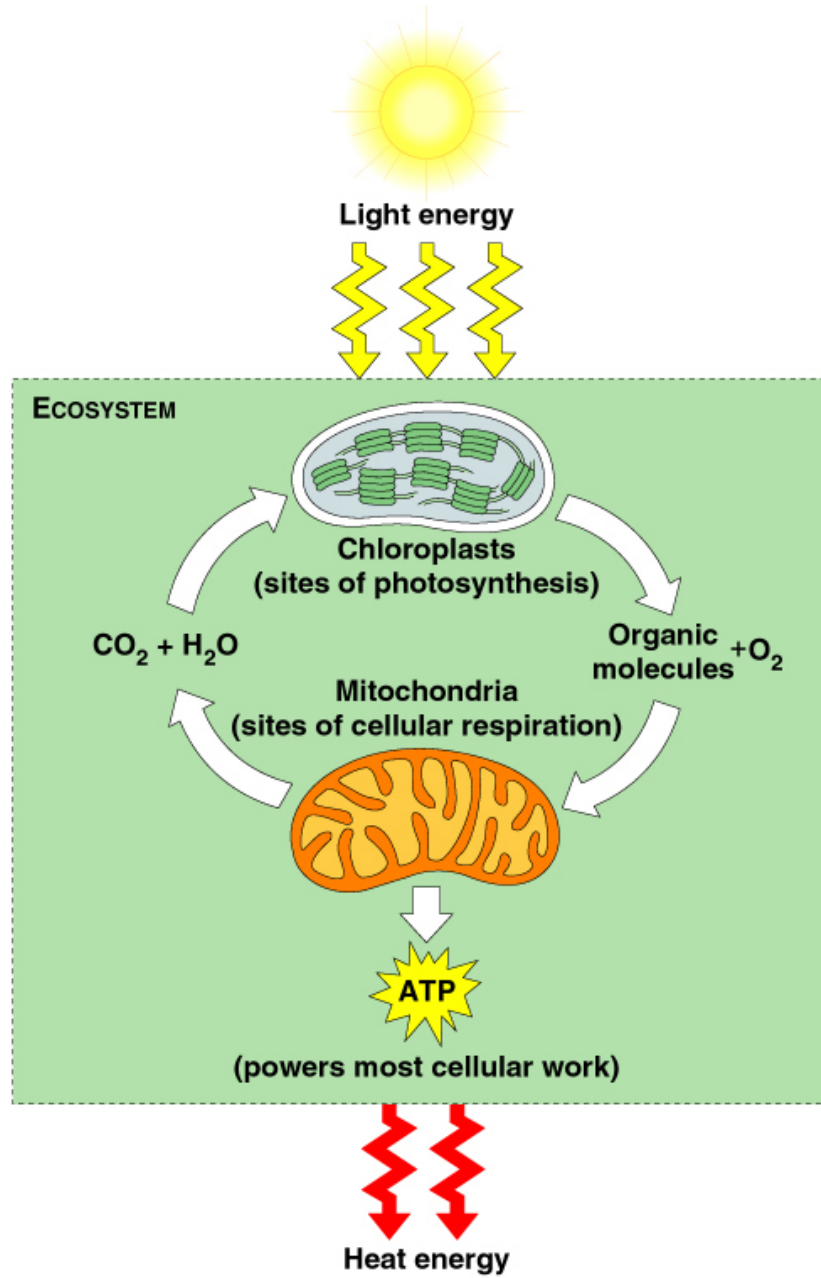


# Cellular Respiration

## Chapter 9: Principles of Energy Harvesting

# Objectives

- Describe energy flow through the biosphere
- Understand and explain redox reactions
- Understand the role of NADH
- Understand how an electron transport chain operates



# Energy Principles

- Energy of organic molecules is stored in the arrangement of associated electrons
- Energy is released through catabolic processes e.g. fermentation, cellular respiration
- ATP releases energy (phosphorylation) then is recycled
- The anabolic and catabolic pathways of ATP are the result of oxidative and reduction chemical processes

