تَنوير

BIOLOGY

Lec no : 10

File Title : Chapter 10

Done By : AlMiqdad Nwihi

وَقُل رَّبِّ زِدْنِي عِلْمًا

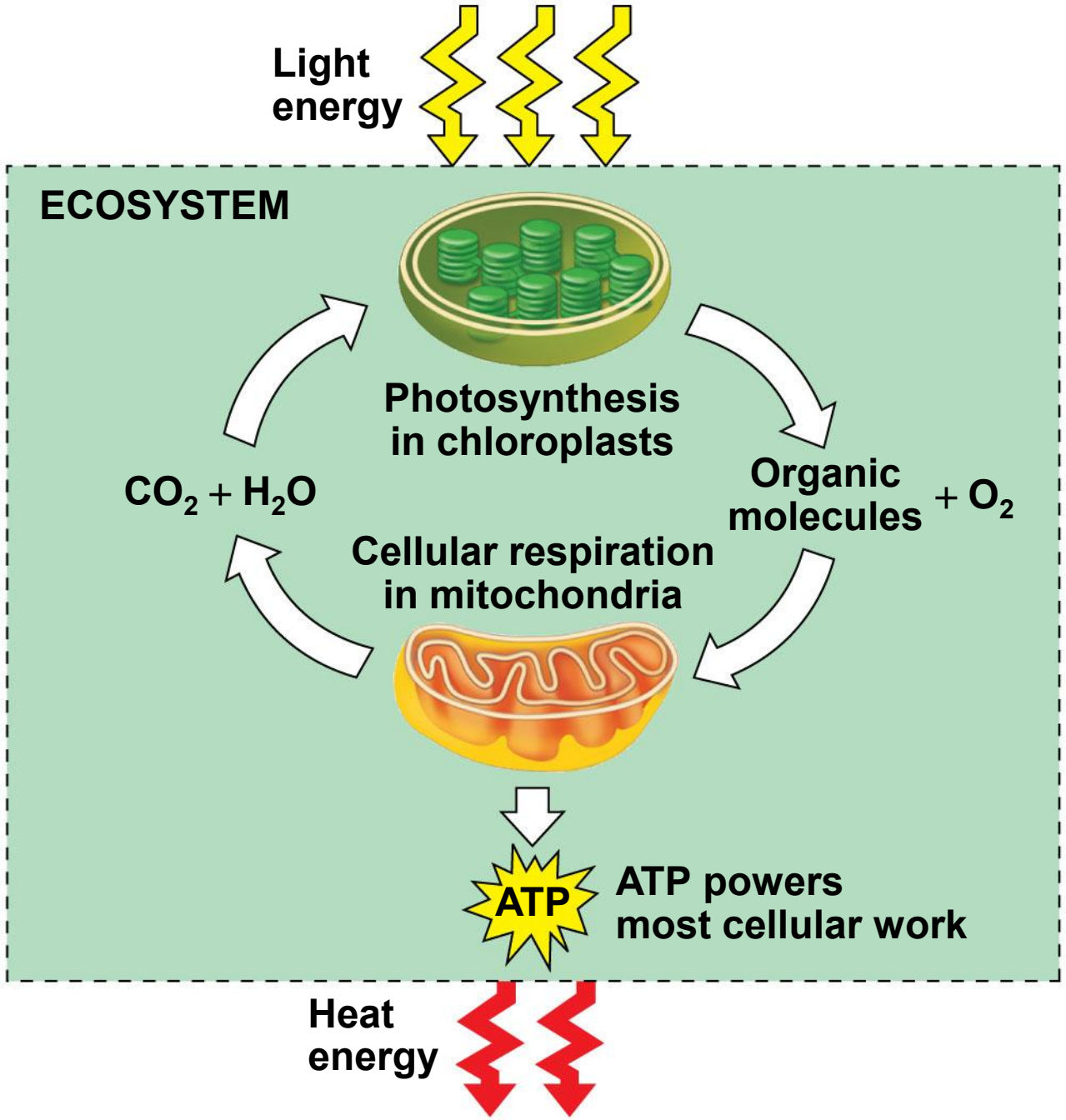
Overview: Life Is Work

- Living cells require energy from outside sources
- Some animals, such as the chimpanzee, obtain energy by eating plants, and some animals feed on other organisms that eat plants

