Study Guide for Unit 2

1. What are the functions of the plasma membrane?
2. Describe the structure of the plasma membrane. Be able to diagram a membrane. Include glycolipids, glycoproteins, peripheral proteins, cholesterol, and transmembrane proteins and functions.
3. What is the Fluid Mosaic Model? How does it explain the barrier action of a membrane? Semi-permeable nature?
4. Describe a channel protein and what kind of amino acids would make up the different domains.
5. How do molecules get across a membrane? What are the three types of transport? Which require energy?
6. What molecules will be able to move across the membrane without help? Facilitated diffusion? Active transport?
7. What factors influence the movement of molecules across the membrane?
8. Describe diffusion factors that control it.
9. Describe the sodium-potassium pump.
10. Define primary active transport verses secondary active transport.
11. Define and be able to identify a uniport, symport, antiport, cotransport and combinations of primary and active transport.
12. Define osmosis.
13. Be able to identify isotonic, hypotonic, and hypertonic conditions and water movement.
14. What is plasmolysis? Turgor pressure? Under what conditions to these events happen?
15. Define endocytosis, pinocytosis, phagocytosis, receptor-mediated endocytosis, and exocytosis.
16. How does the cell membrane contribute to the size of the cell?
17. How do cells signal each other?
18. What are some surface receptors and how do they function?
19. What is a G-protein and what is its function in cell signaling?
20. Cyclic AMP (cAMP) is a second messenger molecule, how is it converted from ATP and how does it function? How is a signal amplified?
21. Where is the major store of calcium in the cell? How does the calcium amplify a signal? What role does calmodulin play in this amplification?
22. Describe how the eye amplifies a signal from a photon.
23. What are some cell surface receptors used in immunology or cell-cell recognition?
24. How are Na-K pumps involved in action potential of nerve cells? How does a nerve cell transmit a signal?
25. How do neurotransmitters work? Acetylcholine? Serotonin? How do these relate to drug addiction?
26. Describe the function of the following cell junctions: Tight junctions, desmosomes, gap junctions, hemidesmosomes and plasmodesmata.
27. How are cadherin and integrin mediated junctions the same/different?
28. Describe an autotroph verses a heterotroph.
29. Describe the difference between potential and kinetic energy and be able to identify each.
30. Know and understand the first and second law of thermodynamics.
31. What does Gibb's free energy tell us?
32. How does changes in entropy determine the reaction direction?
33. Be able to diagram an exergonic, endergonic and a coupled reaction.
34. Describe activation energy how does it contribute to the stability of a compound.
35. What are enzymes and how do they function?
36. How are enzymes controlled?
37. Describe the interaction at the molecular level between an enzyme and substrate, substrate and active site, and transition state,
38. What is equilibrium? When is it obtained? How does an enzyme influence equilibrium?
39. What are the characteristics of enzymes?
40. How are they affected by pH, temperature, substrate concentration, enzyme concentration, proteases, and phenol (protein denaturing agent)?
41. Define Vmax, Km, [S], and Vo.
42. How do enzymes speed reactions up?
43. What is optimal pH and temperature for an enzyme and give some examples.
44. Diagram a Michaelis-Menten graph and identify the key features.
45. Diagram a Hanes Plot and identify the key features.
46. Be able to diagram both graphs from data. See the lab!
47. Describe what makes an irreversible inhibitor irreversible. Compare with a competitive inhibitor.
48. Know in detail the differences between an uncompetitive, competitive, and mix inhibition.
49. How do these graph on a Hanes plot? A Michaelis-Menten plot. What values are the same and different?
50. How does allosteric inhibition relate or compare to competitive or uncompetitive?
51. How is a biochemical pathway regulated by feedback inhibition?
52. Draw an optimum pH or temperature graph. Why is there an optimal area?
53. What are coenzymes, cofactors, and prosthetic groups? Give some examples of each.