# Oxidation-Reduction Reactions

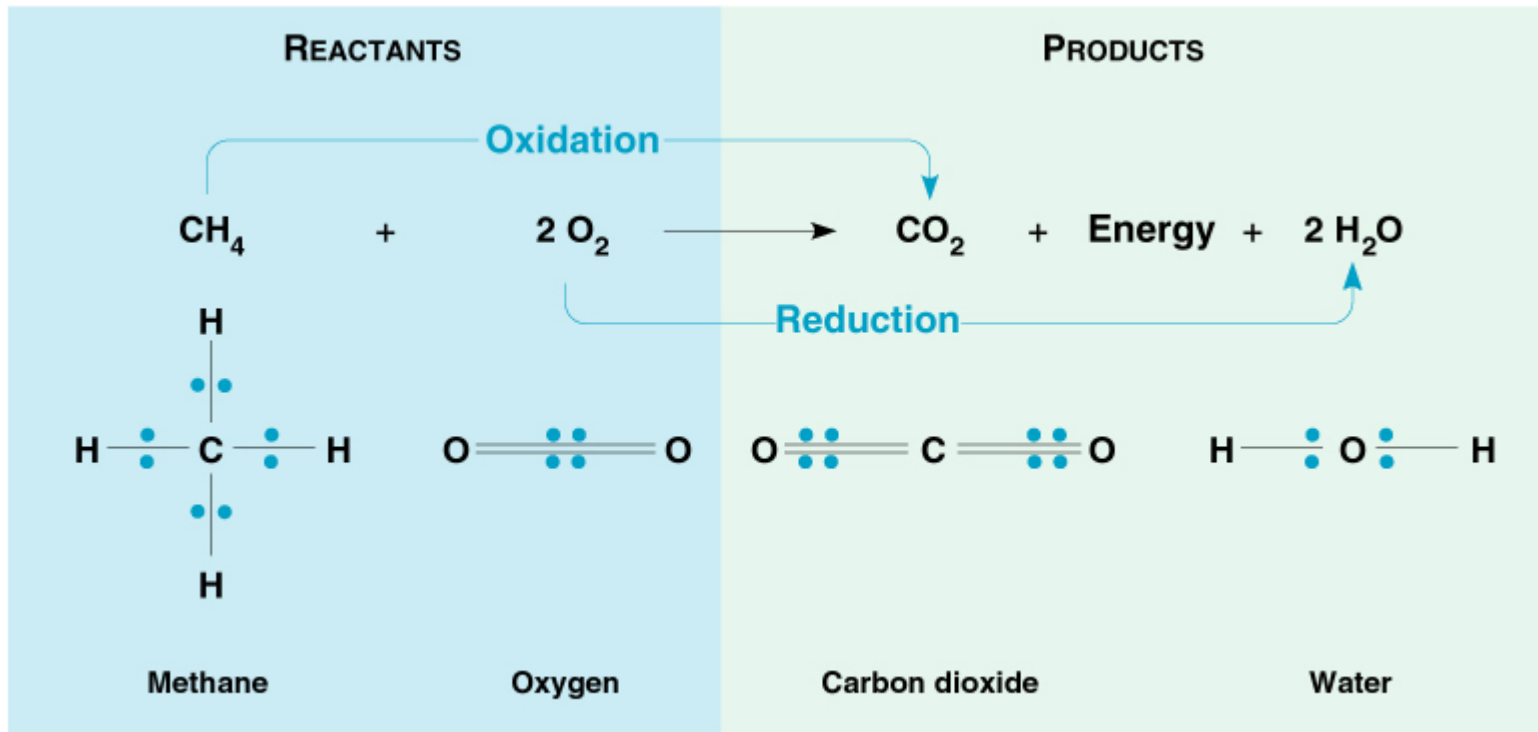
oil rig

- **Oxidation reactions result in a loss of electrons**
- Oxidation may also occur through the addition of oxygen (more electronegative) to a molecule
- **Reduction reactions result in a gain of electrons**
- Reduction may also occur through the addition of hydrogen to a molecule

Electron orbital position is the key: when electrons move to closer orbitals they lose potential energy,  $-\Delta G$

# Oxidation-Reduction Reactions

oil rig



# Cellular Respiration is a Series of Redox Reactions

- Method of energy release is gradual and methodic
  - increases efficiency
  - enzyme catalyzed
- Hydrogen atoms removed from foods as they are oxidized are added to  $\text{NAD}^+$  resulting in reduction to  $\text{NADH}$  &  $\text{H}^+$

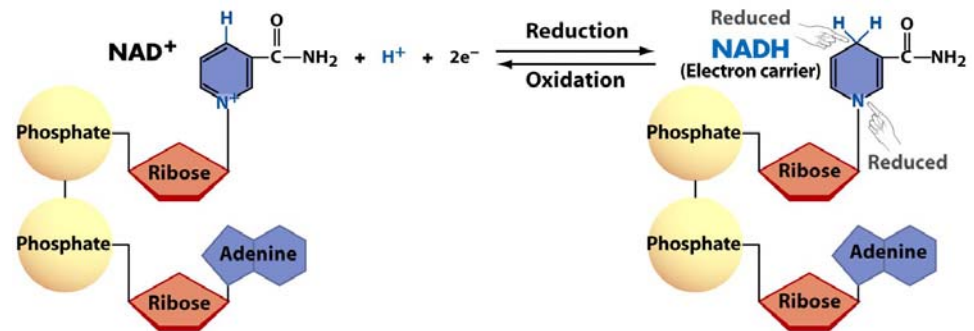


Figure 9-3 Biological Science, 2/e

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This process is assisted by enzymes generically referred to as **Dehydrogenases**

# Energy stored in NADH is released through an Electron Transport Chain

- Electron Transport Chain mechanisms stepwise enable electrons to move to lower orbitals before being accepted by oxygen, resulting in a gradual release of energy
- Each progressive carrier is more electronegative than its predecessor

