) directly by...
 - A. Glycolysis
 - B. The citric acid cycle
 - C. The respiratory/electron transport chain
 - D. Pyruvate oxidation
 - E. ATP synthase

6. The occurrence of multicellular organisms coincides with Earth's atmosphere containing which of the following gases?
- A. Ammonia
 - B. Carbon dioxide
 - C. Methane
 - D. Nitrogen
 - E. Oxygen
7. During the citric acid cycle, which compound has the least available free energy, i.e., is the most oxidized?
- A. Citrate
 - B. Succinate
 - C. Fumarate
 - D. Oxaloacetate
 - E. Acetyl-CoA
8. The microtubules of the mitotic spindle attach to a specialized structure in the centromere region of each chromosome, called the:
- A. Kinetochore
 - B. Nucleosome
 - C. Equatorial plate
 - D. Aster
 - E. Centrosome
9. The enzyme that charges the tRNA molecules with appropriate amino acids and thereby acts as the universal code translator is:
- A. tRNA isomerase
 - B. amino-tRNA chargeatase
 - C. reverse transcriptase
 - D. aminoacyl-tRNA synthetase
 - E. tRNA primase
10. For photosystem II, after electron excitation, what compound gets reduced first in the electron transport chain?
- A. Pheophytin-I
 - B. Ferredoxin
 - C. Plastoquinone
 - D. Plastocyanin
 - E. Cytochrome complex
11. How many moles of ATP are eventually derived from each mole of $\text{NADPH} + \text{H}^+$ generated by the noncyclic light dependent reactions in photosynthesis?
- A. 0 B. 1 C. 2 D. 3 E. 6

12. The enzyme ATP synthase couples the synthesis of ATP to...
- A. the diffusion of protons
 - B. the reduction of NADP^+
 - C. the excitation of chlorophyll
 - D. the reduction of chlorophyll
 - E. the fixation of carbon dioxide
13. Why are the absorption spectrum of chlorophyll a and the action spectrum of photosynthesis not identical?
- A. Accessory pigments contribute energy to drive photosynthesis.
 - B. Chlorophyll a absorbs both red and blue light.
 - C. Chlorophyll a reflects green light.
 - D. Different wavelengths of light have different energies.
 - E. Chlorophyll a can be activated by absorbing a photon of light.
14. When carbon dioxide is added to RuBP, the first stable product synthesized is?
- A. Pyruvate
 - B. Glyceraldehyde 3-phosphate
 - C. 3-phosphoglycerate
 - D. ATP
 - E. None of the above
15. What is by far the number one most abundant protein/enzyme found on the planet?
- A. ATP synthase
 - B. RuBisCo
 - C. Isocitrate dehydrogenase
 - D. Phosphofructokinase
 - E. Cellulose
16. Which of the following occurs during cyclic photophosphorylation?
- A. O_2 gas is released
 - B. ATP is formed
 - C. H_2O donates electrons and protons
 - D. $\text{NADPH} + \text{H}^+$ forms
 - E. CO_2 reacts with RuBP
17. How many moles of GTP are generated for each mole of acetyl-CoA introduced into the citric acid cycle strictly by substrate-level phosphorylation?
- A. 0 B. 1 C. 2 D. 3 E. 6

18. When comparing the different levels of protein structure, which is/are best described by the occurrence of both α and β subunits found in hemoglobin?
- A. primary
 - B. secondary
 - C. tertiary
 - D. quaternary
 - E. all of the above
19. Consider the rate limiting cellular process when it comes to the growth of cells. Which of the following is the rate limiting or slowest process for *Bacteria*, *Archaea*, and *Eucarya* cells?
- A. replication
 - B. transcription
 - C. translation
 - D. translocation
 - E. transformation
20. Cytoplasmic streaming is generated by the movement associated with...
- A. intermediate filaments
 - B. actin filaments
 - C. microtubules
 - D. plectin
 - E. cilia
21. During Glycolysis, which compound has the greatest available free energy, i.e., is the most reduced?
- A. Glucose
 - B. Fructose-bisphosphate
 - C. Lactic Acid
 - D. Glyceraldehyde-3-phosphate
 - E. Pyruvate
22. Which of the following is NOT a mechanism for posttranslational modifications?
- A. Phosphorylation
 - B. Glycosylation
 - C. Proteolysis
 - D. Acylation
 - E. Codon recognition
23. The enzyme that initiates DNA replication is called...
- A. DNA ligase
 - B. primase
 - C. DNA polymerase III
 - D. helicase
 - E. DNA polymerase I