54. Diagram the structure of a plant leaf identifying the following: cuticle, epidermis, mesophyll, bundle sheath cells, stomata, and guard cells.
55. Diagram a chloroplast and know where the processes of photosynthesis occur.
56. Do the same for a thylakoid.
57. What are the functional groups of a chlorophyll molecule? List the membrane part, porphyrin, and cofactor.
58. Know the equation of photosynthesis and which reactants contribute to which products.
59. Why is white light so important to plants and life?
60. Why are plants green?
61. Why are carotinoids, such as ß-carotene, and pigments such as phycoerthrin, phycocyanin important to photosynthesis?
62. Chlorophyll a and b absorb what colors best?
63. What happens in photosystem I and cyclic photophosphorylation?
64. What happens in photosystem II and non-cyclic photophosphorylation?
65. How are the electrons of photosystem II replaced during non-cyclic photophosphorylation?
66. Diagram the thylakoid indicating the areas where photophosphorylation, water splitting, low pH, and Calvin-Benson cycle.
67. What is oxidation? What is reduction?
68. What is the function of NADP+? Which are the reduced form and the oxidized form?
69. What goes into the light reactions? What comes out?
70. What is Rubisco? Starting with Rubisco catalysis, outline the Calvin-Benson cycle?
71. How do water, carbon dioxide, light, and temperature, and nutrients influence photosynthesis?
72. Be able to describe the difference between a C3, C4, and CAM plant. Why are they named such? Include pathways and location in your description.
73. Give some examples of each type of plant.
74. What is the difference between substrate phosphorylation and oxidative phosphorylation?
75. What are NAD+ and FAD+? Which is the reduced form and oxidized form.
76. Diagram glycolysis using one molecule of glucose.
77. Why is the conversion from glucose to glucose-6-phosphate by hexokinase important?
78. Why is phosphofructokinase a key enzyme in glycolysis?
79. What goes into glycolysis and what comes out?
80. What is fermentation? Under what conditions does it work? Diagram some pathways. What are some products? Why is fermentation needed?
81. Diagram the Krebs cycle.
82. What goes into the Krebs cycle? What comes out of the Krebs cycle?
83. Diagram the electron transport chain.
84. What is chemiosmosis?
85. Where do glycolysis, Krebs, and oxidative phosphorylation take place?
86. What are the functions of the Fo and F1 subunits of an ATPase?
87. What are the terminal electron acceptors in fermentation, oxidative respiration, and anaerobic respiration?
88. How is glucose catabolism controlled?
89. How is protein metabolized? Fat?
90. Diagram the mitochondria and tell where each process in cellular respiration occurs.

Sample essay questions

1. a) Explain how enzymes facilitate chemical reactions in biological systems. b) Describe competitive, uncompetitive, mixed and irreversible inhibition. c) What is allosteric regulation? d) What is negative feedback inhibition? e) What do you suppose would be the results of positive feedback mechanisms? f) What is meant by coupled reactions? (5 pt.)

The conformation of the active site with its amino acid R groups (cofactors, coenzymes, prosthetic groups, etc) allows the enzyme to catch substrate molecules and position them precisely to minimize entropic costs and reduce the kinetic energy needed to distort substrate chemical bonds and change bond formations to make product molecules. In this fashion activation energy requirements are lowered so that more substrate molecules have sufficient kinetic energy to produce product speeding up the chemical reaction. Because enzymes speed up chemical reactions, are not used up in the reaction (they are regenerated at the end of each substrate conversion), and are required in small numbers, they are considered to be protein catalysts.

Competitive inhibitors compete with substrate to bind the active site of an enzyme. As substrate concentrations increase, there are relatively fewer inhibitor molecules to interfere with substrate binding and subsequent catalysis so that the rate of the chemical reaction speeds up. Uncompetitive inhibitors bind to the enzyme at some place other than the active site to change enzyme conformation in such a way that the catalytic process is impaired. Adding more substrate does not remove this effect on catalysis so that the reaction rate will always be slower in the presence of inhibitor than without it. Most mixed inhibitors probably bind to

the enzyme at another site away from the active site in such a way that active site accessibility or substrate binding is adversely affected as well as is the catalytic process. Irreversible inhibitors typically bind permanently to active site components preventing further substrate binding and catalysis. The enzyme becomes nonfunctional, or is referred to as being "killed."

Allosteric enzymes have a catalytic subunit and a regulatory subunit. Negative or positive effectors bind allosteric sites on the regulatory subunit in such a way as to decrease or enhance substrate binding and/or catalytic rate in the catalytic subunit. Allosteric enzymes are typically found in key points of metabolic pathways where negative feedback inhibition involves pathway endproducts acting as negative effectors on the allosteric enzymes to slow down or stop them so that pathway metabolic activity is also slowed or shut down temporarily.

Positive feedback would involve positive effectors acting on allosteric enzymes increasing their catalytic rates and consequently increasing pathway metabolic activity.

In coupled reactions energy released from an exergonic reaction is used to drive an endergonic reaction. Often coenzymes are carriers of such energy in the form of high energy electrons and hydrogen, or like ATP donating the energy by transferring a high energy phosphate group to the substrate.

2. Briefly summarize cell membrane attachments a) to other cells, b) to the external matrix and c) to the cytoskeleton. d) Explain how these structures might be necessary to cell functions. (2 pt.)

