

ANSWER KEY EXAM 1, VERSION A/B, Fall 2012

(numbering is 3/8 means question 3 on Version A, question 8 on B). Range 100-30.

Mean = 77.6, Stdev = 12.8, Median score = 80. A+ = 100, A = 99-94, A- = 93-90, B+ = 89-88, B = 87-84, B- = 83-80, C+ = 79, C = 78-74, C- = 73-68, D+ = 66-62, D = 62-61 D- = 60-54 F = 53 or less.

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|-----|-----|-------|---|-------|---|-------|-----|-------|---|-------|---|-------|---|-------|---|-------|---|-------|---|-------|---|
| 1/1 | D | 6/5 | C | 11/9 | B | 16/16 | D/E | 21/17 | A | 26/30 | D | 31/37 | A | 36/32 | B | 41/42 | D | 46/51 | D | 51/46 | C |
| 2/2 | A/B | 7/4 | A | 12/10 | E | 17/20 | E | 22/18 | D | 27/26 | E | 32/36 | A | 37/31 | E | 42/40 | E | 47/49 | B | | |
| 3/8 | E | 8/3 | D | 13/15 | E | 18/21 | E | 23/19 | C | 28/25 | D | 33/35 | D | 38/45 | B | 43/41 | A | 48/48 | E | | |
| 4/7 | C | 9/12 | A | 14/14 | E | 19/22 | C | 24/29 | E | 29/24 | C | 34/34 | E | 39/44 | A | 44/38 | C | 49/47 | B | | |
| 5/6 | D | 10/11 | E | 15/13 | E | 20/23 | B | 25/28 | D | 30/27 | C | 35/33 | D | 40/43 | E | 45/38 | E | 50/50 | E | | |

- 1/1 DNA duplicates during interphase (S phase) but condensation occurs during prophase.
- 2/2 Not graded = version of the exam.
- 3/8 Since electron transport cannot occur you will not form a H⁺ gradient (no ATP) and no reduction of NADP⁺. Consequently no carbon fixation can occur.
- 4/7 Enzymes alter energy of activation. Since the reaction is at equilibrium the addition of enzyme will not change the ratios of products/reactants.
- 5/6 There is a N terminus and a C terminus in polypeptides.
- 6/5 100 X 30 KJ/mole (ATP hydrolysis) = 3000 KJ is captured. Thus about 6000 is lost as heat. The loss is 66%. (6000/9000)
- 7/4 Pyruvate conversion of ethanol releases CO₂ and requires the reduction of acetaldehyde to ethanol via the oxidation of NADH + H⁺.
- 8/3 The formula is C(H₂O) for a carbohydrate.
- 9/12 Nerve cells are in the resting state, G₀.
- 10/11 The organelles that are not part of the endomembrane system are ct, mt and peroxisomes—others are.
- 11/9 Oxidized chlorophyll exists at reaction center 1 & 2. To continue PSN, electrons must reduce the oxidized chlorophyll. Reduced plastocyanin reduces PSI and electrons from water reduce PSII.
- 12/10 Plants do not make glycogen. Both starch and glycogen are polymers of glucose that can be degraded by humans to serve as an energy source. Neither contains ribose in the structure.
- 13/15 The addition of electrons to a molecule results in the reduction of the molecule.
- 14/14 Intermediate filaments are fairly stable and position organelles within cells.
- 15/13 Electric signals are transmitted via the gap junctions. This process is crucial for muscle cells.
- 16/16 Either E or D was accepted. Chloroplast ribosomes and bacterial ribosomes are similar. This is what we meant in the answer but it specifically refers to the proteins synthesized. Indeed they are similar in that they lack post-translational modification. Most students wouldn't be aware of this and may have selected D because the proteins are similar in an N and C terminus, etc. In fairness D was also accepted.
- 17/20 Oxidative phosphorylation does not require light. Both processes require the formation of a H⁺ gradient via an electron transport chain and it takes place in specialized organelles.
- 18/21 Cellulose is used for structural support.
- 19/22 There is no information about whether the reactions are endo or exergonic, nor does this affect where they act upon their substrate. They act differently upon the substrate because they have different active sites.
- 20/23 Carbohydrates are often used for identification for receptor interaction or cell-cell recognition. This occurs on the exterior face of the plasma membrane.
- 21/17 The action spectrum is due to the interaction of many pigments in the antennae absorbing light. Thus it is different from Chl a due to the fact there are other accessory pigments (and the chl a is conjugated with different proteins which affect the absorption spectrum).
- 22/18 CAM plants capture CO₂ at night and then decarboxylate during the day when products from the light reaction are present.
- 23/19 Adding more substrate overcomes competitive inhibition.
- 24/29 Note that not all steps of the pathway are listed but of the steps listed the correct order is E.
- 25/28 CH₂OP (Phosphate) is the formula for the C₅ carbon.

