Cellular Respiration Concept Questions

1. Describe how photosynthesis and cellular respiration are reverse processes. (The products of one are the starting materials for the other. Cellular respiration is essentially an oxidation while photosynthesis is a reduction.)
2. How are mitochondria adapted to carry out cellular respiration? (The inner mitochondrial membrane is highly folded, forming a large surface area. Enzymes of the ETC are on that membrane.)
3. Cells that are more active have a higher number of mitochondria. Why would this be? (Active cells require more ATP and so have more mitochondria to produce the needed ATP from fuel more quickly.)
4. Cellular respiration uses glucose, a high energy molecule and produces CO_2 and water, low energy molecules.
a) Is it spontaneous? (Yes because it releases energy.)
b) Is it exergonic? (Yes because it releases energy.)
c) What happens to the energy released from glucose? (The energy released is used to make ATP.)
5. Why is it important for energy-releasing reactions to take place in living cells? (These reactions release energy which can be used to make ATP. ATP is used to do cell work.)
6. Differentiate between oxidation and reduction reactions. (Reactions in which electrons are lost are oxidations. Those which involve a gain of electrons are reductions.)
7. a) Describe how ADP is converted into ATP. (Energy is used to attach a phosphate to ADP.)
b) Why are oxidation reactions often coupled to the production of ATP? (Oxidation reactions release energy which can be used to make ATP.)
8. Cellular respiration provides the energy for the synthesis of ATP but the first steps of glycolysis actually use ATP. Why is this so? (ATP is needed to energize glucose, making it unstable. This moves glucose closer to activation energy)
9. Explain how the citric acid (Krebs) cycle contributes to the production of ATP. (The citric acid cycle makes NADH which carries electrons to the ETC. Some ATP is also made during substrate level phosphorylation.)
10. When you exhale, your breath contains carbon dioxide. Where did this come from? (The carbon atoms in food are released as CO_2 during the citric acid cycle.)
11. Why is an electron transport system important to living organisms? (The transport of electrons releases energy from fuel in a slow, controlled fashion.)
12. Explain how energy is released in useful packets through the ETC. (Energy is released stepwise at each cytochrome as it is used to transport protons across the mitochondrial membrane.)
13. Why is cellular respiration considered to be more efficient than glycolysis alone? (Cellular respiration produces 36 ATP per glucose rather than the 2 ATP produced by glycolysis.)
14. a) When do animal cells perform photosynthesis? (Never.)
b) When do plant cells perform photosynthesis? (In light.)
c) When do animal cells perform cellular respiration? (Always.)
d) When do plant cells perform cellular respiration? (Always.)
15. Compare and contrast alcoholic fermentation in yeast cells, lactic acid fermentation (in human cells), and glycolysis. (They all have glycolysis in common. In yeast, CO_2 is released and alcohol is produced while in humans lactic acid is produced. The goal is to produce NAD^+ to enable glycolysis to continue.)
16. Think of the difference between alcohol fermentation in yeast and lactic acid fermentation in humans. What would be the result if an enzyme in your body removed the carbon dioxide from pyruvate before lactic acid formed? (CO_2 would be released in cells and alcohol would be formed.)
17. a) Under what conditions does lactic acid fermentation occur in muscles? (Lactic acid is formed under anaerobic conditions when the oxygen demand exceeds the supply.)
b) How can we tell that the fermentation is occurring? (It causes pain and eventual cramping and seizing

of the muscle.)
18. After a heart attack, small amounts of lactic acid can be found in heart muscle cells. What does this evidence suggest about the nature of a heart attack? (The heart did not receive the oxygen it required and the lactic acid was produced during anaerobic respiration in the heart muscle cells.)
19. Complete the chart below:

	Anaerobic Respiration	Aerobic Respiration
a) net amount of ATP produced	2	36
b) terminal electron acceptor	pyruvate	O_2
c) location in cell	cytosol	mitochondrion
d) final products	lactic acid, NAD^+, EtOH, ATP	CO_2, H_2O, ATP

20. Hard (or distilled) liquor is available at concentrations of up to 75% alcohol but the maximum alcohol concentration in wine is usually no more than 12-14%. Explain. (Concentrations above ~14% are toxic to yeast.)
21. If yeast cells were large organisms, they could not live anaerobically. Explain. (The two ATP produced per glucose would be insufficient.)
22. a) What happens to the NADH produced by yeast cells that are living in anaerobic conditions? (It is oxidized back to NAD^+ by reducing pyruvate.)
b) Why is it important for this to happen? (This allows glycolysis to continue.)
23. Identify the use of each of the reactants in cellular respiration and the source of each of the products. (O_2 is the terminal e^- acceptor; glucose is the source of e^-, CO_2 is produced in the citric acid cycle, H_2O is produced when O_2 accepts e^-.)
24. How can a cell use noncarbohydrate foods such as proteins and fats to release energy? (A variety of fuel molecules can be used because they enter cellular respiration at different places. They all have carbon atoms which can be oxidized.)
25. Why is it useful for AMP to stimulate cellular respiration and ATP to inhibit it? (The presence of AMP indicates a high demand for ATP so more should be produced. The presence of ATP means no more is needed.)