Figure 9.1

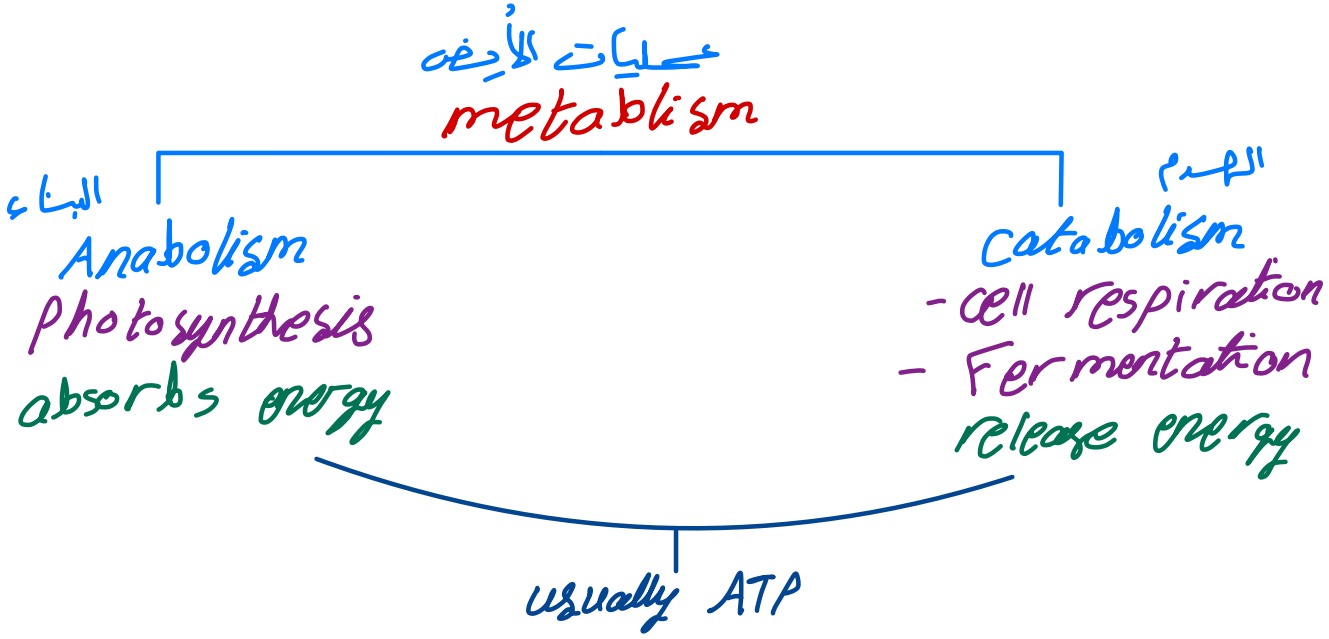
- Energy flows into an ecosystem as sunlight and leaves as heat
- Photosynthesis generates O_2 and organic molecules, which are used in cellular respiration
- Cells use chemical energy stored in organic molecules to regenerate ATP, which powers work

Figure 9.2



Concept 9.1: Catabolic pathways yield energy by oxidizing organic fuels

- Several processes are central to cellular respiration and related pathways



Catabolic Pathways and Production of ATP

- The breakdown of organic molecules is exergonic
- **Fermentation** is a partial degradation of sugars that occurs without O_2
- **Aerobic respiration** consumes organic molecules and O_2 and yields ATP
- Anaerobic respiration is similar to aerobic respiration but consumes compounds other than O_2

- **Cellular respiration** includes both aerobic and anaerobic respiration but is often used to refer to aerobic respiration
- Although carbohydrates, fats, and proteins are all consumed as fuel, it is helpful to trace cellular respiration with the sugar glucose

$$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + \text{Energy (ATP + heat)}$$

complete oxidation happens to the sugar

Redox Reactions: Oxidation and Reduction

- The transfer of electrons during chemical reactions releases energy stored in organic molecules
- This released energy is ultimately used to synthesize ATP

