

BIOLOGY 205
FINAL EXAM - 11 March 2012
(135 points total)

Name _____

Multiple choice questions – 3 points each (single best answer for each).

1. Imagine that a novel life form is found deep within Europa's Ocean. Evaluation of its DNA yields no surprises in terms of purines and pyrimidines. However, it is found that a codon for this life form contains just two bases. How many different amino acids (maximum) could this organism be composed of?
 - A. 4
 - B. 8
 - C. 16
 - D. 32
 - E. 64

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 pineapple (a CAM plant), CO₂ is "fixed" for use in the Calvin-Benson cycle:
 - A. In the bundle sheath cells
 - B. During the nighttime only
 - C. In glucose molecules
 - D. In the stroma
 - E. None of the above

4. 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.

5. How many moles of ATP are eventually derived from each mole of NADPH + H⁺ generated by the noncyclic light dependent reactions in photosynthesis?
 - A. 0
 - B. 1
 - C. 2
 - D. 3
 - E. 6

6. In *Eucarya* cells, where are proteins that are initially guided by signal recognition particles translated?
- nucleus
 - Golgi apparatus
 - mitochondria
 - endoplasmic reticulum
 - cytoplasm
7. Cytoplasmic streaming is generated by the movement associated with...
- intermediate filaments
 - actin filaments
 - microtubules
 - pectin
 - cilia
8. During photosynthesis, which of the following zones becomes more basic (i.e., depleted in protons)?
- stroma
 - matrix
 - inter membrane space
 - thylakoid space
 - cytoplasm
9. The sodium-potassium pump is an example of...
- symport using primary active transport
 - symport using secondary active transport
 - antiport using primary active transport
 - antiport using secondary active transport
 - facilitated diffusion using passive transport
10. The reduction of pyruvate to lactic acid during fermentation allows glycolysis to continue in the absence of oxygen. Why?
- This reaction is coupled to the electron transport system
 - This reaction is coupled to the oxidation of FADH_2 to FAD^+
 - This reaction is coupled to the oxidation of $\text{NADH} + \text{H}^+$ to NAD^+
 - This reaction is coupled to the formation of ATP
 - This reaction is coupled to the reduction of NAD^+ to $\text{NADH} + \text{H}^+$
11. Isocitrate dehydrogenase is an important control enzyme. The following features correspond to this enzyme EXCEPT:
- It is an allosteric enzyme
 - It is inhibited by ATP & $\text{NADH} + \text{H}^+$
 - It is activated by ADP & NAD^+
 - It modulates the rate of the citric acid cycle
 - It is activated by oxaloacetate

True or False – (2 points each)

12. _____ Helicase and ATP synthase are both examples of rotary motors.
13. _____ Photosynthesis reduces carbon. Respiration oxidizes carbon.
14. _____ Photosynthesis oxidizes water. Respiration reduces oxygen.
15. _____ Dog feces represents an increase in entropy.
16. _____ An adult dog represents a net increase in entropy in the universe.
17. _____ The ribosome is also a ribozyme.

Matching – 2 points each. Use single best answer to match the type of molecule with the class of biomolecules that is best described or associated with it. The possible answers are: **(A)** nucleotide derivative, **(B)** DNA, **(C)** RNA, **(D)** Protein, and **(E)** Porphyrin derivative.

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|-----------|-------------------|-----------|------------------------|
| 18. _____ | Cytochrome C | 24. _____ | Cyclic AMP |
| 19. _____ | Elongation Factor | 25. _____ | NADPH + H ⁺ |
| 20. _____ | Operator | 26. _____ | Repressor |
| 21. _____ | TATA Box | 27. _____ | CAP |
| 22. _____ | Silencer | 28. _____ | Chlorophyll |
| 23. _____ | Codon | 29. _____ | Anticodon |

More Matching – 2 points each. Match the proper stage of photosynthesis with the statements below. The possible answers are **(A)** Photosystem I, **(B)** Photosystem II, **(C)** Electron Transport Chain, **(D)** Photo-phosphorylation, **(E)** Calvin cycle.

30. _____ Excited electrons handed off first to pheophytin-I/plastoquinone?
31. _____ Excited electrons handed off first to ferredoxin?
32. _____ At which stage do hydrogen ions (i.e., protons) diffuse down a gradient?
33. _____ At which stage do hydrogen ions (i.e., protons) get pumped forming PMF?
34. _____ At which stage does 3-PG get reduced to G3P?
35. _____ Determines if cyclic or noncyclic electron flow gets used?

Short answer – Number of points in parentheses.

- 36. (9 points)** Consider the **RNA processing** that occurs inside the nucleus. **(A)** What are the three ways that pre-mRNA gets modified prior to transport to the cytoplasm? **(B)** What is the structure that is analogous to a ribosome that is used for one of these RNA modifications?
- 37. (6 points)** Consider the methods available to make ATP: Ox-phos, photo-phos, & substrate level phosphorylation. **(A)** Which can occur without oxygen, **(B)** which is dependent upon the electrons from water, AND **(C)** which is responsible for generating most of the ATP in your body?
- 38. (6 points)** How many ATP equivalents does it take to produce polypeptide that is 12 amino acids long?

- 39. (6 points)** Electrons from both **NADH + H⁺** and **FADH₂** ultimately wind up at **ubiquinone** (within the electron transport chain). In principle, could either of these two redox specialty molecules drop their electron load here directly? Explain your answer in terms of reduction potentials, acquisition of free energy and ATP equivalents.
- 40. (6 points)** Consider issues that relate to photorespiration. **(A)** Under what conditions might photorespiration be more likely to occur AND why? **(B)** What is the “hard to recycle” waste product generated during photorespiration?
- 41. (6 points)** Photosystem II acquires its electrons from H₂O. **(A)** What is the primary advantage to this, and **(B)** what is the primary disadvantage to this overall strategy?

42. (3 points) What do multicellular organisms spend a larger proportion (i.e., percentage) of their expressed genome on (in terms of gene function categories)?
43. (6 points) What does tagging a protein with **ubiquitin** generally result in happening next and where will this occur?
44. (6 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 15% K, then how much Z would you expect?
45. **Extra Credit (3 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?
46. **Extra Credit (3 points)** During glycolysis, which compound has the most available free energy, i.e., is the most reduced?