24. Consider the structure and function of the chromosome, which of the following is NOT involved during the organization of chromatin material?
- A. Histones
 - B. Mesosomes
 - C. Cohesins & condensins
 - D. Nucleosomes
 - E. Looped domains
25. In bright light, the pH of the thylakoid space can become _____ ?
- A. neutral at a physiological pH of 7.0
 - B. more basic
 - C. more acidic
 - D. nothing happens, this compartment's pH never changes
 - E. none of the above
26. Prion diseases like "mad cow disease" are caused by which of the following?
- A. Erroneous chaperonins
 - B. Loss of control by Cyclin-Cdk complexes
 - C. Receptor-mediated endocytosis
 - D. Mutation of pseudogenes
 - E. Sexually transmitted viruses
27. When a plant cell is placed in a hypertonic solution, which of the following occurs?
- A. The cell takes up water until balanced by the pressure potential of the cell wall
 - B. The cell takes up water and eventually bursts
 - C. The cell shrinks away from the cell wall
 - D. There is no movement of water into or out of the cell
 - E. Water moves into the cell
28. Consider the features of gene expression and control in Eucarya (aka Eukaryotes), which of the following is NOT a true statement?
- A. Eucarya have multiple RNA polymerases.
 - B. Eucarya have complex transcription factors.
 - C. Eucarya have both local and distal control elements.
 - D. Eucarya have sets of multiple genes under operon control.
 - E. Eucarya have to contend with chromatin structure.
29. The organelle that is most closely associated with the cellular process of apoptosis is?
- A. Ribosome
 - B. Mitochondria
 - C. Lysosome
 - D. Peroxisome
 - E. Chloroplast

30. Isocitrate dehydrogenase is an important control enzyme. The following features correspond to this enzyme EXCEPT:
- A. It is activated by α -ketoglutarate & citrate
 - B. It is inhibited by ATP & NADH + H⁺
 - C. It is activated by ADP & NAD⁺
 - D. It modulates the rate of the citric acid cycle
 - E. It is an allosteric enzyme
31. In cyclic photophosphorylation, chlorophyll is reduced by which of the following?
- A. ATP
 - B. NADPH + H⁺
 - C. Ferredoxin
 - D. Plastocyanin
 - E. Hydrogens liberated by the splitting of a water molecule
32. In noncyclic photophosphorylation, electrons from which source replenish chlorophyll molecules that have given up electrons?
- A. Carbon Dioxide
 - B. Water
 - C. NADPH + H⁺
 - D. Oxygen
 - E. ATP
33. The sodium-potassium pump is an example of...
- A. symport using primary active transport
 - B. symport using secondary active transport
 - C. antiport using primary active transport
 - D. antiport using secondary active transport
 - E. facilitated diffusion using passive transport

4. **(4 points)** Describe what is meant by the concept of **metabolic disequilibrium** in terms of free energy considerations? Why is this important to biology?
5. **(5 points)** An alien DNA-like molecule was isolated from the frozen remains of a Martian life form, which was discovered beneath the Martian polar ice cap. It is established that for every nitrogenous base designated K, there is 2 times that amount of the base P, and for every base X there is 2 times that amount of the base designated Z. If this alien organism's DNA-like molecule contains 22% P, then how much Z would you expect?
6. **Extra Credit (5 points)** What type of model in terms of how many strands would you propose for this polymer's molecular structure that best fits these data?