The Principle of Redox

- Chemical reactions that transfer electrons between reactants are called oxidation-reduction reactions, or **redox reactions**
- In **oxidation**, a substance loses electrons, or is oxidized
- In **reduction**, a substance gains electrons, or is reduced (the amount of positive charge is reduced)

Figure 9.UN01

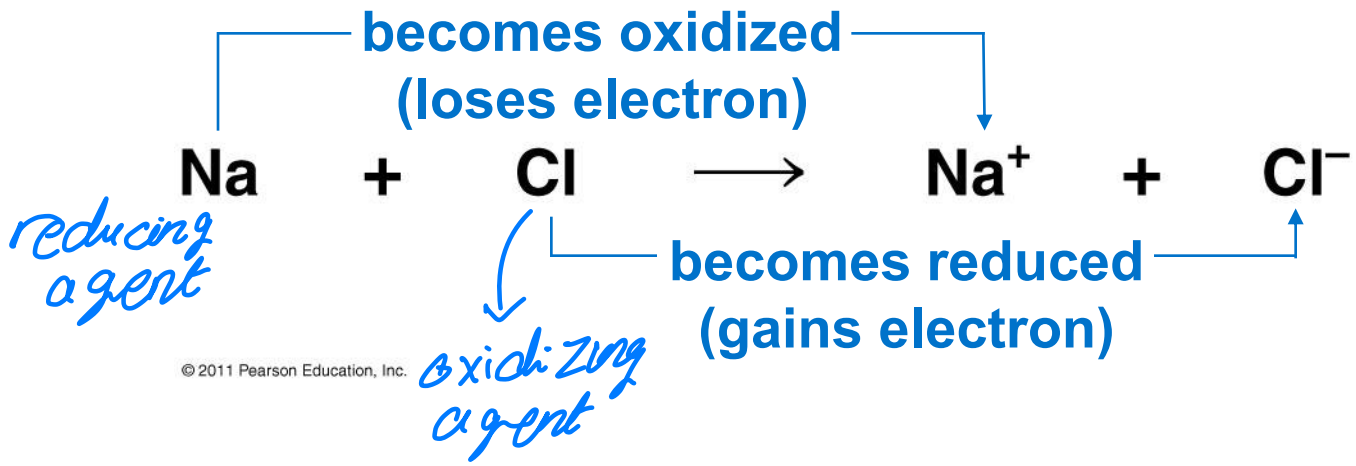
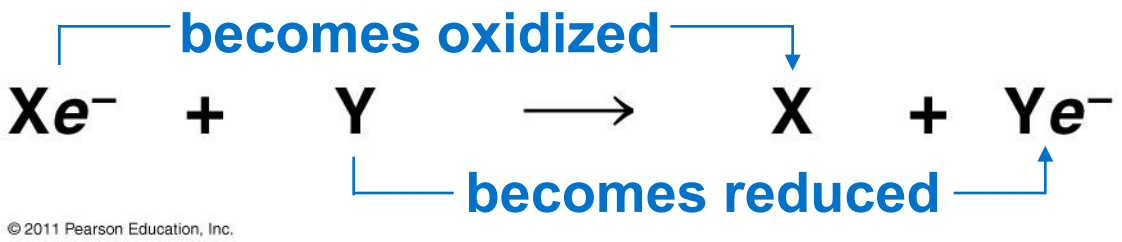
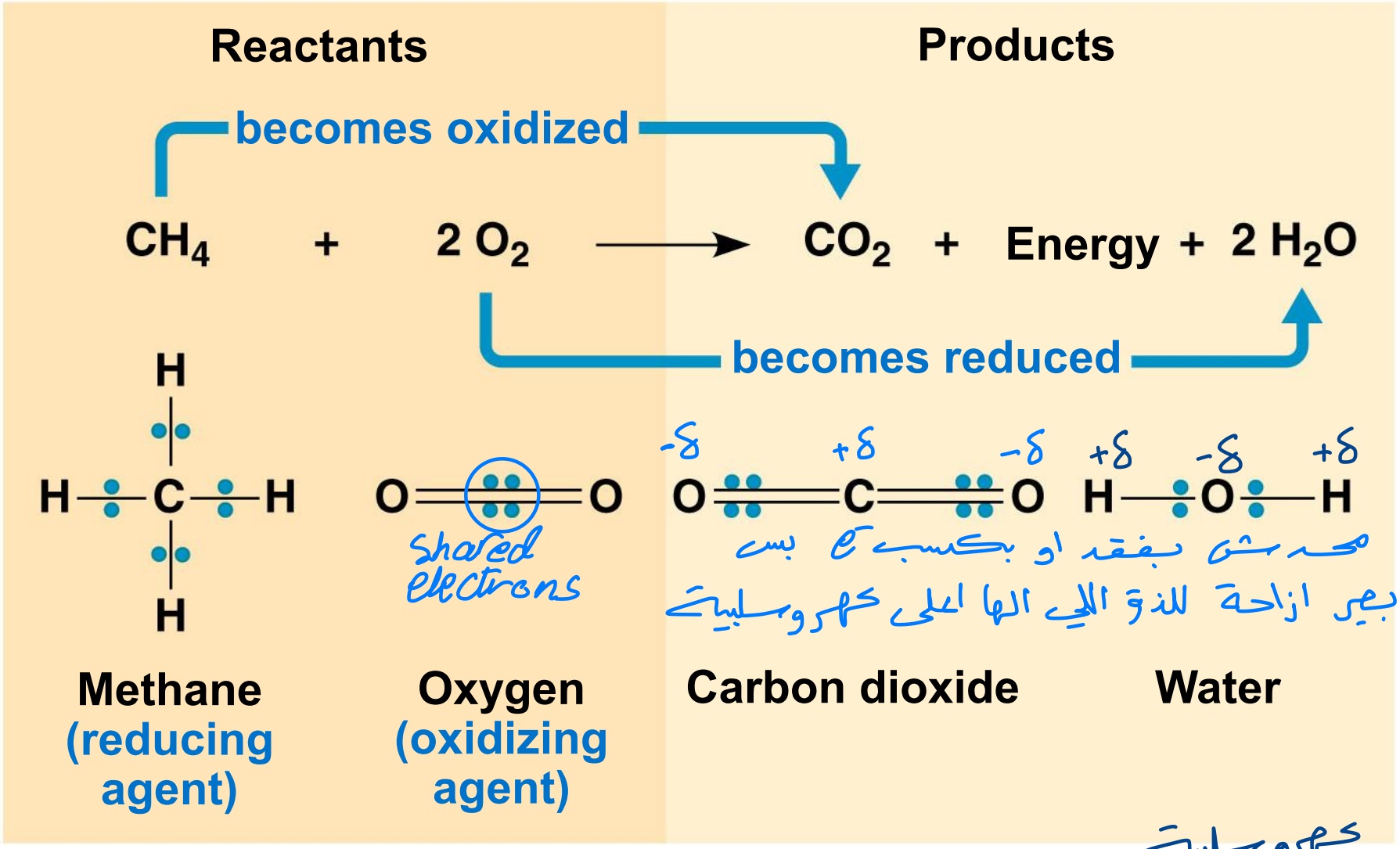