Animal cells may be attached to each other cells by tight junctions like a seam of protein threads or by desmosomes (or hemidesmosomes) that function much like rivets to protect against tearing forces. In the intestinal epithelial cells the tight junctions prevent bacteria or other pathogens from slipping past the cells lining the gut into the blood stream to cause sepsis or a major infection threat to the body. Because the gut twists and churns in digestion and in response to physical activities of the human, riveting stress points with desmosomes helps prevent the tearing of tight junctions. Gap junctions in animals and plasmodesmata in plants really do not hold cells together. Rather, their function is to speed up cell-to-cell communication with large cytoplasmic channels bridging the cells. Plant cells are held together by a middle lamellae of gluey pectins and hemicelluIoses that hold the cellulose cell walls together. Animal cells are attached to the extracellular matrix (or basal lamina) via protein links between the intermediate fibers of the cytoskeleton and the glycoproteins of the matrix. Additionally, cadherins and N-cam proteins may provide direct protein-protein links between adjoining cell membranes. Lectins in plants or bacteria link cells as these proteins have multiple sugar-binding sites such that they may bind sugars on the surfaces of two different cells and hold them in close proximity. In looking at hepatocytes (liver cells), we find that the cytoskeleton forms a distinctive shape with the microtubules extending the scaffolding of the cell which is reinforced by the intermediate filaments. Certain tight junctions and desmosomes make sure that the bile-loading and transporting sinuses with their protected membranes are kept separate from regular cell-to-cell contacts. There are also blood sinuses with lots of projections mediated by actin filaments to increase surface area so that more blood toxins can be unloaded into the liver cell for processing. If the liver cell loses it shape, it cannot function properly and soon dies.

3. Membranes function to separate or compartmentalize cytoplasmic and organellar (colloidal suspensions) contents. Explain why this is critical to photosynthesis or cellular respiration. Pick one only. (3 pt.)

The H+ ion gradient that develops in the thylakoid lumen in chloroplasts or in the intermembrane space of mitochondria that is used to drive ATP synthesis (chemiosmotic theory) could not occur without separation from the stroma by the thylakoid membrane or from the matrix by the inner mitochondrial membrane (cristae). Also several key substrate molecules in the Calvin-Benson cycle such as 1,3 bisPGA, 3PGA and PGAL would be diluted from the cycle and run through glycolysis if there were no membrane separations between the chloroplast and the cytoplasm. Key Krebs cycle substrates would be diluted into other metabolic pathways as well.

4. Membranes also function as surfaces for chemical reactions. Explain how this applies to photosynthesis or cellular respiration. Pick a different one from the one used in question #2 above. (3 pt.)

Membrane-associated quinones, other organic non-protein carriers, cytochromes and other proteins carry high-energy electrons whose energy is used to pump H+ ions across the membranes to establish proton gradients in both photophosphorylation and oxidative phosphorylation. If there were no membranes there would be no direct electron transfer nor the pumping of H+ ions to produce proton gradients. Light energy trapped by membrane-bound chlorophyll and carotenoid pigments and chemical energy in reduced NADH (and FADH2) could not be converted to ATP. Also there would be no splitting of water to produce oxygen, electrons and H+ ions in photophosphorylation. Neither would there be oxygen picking up electrons and H+ ions to form water in oxidative phosphorylation. In the mitochondria NADH reductase and succinate deHase are also associated with the cristae where

they unload electrons and hydrogen from reduced NADH and FADH2 respectively. Pyruvate dehydrogenase complex is also associated with the cristae.

5. Diagram and explain the significance of the enzyme cascade in cell signaling. See page 136 in Raven and Johnson. (2 pt.)

Basically, epinephrine activates a fight or flight response that will require extra ATP. ATP is more easily produced from burning glucose in cellular respiration, so the body needs a lot of glucose fast. The epinephrine hormone binds to it receptor on the liver or muscle cell. This receptor is associated with a G-protein that exchanges GDP for GTP and disassociates with the GTP-bearing subunit migrating to the membrane-bound adenylyl cyclase and activating it. Activated adenylyl cyclase produces a number of cyclic AMP molecules from ATP which in turn activate several units of the allosteric enzyme protein kinase A. This kinase A puts phosphate groups on all the glycogen synthase enzymes it can to shut them down because this enzyme takes glucose out of the system to make glycogen. Kinase A also phosphorylates phosphorylase kinase enzymes that put phosphate groups on more glycogen phosphorylases activating them to break off glucose-6-P units from glycogen. At each step the signal is amplified or increased so that many glucose-6-P units enter glycolysis directly to be burned up to make ATP.

