What is ATP Production and Energy Transfer?

Worksheet

Aerobic respiration produces roughly 30-32 ATP per glucose molecule across its three stages, and hydrolyzing one mole of ATP releases about 30.5 kJ (7.3 kcal) of usable energy.

$$ATP + H_2O \rightarrow ADP + P_i + \text{energy (~30.5 kJ/mol)}$$

Questions

1. About how much energy is released by hydrolyzing one mole of ATP?

A) 3.05 kJ
B) 30.5 kJ
C) 305 kJ
D) 0.305 kJ

2. Roughly how many ATP does aerobic respiration yield per glucose molecule?

A) 2
B) 6
C) 30-32
D) 100

3. Which stage of aerobic respiration produces the most ATP?

A) Glycolysis
B) Krebs cycle
C) Electron transport chain
D) Fermentation

4. What are the products of ATP hydrolysis?

A) Glucose and oxygen
B) ADP, phosphate, and energy
C) NADH and FADH2
D) Carbon dioxide and water

5. How much energy is released when 2 moles of ATP are hydrolyzed to ADP?

6. A muscle cell hydrolyzes 0.5 mole of ATP during a contraction. How much energy is released?

7. If aerobic respiration yields about 30 ATP per glucose, how much total energy is available from hydrolyzing all of it?

8. Define: What is ATP?

9. Define: How much energy does hydrolyzing one mole of ATP release?

10. Define: Roughly how much ATP does one glucose molecule yield in aerobic respiration?

Answer Key

1. B) 30.5 kJ - ATP hydrolysis releases about 30.5 kJ per mole under cellular conditions.
2. C) 30-32 - Combining glycolysis, the Krebs cycle, and the ETC yields roughly 30-32 ATP.
3. C) Electron transport chain - The electron transport chain produces the majority of ATP via oxidative phosphorylation.
4. B) ADP, phosphate, and energy - ATP is hydrolyzed to ADP + inorganic phosphate, releasing energy.
5. Energy per mole ATP hydrolyzed 30.5 kJ Energy = 2 30.5 = 61 kJ
6. Energy = n 30.5 kJ/mol Energy = 0.5 30.5 = 15.25 kJ
7. n = 30 mol ATP (per mole of glucose) Energy = 30 30.5 = 915 kJ
8. Adenosine triphosphate, the cell's main energy-carrying molecule.
9. About 30.5 kJ (7.3 kcal) of usable energy.
10. About 30-32 ATP, combining glycolysis, the Krebs cycle, and the electron transport chain.