- 26/30 We are starting with pyruvate so we must yield 3 CO₂. We need to be sure to include the (NADH + H⁺) from pyruvate oxidation, the 3 (NADH + H⁺) from the Krebs cycle along with the 1 FADH₂ from Krebs. Each of the (NADH + H⁺) will yield 2.5 ATP. 4 X 2.5 = 10. The FADH₂ will yield 1.5 ATP (less than (NADH + H⁺)). There is 1 ATP from SLP yielding a total of 12.5 ATP per pyruvate.
- 27/26 H bonds between R groups help to stabilize tertiary structure. The H bonds along the backbone help stabilize secondary structure. NO answer is correct.
- 28/25 Rubisco can either incorporate CO₂ or O₂. When O₂ is incorporated CO₂ will eventually be released.
- 29/24 Hydrogenation converts C double bonds into C single bonds with the incorporation of H. This would decrease fluidity. Peanut butter is often hydrogenated to make sure the peanut oil does not separate and float to the top.
- 30/27 To increase fluidity we would want to decrease the % of saturated FA which is the same as increase the % of unsaturated FA. Another method would be to decrease the length of the FA chains.
- 31/37 As you increase the concentration of substrates V_{max} is reached because all of the enzyme molecules are saturated.
- 32/36 Leaky means there will no longer be a H⁺ gradient. Thus no ATP could be made. You would expect to increase the rate of the electron transport chain.
- 33/35 DNA is double stranded, anti-parallel and must follow base pairing rules (A with T, C with G).
- 34/34 Allosteric effectors bind at sites other than the active site. Inhibitors decrease the amount of active form, activators increase the amount of active forms.
- 35/33 Since the pigment is colored orange it is NOT absorbing orange color and is either transmitting it or scattering that wavelength.
- 36/32 The bilayer of the plasma membrane consists two layers. This creates three areas- one layer can be considered outside (extracellular face), the other inside (cytosolic face), and the interior between the two layers. The interior is hydrophobic, the faces would be hydrophilic.
- 37/31 If you inhibit the ETC (Complex IV is a part of the ETC) you will expect to stop pumping protons from the matrix into the intermembrane space. Thus the H⁺ concentration increases in the matrix (this is a decrease in pH) and the amount of ATP produced would decrease.
- 38/45 A low concentration of solutes is the same as a high concentration of water and diffusion occurs from high to low (ignoring charge forces). Osmosis is the specialized case of water diffusion.
- 39/44 The driving force for photosynthesis is light. In PSII the oxygen evolving complex strips electrons from water and donates it to oxidized Chl a. It is the oxidized chlorophyll that acts as an oxidant of water.
- 40/43 Prokaryotes lack a nucleus and ER. They certainly have ribosomes, DNA and ribosomes.
- 41/42 Anabolic is to build up (anabolic steroids build muscle).
- 42/40 Oxygen is produced by oxygenic photosynthesis.
- 43/41 Exergonic releases energy.
- 44/39 C₄ plants capture CO₂ in the mesophyll cells. The organic acid is transferred to the bundle sheath cells where the CO₂ is released.
- 45/38 Ribosomes are responsible for protein synthesis. Lysosomes typically do not contain ribosomes whereas the other four cell types/organelles always do.
- 46/51 Particular portions of prokaryotic chromosomes attach to the cell membrane. This attachment, coupled with growth in the cell membrane separates the chromosomes (to separate poles).
- 47/49 Exergonic releases energy. Of the processes listed all require net energy except B.
- 48/48 Dr. Pauly specifically mentions "All energy for life comes from the sun". Lecture 10, 12:18. It was a theme of his lectures. We do not want the questions to be ambiguous. Quite a few students picked plants. The question did not use the term "directly dependent". If the question said "directly dependent" the answer would have been D. But it didn't and the lectures emphasized answer E. We will not accept D.
- 49/47 Varying levels of different types of cyclin and constant levels of different types of CDKs interplay to affect progress through the cell cycle.
- 50/50 The R groups are all hydrophobic.
- 51/46 Plant cells lack centrioles. This is the obvious and correct answer. Always pick the most obvious answer. Some students chose D. Plants cells have plasma membranes and cell walls.