What is ATP?

Worksheet

ATP is the nucleotide cells use to store and carry usable energy; hydrolysis of its terminal phosphate bond releases about 30.5 kJ/mol (7.3 kcal/mol) of energy for cellular work.

Questions

1. What three parts make up an ATP molecule?

A) Adenine, ribose, three phosphate groups
B) Glucose, ribose, one phosphate group
C) Adenine, deoxyribose, two phosphate groups
D) Uracil, ribose, three phosphate groups

2. Approximately how much energy is released hydrolyzing 1 mole of ATP?

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

3. What are the products of ATP hydrolysis?

A) Glucose + oxygen
B) ADP + inorganic phosphate + energy
C) Two ADP molecules
D) CO_2 + water

4. Why can't cells store large amounts of ATP for later use?

A) ATP is toxic in large amounts
B) ATP is rapidly made and used within seconds, so cells keep only a small reserve
C) ATP doesn't dissolve in water
D) Cells don't need much energy

5. A muscle cell hydrolyzes 4 moles of ATP during a contraction. How much energy is released?

6. A cell needs 610 kJ of energy for an active transport process. How many moles of ATP must be hydrolyzed?

7. During protein synthesis, a cell hydrolyzes 0.5 mole of ATP. Calculate the energy released.

8. Define: What does ATP stand for?

9. Define: Why is ATP called the 'energy currency' of the cell?

10. Define: How much energy does hydrolyzing 1 mole of ATP release?

Answer Key

1. A) Adenine, ribose, three phosphate groups - ATP = adenine base + ribose sugar + a chain of three phosphate groups.

2. B) 30.5 kJ - ATP hydrolysis releases about 30.5 kJ/mol (7.3 kcal/mol) under cellular conditions.

3. B) ADP + inorganic phosphate + energy - ATP + H2O ADP + Pi + energy.

4. B) ATP is rapidly made and used within seconds, so cells keep only a small reserve - ATP turnover is extremely fast - most cells recycle their entire ATP pool every 1-2 minutes rather than storing it.

5. Energy = moles 30.5 kJ/mol Energy = 4 30.5 = 122 kJ

6. moles = Energy 30.5 moles = 610 30.5 = 20 mol ATP

7. Energy = moles 30.5 kJ/mol Energy = 0.5 30.5 = 15.25 kJ

8. Adenosine triphosphate - a nucleotide made of adenine, ribose sugar, and three phosphate groups.

9. Because cells constantly earn (synthesize) and spend (hydrolyze) it to power nearly every process, just like currency is exchanged.

10. About 30.5 kJ/mol (7.3 kcal/mol) under standard cell conditions.