6. Compare and contrast photophosphorylation in photosynthesis with oxidative phosphorylation in aerobic respiration. In other words, how is the light reaction similar to and different from the electron transport chain in respiration? Do not forget organelle comparisons. See lab manual for additional help. (4 pt.)

Both occur in inner organellar membranes involving electron transport and H+ ion pumping. Photophosphorylation converts light energy into chemical energy stored in ATP and reduced NADPH splitting H2O to make O2 and releasing the electrons and H+ ions that will go to fill up the NADP+ taxi cabs. Oxidative phosphorylation converts the chemical energy in reduced NADH (and FADH2) to ATP ultimately passing electrons and H+ ions on to O2 to make H_2O.

7. Compare and contrast the Krebs cycle in aerobic respiration with the Calvin-Benson cycle in photosynthesis. See the lab manual for additional help. (4 pt.)

Both occur in organellar cytoplasm involving C skeleton rearrangements. In the catabolic Krebs cycle, two 3C pyruvates derived from glucose are burned to CO2 with chemical energy trapped mostly in reduced NADH and some in $FADH_2$ and ATP. In the anabolic Calvin-Benson cycle, CO_2 is trapped and fixed into two 3C PGAL sugars using chemical energy (and electrons and hydrogen) from ATP and reduced NADPH essentially storing that chemical energy in the C-C and C-H bonds of the sugar molecules. PGAL is exported to the cytoplasm and used to make glucose among other things.

8. Even though glycolysis is described as an anaerobic process, a) what is necessary for glycolysis to be able to continue under anaerobic conditions? b) What is meant by substrate phosphorylation? (2 pt.)

Glycolysis only produces a net 2 ATP per glucose molecule split. Eukaryotic systems require a lot of ATP to overcome volume-surface area limitations among other things. Under anaerobic conditions glycolysis needs to run at very high speeds to supply minimal amounts of ATP to keep the cells alive. Soon NAD+ carriers needed to pick up electrons and H+ from PGAL being oxidized to 1,3 bisPGA are all-full (reduced NADH) and cannot pick up any more electrons and H+ ions.
When this happens glycolysis shuts down producing no more ATP and the cell dies. Fermentation is the process whereby the reduced NADH gives up its electrons and H+ ions to another substrate so that it is oxidized to NAD+ which can then return to glycolysis to pick up more electrons and H+ from PGAL oxidation allowing glycolysis to continue. There are several fermentative pathways including lactic acid fermentation and ethanol fermentation with which you are familiar. If you are not familiar with these, see text for a rewarding and enlightening discussion. Substrate phosphorylation is where a given substrate has so much energy stored in its chemical bonds that during an enzyme-catalyzed reaction this free energy enables the enzyme to push a phosphate group onto ADP to make ATP.

9. Diagram sequentially the events in which a section of plasma membrane at resting potential is depolarized to initiate an action potential and then returns to the resting potential. Include K^+ and Na^+ ion channels and Na^+/K^+ ATPase. (3 pt.)

9. In your diagram there should be the Na+ channel opening up first in response to threshold depolarization of the membrane. This allows extracellular Na+ to flood into the cell so that negatively charged inside layer of the cell membrane becomes positive like the outside layer was before the Na+ ion influx. This change in the electrical potential of the membrane changes the

conformation of the K+ ion channel so that it now opens. With more K+ inside than out, it floods to the outside beginning to restore the negative inner charge of the plasma membrane. The changing potential of the membrane causes the Na+ ion channel (ionophore) to alter its configuration such that it becomes refractory to further passage of Na+ ions. In time the K+ channel also closes down and no more K+ ions move to the outside, but the inside of the membrane is now more negative than before. The membrane is in the state of hyperpolarization. The resting potential is not fully reestablished until the Na+/K+ ATPase using ATP sufficiently pumps out Na+ and pumps in K+ in an antiport fashion.

10. Diagram or explain lucidly the processes of a) diffusion, b) osmosis, c) facilitated diffusion (both channels and mobile carriers), d) primary (ATP) and e) secondary (gradient) active transport. (2 pt.)

Most nonpolor molecules move across membranes by diffusion. This is a random movement of molecules that leads to a uniform distribution of molecules in the solution or on both sides of the membrane. It also refers to the random movement of molecules in is a solution in order to reach and equilibrium.

Osmosis is the flow of water across a semi-permeable membrane. Water can flow across the membrane as a result of differences mechanical pressure. This contributes to important water flow in plants. Increase pressure from osmosis in plant leads to turgor pressure. An over outward flow of water from a cell leads to plasmolysis in plants and shrinking of the cells in animals. This would occur in a hypertonic solution. In an isotonic solution, the water movement would be equal and no changes would occur. In a hypotonic solution, the overall flow of water would move into the cell causing turgor pressure in plants or in lysing the many animal cells. Many single celled organisms have developed contractile vacuoles that enable them to deal with life in hypotonic solutions.

