

Midterm 1 study guide

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(NOTE* This guide is supplemental to the *Quiz 1 study guide* (i.e., it covers material since Quiz 1). You should be able to answer all questions posed here, and on the Quiz 1 study guide. Ability to do so will help ensure success on the midterm – many of the following questions are directly from the midterm!) Be sure to also study the bolded terms in my posted lecture notes, as well as your diagrams and important concepts from your handwritten lecture notes.

February 5 lecture: cellular respiration and anaerobic respiration (fermentation) **(This material also covered in great detail during lab – consult your notes!)**

- 1) What is fundamental difference between the cells of prokaryotes and eukaryotes?
- 2) How many cells do prokaryotic organisms have?
- 3) What are the four kingdoms of eukaryotes?
- 4) Write the balanced chemical equation for cellular respiration
- 5) Yeast cells in the absence of oxygen will generate ____ ATP per glucose molecule that they break down chemically.
A) 0 B) 2 C) 4 D) 28 E) 32
- 6) Which of the following organisms conduct cellular respiration?
A) Plants B) Animals C) Fungi D) B and C E) A, B, and C
- 7) Write the chemical equation, and identify the products of alcohol fermentation, now do the same for lactic acid fermentation (you do not need to know the molecular formulas for ethanol and lactic acid – just write “ethanol” or “lactic acid”).
- 8) What organisms perform alcohol fermentation? Lactic acid fermentation?
- 9) How do cyanide and rotenone kill organisms?
- 10) What is the adaptive value of naturally-occurring rotenone and cyanide in the tissues of plants?
- 11) Where in a cell do most stages of cellular respiration occur?
- 12) Can fermentation occur in the absence of O₂?
- 13) Can cellular respiration occur in the absence of O₂?
- 14) The diet of a panda is almost exclusively bamboo. Describe the three aspects of bamboo that we discussed in lecture that present a challenge to pandas living solely off of this food source.
- 15) *Recall our conversation about Chris McCandless and his demise, due potentially (or in part) to the consumption of a toxic legume. What lessons about proteins and legumes did we glean from this to support our prior lessons about legumes, N fixation, and proteins? (Extra credit question?)*

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February 7 lecture: Photosynthesis I

- 1) Write the overall balanced chemical equation of photosynthesis
- 2) True/False: plant cells conduct cellular respiration.
- 3) After its production during photosynthesis, what are 2-3 fates of glucose in plants? (we listed 4 in lecture).
- 4) If plants can conduct photosynthesis, why do they need to conduct cellular respiration?
- 5) Why would ATM [CO_2] under a forest canopy rise at night but fall during the day?
- 6) Draw the annual fluctuation of ATM [CO_2] in a keeling curve, and explain the increases/decreases in terms of seasonal changes in total photosynthesis and cellular respiration.
- 7) What is a pigment?
- 8) What does chlorophyll do? Where is it located?
- 9) What is an accessory pigment?
- 10) Explain, in biological/chemical detail, why autumn leaves of deciduous trees change color from green to red/orange/yellow.
- 11) True/False: All C atoms in your body can ultimately be traced back to the atmosphere where they existed as a molecule of CO_2 .
- 12) Assuming that the statement above is true, and that photosynthesis is driven by energy in sunlight, it is often said that the ultimate source of energy for all life on earth is _____.
- 13) What is a greenhouse gas?
- 14) What are the two leading human causes of climate change ('global warming')?
- 15) What is a 'fossil fuel'? Provide the definition, then provide an example.
- 16) What is the link between the Carboniferous period (360-300mya) and increases in [CO_2] in Earth's ATM since the 1800's?
- 17) Define the term "carbon fixation". How is it different and how is it similar to nitrogen fixation – wow what a cool question. Maybe I'll...
- 18) Where, ultimately, did every C atom in your body originate from, and how did it get from "there" to in the molecules in your body?
- 19) Define the term "autotroph"
- 20) Define the term "heterotroph"

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- 21) What types of organisms are heterotrophs?
- 22) What types of organisms are heterotrophs?
- 23) Define the term “photoautotroph”
- 24) What types of organisms are photoautotrophs?

