Glycolysis

**STEP 1:**
As soon as a glucose molecule enters the cytoplasm, a phosphate group is attached to the molecule.

**STEP 2:**
A second phosphate group is attached. Together, steps 1 and 2 cost the cell 2 ATP.

**STEP 3:**
The six-carbon chain is split into two three-carbon molecules, each of which then follows the rest of this pathway.

**STEP 4:**
Another phosphate group is attached to each molecule, and NADH is generated from NAD.

**STEP 5:**
One ATP molecule is formed for each molecule processed.

**STEP 6:**
The atoms in each molecule are rearranged, releasing a molecule of water.

**STEP 7:**
A second ATP molecule is formed for each molecule processed. Step 7 produces 2 ATP molecules.

**ENERGY SUMMARY**

<table>
<thead>
<tr>
<th>Steps</th>
<th>ATP Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2</td>
<td>-2 ATP</td>
</tr>
<tr>
<td>5</td>
<td>+2 ATP</td>
</tr>
<tr>
<td>7</td>
<td>+2 ATP</td>
</tr>
</tbody>
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**NET GAIN:** +2 ATP
Decarboxylation and The Citric Acid Cycle
Electron Transport and Oxidative Phosphorylation
Summary of the Energy Yield of Aerobic Metabolism

**Glycolysis:**
- 4 ATP by substrate-level phosphorylation
- 2 ATP used to initiate glycolysis
- 2 ATP net gain to cell

**The Electron Transport System and TCA Cycle:**
- 4 ATP from NADH produced in glycolysis
- 24 ATP from NADH generated in TCA cycle
- 4 ATP from FADH₂ generated in TCA cycle
- 2 ATP via GTP produced by substrate-level phosphorylation
- 36 ATP net gain to cell from aerobic catabolism of one glucose molecule
Pathways of Catabolism and Anabolism