Figure 9.UN02



- The electron donor is called the **reducing agent**
- The electron receptor is called the **oxidizing agent**
- Some redox reactions do not transfer electrons but change the electron sharing in covalent bonds
- An example is the reaction between methane and O_2

Figure 9.3



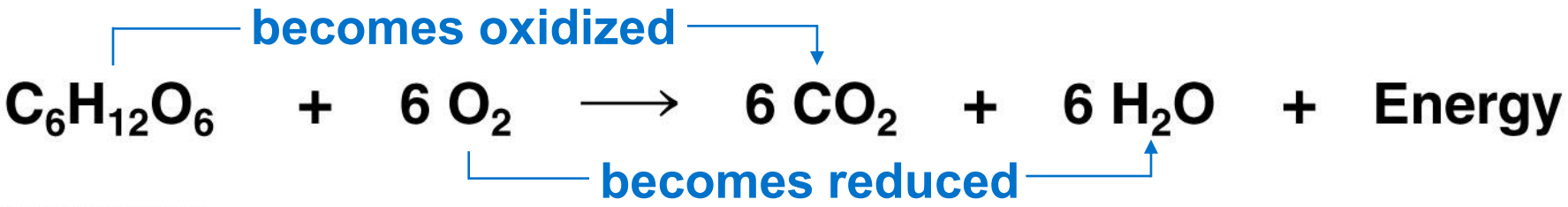
Electrons are closer to the atom that has a higher electronegativity

Oxidation of Organic Fuel Molecules During Cellular Respiration

- During cellular respiration, the fuel (such as glucose) is oxidized, and O_2 is reduced

the last electron

Figure 9.UN03



All energy is stored in the bonds between atoms in the glucose , and to get the energy out of it wen need to break these bonds by giving them a little bit of energy to weaken them with the help of na enzyme (dehydrogenase) , and when they are broken the protons and electrons will be released holding all energy in electrons

(oxygen will receive the electrons and combine with the protons and form water)

The last electron receptor is the oxygen

Primary electrons acceptor: NAD+

Stepwise Energy Harvest via NAD^+ and the Electron Transport Chain

- In cellular respiration, glucose and other organic molecules are broken down in a series of steps
- Electrons from organic compounds are usually first transferred to **NAD^+**, a coenzyme
- As an electron acceptor, NAD^+ functions as an oxidizing agent during cellular respiration
- Each NADH (the reduced form of NAD^+) represents stored energy that is tapped to synthesize ATP