Lipids lecture: (from lab during week 3**)**

- 1) Draw an unsaturated fat, a saturated fat. What about an unsaturated fat constructed with two unsaturated fatty acids and once saturated fatty acid. Label the glycerol head and fatty acid tails.
- 2) Unsaturated fats are _____ at room temperature.
- 3) What is the role of waxes in botany (i.e., where are they found on plants, and why)?
- 4) Draw a cluster of phospholipids in water and describe how/why they orient relative to each-other, and where they are found in cells.
- 5) Hummingbirds are nectar feeders, so why does a hummingbird store energy as fat before making a long migration?
- 6) Are fatty acids hydrophobic or hydrophilic?
- 7) Are fats hydrophobic or hydrophilic?
- 8) Are phospholipids hydrophobic or hydrophilic? (be careful!)
- 9) Are waxes hydrophobic or hydrophilic?
- 10) Palm oil is high in saturated fatty acids, and thus there is concern over its impacts to human health. Aside from these health impacts, what is one reason that an environmentally-minded consumer might be concerned about the source of his/her palm oil?
- 11) Where specifically are waxes, phospholipids, and fats typically found in plants?
- 12) Name two molecules in plants that contain phosphorous atoms, and that are present in large quantities in cells (note: we learned about one of these on a previous lecture).

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February 12 lecture : Photosynthesis II (Light Reactions)

Big picture:

- 1) In the light reactions, light energy is converted to what form of chemical energy (i.e., what two molecules are produced).
- 2) During the light-independent reactions (aka; dark reactions, Calvin cycle) the chemical energy from the light reactions is used to drive carbon fixation (be able to define C fixation!!).
- 3) Where exactly do the light reactions occur?
- 4) Know the structure of the chloroplast (thylakoid, grana, thylakoid membrane, stroma, lumen).

Digging deeper:

- 5) Where is the proton gradient that forms during the light reactions?
- 6) Regarding question 5, where are the two sources of protons?
- 7) Be able to place the following in their proper "order" (i.e., the sequence in which they receive & transfer electrons) on the thylakoid membrane: PS II, Plastiquinone (PQ), Cyt b₆/f, plastocyanin (PC), PS I, and ATP synthase, and be able to tell me what each does during the light reactions. **STUDY THIS!!!!** Know that this sequence of proteins and electron shuttles is called an "electron transport chain".
- 8) Where in photosynthesis is O₂ produced and H₂O split?
- 9) What are atrazine and paraquat? Specifically, explain how they function.
- 10) Describe the flow of electrons during the light reactions of photosynthesis. For example, can you answer the following question:

Match the molecules (A-E, right column) with the terms/tasks listed at left (29-33):

- | | |
|---|-------------------------------|
| <i>1) Transfers electrons from PSII to Cyt b₆/f</i> | <i>A) ATP synthase</i> |
| <i>2) Pumps protons across the thylakoid membrane</i> | <i>B) PS I</i> |
| <i>3) Protons pass through and energy molecules are generated</i> | <i>C) PS II</i> |
| <i>4) Harvests light, excites an e⁻ for the first time, and initiates light reactions</i> | <i>D) PQ</i> |
| <i>5) Harvest light, excites e⁻ for a second time, e⁻ passed to help form NADPH</i> | <i>E) Cyt b₆/f</i> |

February 14: Photosynthesis III (light-independent reactions)

1) Compare/contrast C_3 , C_4 , and CAM plants – with specific emphasis on (STUDY THIS!!!!):

- a) How do they differ w/ regard to how CO_2 is introduced to Rubisco?
- b) What types of plants do each type? How prevalent is each in the Kingdom Plantae?
- c) Which one evolved first and which two came later.
- d) In what types of environments is/are C_4 and CAM an adaptive trait?
- e) What limitation of Rubisco does C_4 and CAM minimize?

2) Why are the light-independent reactions called “light-independent” if photosynthesis requires light energy (AKA “dark reactions”)? (Recall: this series of reactions is also called the Calvin cycle)