Large polar molecules such as glucose are unable to cross the membrane without the help of carrier molecules. Glucose transport molecules such as glucose permease bind glucose and carry them across the membrane. This will proceed until equilibrium is reached. For channel-mediated transport, highly charged molecules such as Ca++ and Na+ need a channel to flow through. The movement of molecules is in a downhill flow and not against a concentration gradient. This depends on Gibbs free energy. Gibbs free energy not only depends on the concentration of the molecules but the charge on the molecule.

To transport a substance across a membrane against a concentration gradient requires and energy source such as ATP. There a number of ATP driven pumps in living systems. The sodium-potassium pump simultaneously transports three sodium ions out of the cells and two potassium ions into the cells using ATP as an energy source. This sets up an electrochemical gradient.

The electrochemical gradient set up by the use of ATP can be used to drive other transport processes in the cell. The proton gradient established by the oxidation-reduction reactions of the electron transport chain is another example of secondary active transport system. The cotransport of molecules across the membrane can be either symport or antiport.

MULTIPLE CHOICE (1 point each)

20. The most predominant components of biological membranes are _____.
   a. lipids
   b. sugars
   c. nucleic acids
   d. starches
   e. oils

21. A membrane that allows only certain molecules to pass through it is called a (n) _____ membrane.

   a. selectively permeable
   b. differentially obstructive
   c. permanently fusible
   d. sieve type
   e. hydrophobic

22. The random movement of like molecules or ions from an area of high concentration to an area of low concentration is called _____.

a. kinesis
b. diffraction
c. simple diffusion
d. gradation
e. fusion

23. The movement of water across a selectively permeable membrane in response to a concentration gradient is called _____.

a. simple diffusion
b. induced fit
c. gradation
d. fusion
e. osmosis

24. Which one of the following mechanisms of membrane transport requires the expenditure of energy by the cell?

a. polymerization
b. passive transport
c. hydrolysis
d. condensation
e. active transport

Use the following words to make sense of the paragraph below: (Note that not all terms may be used)

a.	ATP	f.	Krebs	l.	outer
b.	glucose	g.	energy	m.	oxidized
c.	citric acid	h.	NAD+	n.	reduced
d.	cytoplasm	i.	electron transport system	o.	glycolysis
e.	pyruvate	j	acetyl-CoA		
o.	mitochondrial matrix	k.	inner		

Cellular respiration is a process whereby glucose is (28)_____ by the cell to produce (29)_____ in the form of the molecule (30)_____. The conversion of glucose to 2 molecules of (31)_____ is known as (32)_____. This process occurs in the (33)_____. Once transported into the (34)_____, these molecules are combined with Co-enzyme A to form 2 molecules of (35)_____. This molecule combines with OAA (oxaloacetate) to form (9)_____. Carbon atoms are cycled in (36)_____ cycle. Spare electrons and protons are temporarily held by the transport molecule (37)_____. Electrons are passed through the (38) _____ _____ _____. In this process, protons are shuttled into the space between the (39)_____ and _____ membranes of the mitochondrion. The chemiosmotic potential allows the protons to be pushed back into the matrix allowing (40)_____ to be synthesized.

Photophosphorylation is the process by which useable energy is formed in photosynthesis. Oxidative phosphorylation is the process by which useable energy is formed in cellular respiration. Compare and contrast photophosphorylation and oxidative phosphorylation by answering the following questions. The lab manual may be very helpful for this (6 pt.)

a. In very specific terms, where in the cell do these processes occur? (Do not just mention the organelle!)

PHOTOPHOSPHORYLATION	OXIDATIVE PHOSPHORYLATION

b. What is the source of electrons in these processes?

PHOTOPHOSPHORYLATION	OXIDATIVE PHOSPHORYLATION

c. How do the electrons acquire their energy in these processes?

PHOTOPHOSPHORYLATION	OXIDATIVE PHOSPHORYLATION

42. Photosynthesis is often summarized in this manner:

$$6CO_2 + 6H_2O \xrightarrow{sunlight} C_6H_{12}O_6 + 6O_2$$

State which part(s) of the molecule apply to the light dependent reactions and which apply to the light independent reactions. (4 pt.)

