

Biology Lecture Notes

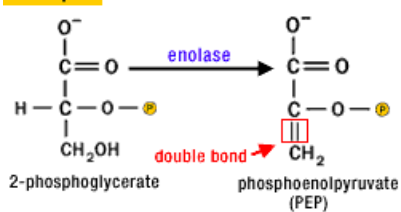
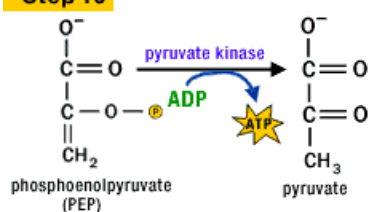
Glycolysis: The Energy Payoff

>> Key Concepts:

- ✎ **Review:** The energy investment phase of **glycolysis** involves the investment of two **ATP** molecules and results in the formation of two molecules of glyceraldehyde phosphate.
- ✎ The energy payoff phase of glycolysis consists of five additional steps and results in the formation of four **ATP**, two **NADH + H⁺**, and two **pyruvate** molecules.
- ✎ **Substrate level phosphorylation** is the process by which ATP is produced from the transfer of a phosphate group from a substrate molecule in a metabolic pathway.

<p>Step 6 1st oxidation of the substrate</p> <p>glyceraldehyde 3 phosphate (GAP) + NAD⁺ + P_i → 1,3-bisphosphoglycerate + NADH + H⁺</p>	<p>Step 6: Glyceraldehyde phosphate is oxidized (NAD⁺ is reduced) and phosphorylated by the enzyme triose phosphate dehydrogenase to produce 1,3-bisphosphoglycerate. Two molecules of NADH + H⁺ are produced.</p> <p>This is an example of a coupled reaction. The highly exergonic redox reaction fueled the endergonic formation of the phosphate bond.</p>
<p>Step 7</p> <p>1,3-bisphosphoglycerate + ADP → 3-phosphoglycerate + ATP</p>	<p>Step 7: A phosphate group is removed from each 1,3-bisphosphoglycerate to make two ATP and 3-phosphoglycerate. This reaction is mediated by the enzyme phospho-glycerokinase.</p> <p>This reaction is an example of substrate level phosphorylation. A phosphate group was removed from a substrate molecule and added to ADP to make ATP.</p>
<p>Step 8</p> <p>3-phosphoglycerate → 2-phosphoglycerate</p>	<p>Step 8: The remaining phosphate group is transferred to the middle carbon by the enzyme phosphoglyceromutase. This reaction will energize the molecule and make it less stable. 2-phosphoglycerate results.</p>

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<p>Step 9</p>  <p>2-phosphoglycerate</p> <p>phosphoenolpyruvate (PEP)</p>	<p>Step 9: A water molecule is removed and a double bond is added to both 2-phosphoglycerate molecules to produce two phosphoenolpyruvate (also known as PEP) molecules.</p>
<p>Step 10</p>  <p>phosphoenolpyruvate (PEP)</p> <p>pyruvate</p>	<p>Step 10: Both PEP molecules are dephosphorylated by pyruvate kinase to produce two pyruvates and two ATP.</p>