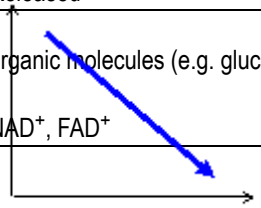
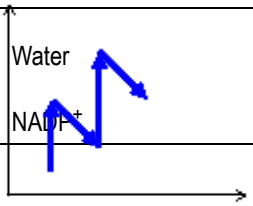
UNIT 1: METABOLIC PROCESSES

F. Photosynthesis and Cellular Respiration

- photosynthesis and respiration both take place in the same cell for autotrophs, whereas heterotrophs only undergo respiration
- Calvin cycle processes and C_4 and CAM processes are similar to reactions in cellular respiration, only they are in reverse
- electron transport chains are found in both systems, and the proteins, quinines and cytochromes are similar in structure and, in some cases, are exactly the same
- both photosynthesis and respiration use chemiosmosis to transform energy from one form to another
- in mitochondria, H^+ ions are pumped from the matrix into the intermembrane space, with ATP synthesis occurring in the matrix
- in chloroplasts, H^+ ions are pumped from the stroma into the thylakoid lumen, with ATP synthesis occurring in the stroma
- Figure 2, p. 180 illustrates chemiosmosis in both processes
- the following Table summarizes the comparisons between photosynthesis and respiration:

Comparison	Respiration	Photosynthesis
1. Overall Reaction a. reactants b. products c. energy	• organic molecules (e.g. glucose) • CO_2 + H_2O • Released	• CO_2 + H_2O • organic molecules • stored
2. Electrons a. source b. carrier(s)	• organic molecules (e.g. glucose) • NAD^+, FAD^+	• Water • $NADP^+$
3. Electron Transport System a. energy profile b. electron source c. electron sink d. products	 Energy time • $NADH$ and $FADH_2$ • oxygen • ATP	 Energy time • water • NADPH • ATP and NADPH
4. ATP Synthesis and Organelle Structure and Function a. location of ETC b. H^+ ion reservoir and the pumping action of the ions by the ETC c. membrane embedded ATPase and the synthesis	• inter membrane (cristae) • pumped out of the matrix and into the inner membrane space	• thylakoid membrane • pumped into the out of the stroma and into the thylakoid lumen

pf ATP by chemiosmosis	• ATPase is oriented such that the H^+ ions move from the outside in and ATP is made on the matrix side	• ATPase is oriented such that the H^+ ions move from the inside out and ATP is made on the stroma side

Homework: 1-5, p. 182