Light dependent

Light independent

43. Enzymes

a. enhance reaction rates
b. are affected by pH
c. act on specific substrates
d. all of the above

91. Stored energy is termed

a. entropy.
b. free energy.
c. potential energy.
d. energy of activation.
e. kinetic energy

92. Enzymes lower the activation energy for biochemical reactions. They do this by _____.

a. creating energy for use in the reactions they catalyze.
b. forming a substrate-enzyme complex
c. releasing energy which ultimately lowers the activation energy
d. diffusion of Na and K through the Na-K pump
e. always having a higher energy than the substrates

93. Evidence supporting the second law of thermodynamics is that…

a. transfer of energy in the cell is not 100% efficient
b. heat is produced during metabolism
c. energy is required to counteract entropy
d. ultimately every complex molecule degrades into smaller components
e. all of the above

47. For the following chemical half-reaction, state which is the reduced form of the molecule NAD+.

$$NADH + H^+ \rightarrow NAD^+ + 2e^- + 2H^+$$

a. NAD
b. NADH

94. The wavelength of light that is absorbed best by chlorophyll a is

a. red
b. orange
c. yellow
d. green
e. blue

95. True or False: C4 plants are better adapted to high temperatures.

96. Which of the following types of plants best describes a CAM plant?

a. Kentucky bluegrass, alfalfa, and other cool season plants
b. corn, sugarcane, crabgrass, sorghum and other warm climate grasses
c. Saguaro cactus, prickly pear, and other succulents
d. sedges, mosses and plants requiring a moist environment
e. sage brush, cheatgrass, pinyon pine and other plants of the Great Basin

c. The terminal electron acceptor in respiration when conditions are aerobic is

a. pyruvate
b. water
c. oxygen
d. carbon dioxide
e. nitrate

d. The terminal electron acceptor when conditions are anaerobic and the organism uses fermentation to generate energy is

a. pyruvate
b. water
c. oxygen
d. carbon dioxide
e. nitrate

e. Which of the following sets of reactions results in the most amount of energy being produced under aerobic conditions (after electron transport)?

a. glycolysis
b. pre-Krebs cycle
c. Krebs cycle
d. Calvin-Benson cycle
e. fermentation

f. The products of cellular respiration are

a. O_2 , H_2O, ATP.
b. CO_2 , H_2O, ATP.
c. heat, O_2 , H_2O.
d. ADP, CO_2 , H_2O.

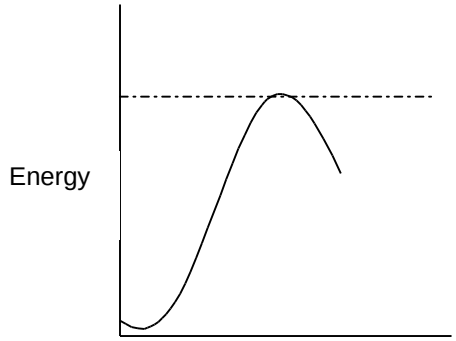
g. Organisms that ferment sugars do so in order to produce 2 ATPs and to

a. regenerate NAD^+
b. use up additional pyruvate produced by glycolysis
c. prevent Krebs cycle because it only creates one ATP per acetyl-CoA
d. produce alcohol and lactic acid
e. produce NADH for electron transport

57. $FADH_2$ does not result in as much energy formation as does NADH

a. True
b. False

57. The diagram below represents what kind of reaction?



a. Endergonic
b. Exergonic
c. Coupled reaction

58. The type of enzyme inhibition that lowers the rate at which a process proceeds by rivaling the substrate for the active site is known as _____ inhibition.

c. competitive
d. uncompetitive
e. allosteric

59. The cell organelle that produces ATP from the breakdown of energy-containing molecules is called the _____.

a. lysosome
b. chloroplast
c. ribosome
d. mitochondrion
e. Golgi complex

60. Another name for the "light-dependent reactions" of photosynthesis is _____.

a. chemiluminescence
b. photophosphorylation
c. incandescence
d. photolabile
e. photon extraction

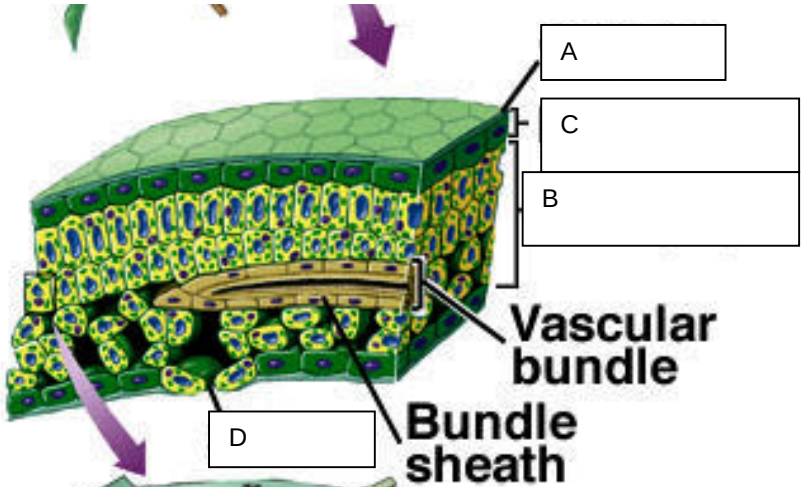
61. The stoma is part of the chloroplast whereas the stroma is a pore in the leaf.