Figure 9.4

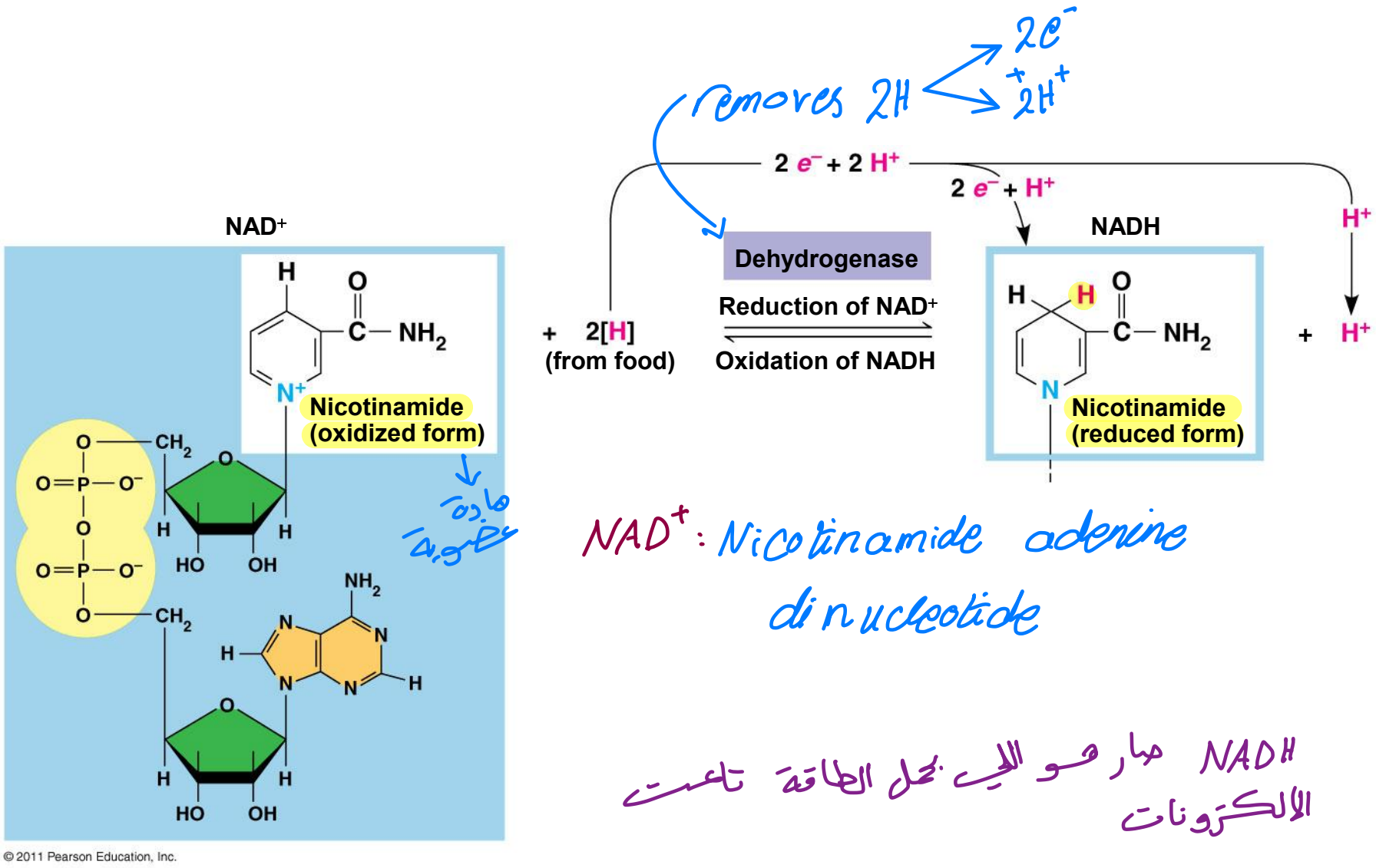
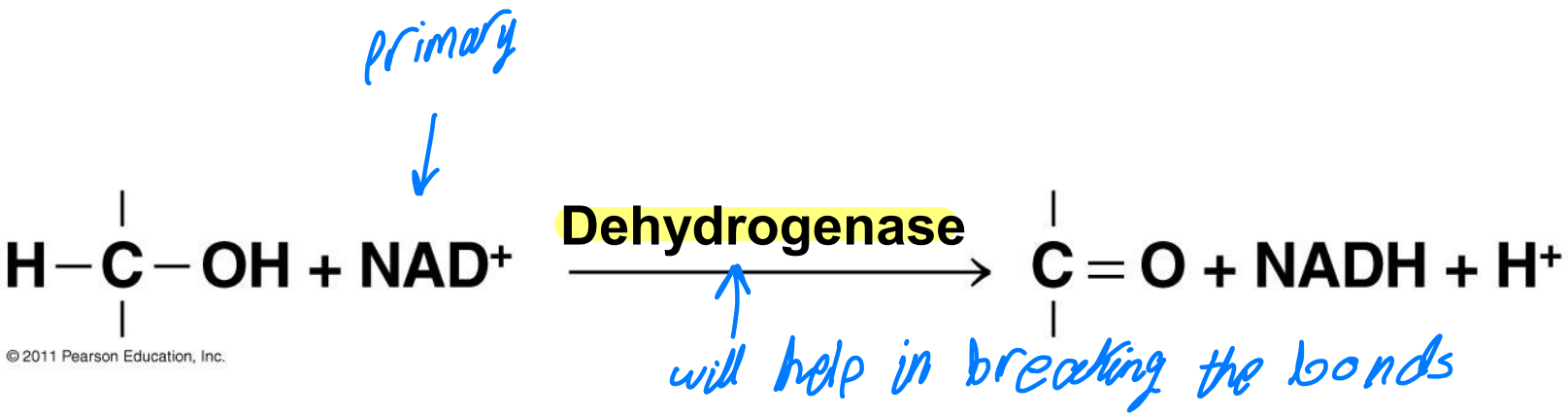


Figure 9.UN04



- NADH passes the electrons to the **electron transport chain**
- Unlike an uncontrolled reaction, the electron transport chain passes electrons in a series of steps instead of one explosive reaction
- O_2 pulls electrons down the chain in an energy-yielding tumble
- The energy yielded is used to regenerate ATP

Figure 9.5