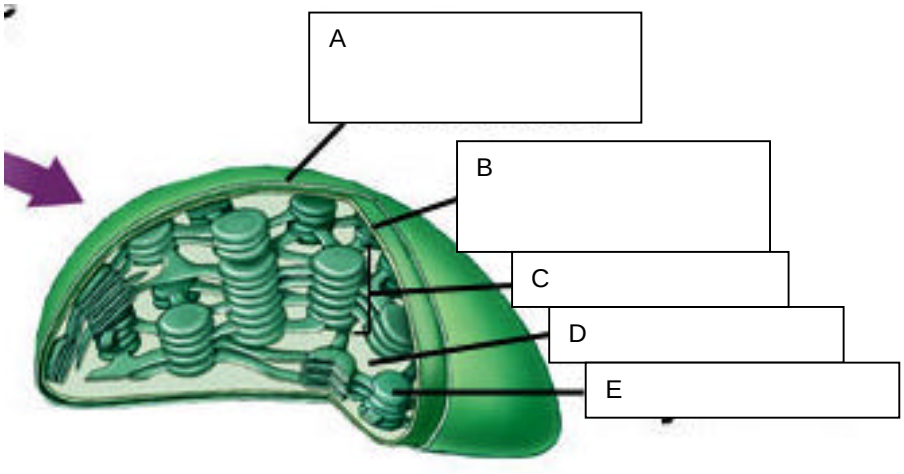
a. True
b. False

62. A measure of the smallest distance that distinguishes two individual objects is the _____.
63. The light microscope has glass lenses for focusing light for imaging, whereas the electron microscope has _____ for focusing electrons for imaging filament.
64. The _____ molecules of membranes act as barriers to the passage of many materials and serve to maintain the membrane's physical integrity.
65. The boundary of the cell is called the _____.
66. _____ _____ _____is the movement of specified macromolecules into a cell; it involves "coated pit", clathrin, and coated vesicles.
67. You place a cell into a solution, and the cell shrinks, this solution is _____ relative to the cell.
68. The cells of the intestinal epithelium are joined to one another by _____ _____ that prevent substances from passing between the cells of this tissue.
69. The coupled transport system by which glucose and sodium ions enter intestinal epithelial cells is called _____.
70. Diffusion occurs **up or down** (circle one) a concentration gradient.
71. The force that increases inside a plant cell when it is placed in water, which finally prevents further net movement of water molecules into the cell, is called _____ pressure.
72. Membrane proteins with carbohydrates attached are called _____.
73. Membrane lipids with carbohydrates attached are called _____.
74. The process of one cell engulfing another is called _____.
75. Complexes of RNA and protein that function in protein synthesis are called _____.
76. An organelle found only in plants that uses sunlight to make ATP is called the _____.
77. The plasma membrane consists of _____ layers of _____.
78. The movement of water across a selectively permeable membrane in response to a concentration gradient exerts a force that is called _____.
79. The process that cells use to expel small amounts of material by placing them in membrane vesicles and fusing the vesicles to the plasma membrane is called _____.
80. _____ _____ is the energy in a system available for doing work.
81. Changing ATP to ADP is a (an) _____ process.
82. Changing ADP to ATP is a (an) _____process.
83. _____-_____ bonds, are stable chemical bonds the give up energy to form more-stable, low-energy bonds.
84. Physicists define a measure of disorder as _____.
85. Most of the earth's energy comes from the _____.
86. Cells mostly use _____ as an immediate source of energy.
87. For a reaction to be spontaneous, the change of free energy of the reaction, ΔG, must be _____.
88. The enzyme phosphoglucoisomerase catalyzes the conversion of glucose6-phosphate to fructose 6-phosphate. The region on the phosphoglucoisomerase where glucose 6-phosphate binds is called the _____ _____.
89. Enzymes are biological _____.
90. When an enzyme is heated until its three-dimensional structure is destroyed, the enzyme is said to be _____.
91. Potential energy can be converted to _____ energy, which does work.
92. The building up of molecules in a living system is _____, while the breaking down is _____.
93. Every enzyme has a (an) _____ _____ that the substrate fits into.
94. Organisms that are self-feeders, that is they obtain energy and synthesize organic molecules from inorganic material are called _____.
95. Organisms that obtain chemical energy from other organisms are _____.

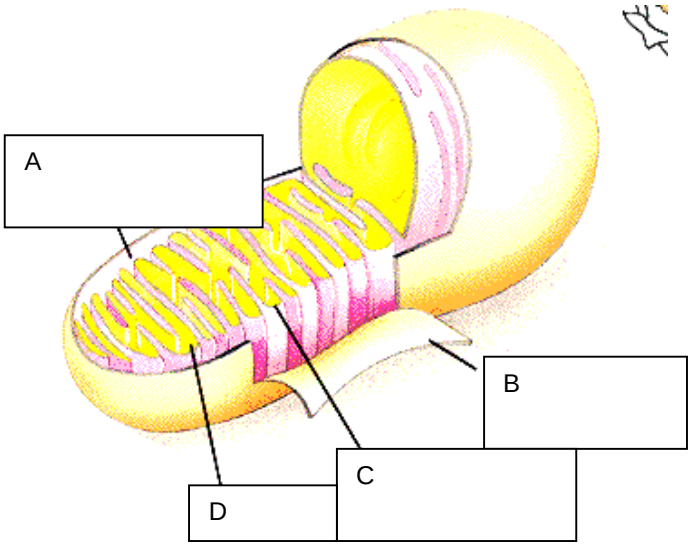
96. The reduced form of NAD is _____.
97. The oxidized form of NAD is _____.
98. The bread yeast Sacchromyces cerevisiae is a facultative anaerobe, an organism that can live either anaerobically, by _____ or aerobically, using the oxidative phosphorylation.
99. Pyruvate is **oxidized or reduced** (circle one) to form acetyl Co A.
100. An enzyme that transfers a phosphorous from ATP to another protein is called a _____.
101. The conversion of glucose to lactic acid is a form of _____.
102. The pathway for the oxidation of glucose to pyruvate is called _____.
103. During alcohol fermentation, NAD+ is regenerated by the reduction of acetaldehyde to _____.
104. Photosynthesis removes _____ from the air and gives off _____ as a waste product.
105. Another name for the "light-dependent reactions" of photosynthesis is _____.
106. The particular wavelengths that a molecule absorbs is called its _____ _____.
107. The energy stored in the chemical bonds of NADPH and ATP is used to make a more stable form in which energy can be stored in plants called _____.
108. Atmospheric carbon dioxide enters plant leave through openings called _____.
109. In noncyclic photophosphorylation, the electrons for the reduction of chlorophyll in photosystem II come from _____.
110. The cycle or set of reactions that convert the carbon atoms of carbon dioxide into the carbon atoms of glucose are called the _____ cycle.
111. Plants that have a special adaptation of the carbon pathway that utilizes oxaloacetate instead of phosphoglycerate are called _____ plants.
112. Desert adapted plants, such as cacti, use a modified carbon pathway called the _____ pathway.
113. When _____ plants are exposed to light and CO_2, four-carbon compounds are the first carbon-containing products.
114. During the process of _____, Rubisco catalyzes the reaction of RuBP with oxygen.
115. The Calvin-Benson cycle is sometimes called the _____ _____.
116. The most abundant enzyme on the earth is _____.

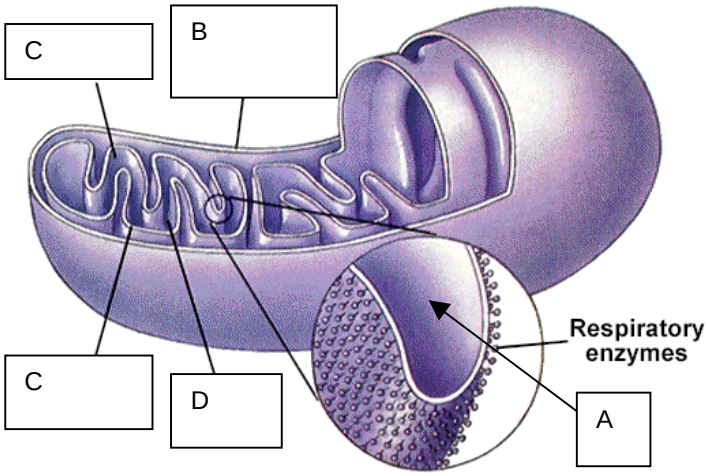
117. Label the leaf section below (4 pt.)





118. Label the chloroplast above (5 pt.)





119. Label the mitochondria above (4 pt.). Letter A indicates the same structure in both figures. The same is true for the other letters.