Worksheet 2 - ATP/ADP Cycle and Energy Coupling

IB Biology C1.2 - Trimester assessment practice
SL core emphasis with IB-style questioning.

IB Biology C1.2	**Total marks:** 24
Suggested time: 45 minutes	**Name:** ____________________ **Class:** __________ **Date:** __________

Section A - Multiple choice

Q1. Which change is endergonic? [1]

A. ATP hydrolysis to ADP + Pi

B. ADP + Pi forming ATP

C. Lactate converting to pyruvate with no energy input

D. Water evaporating from a leaf surface

Q2. Which statement about the ATP cycle is correct? [1]

A. ATP is stored in very large amounts in most cells.

B. The cycle stops whenever ATP is hydrolysed.

C. Energy from oxidation of nutrients can be stored in ATP.

D. ADP cannot be reused after hydrolysis.

Q3. Which best describes coupling in metabolism? [1]

A. All reactions in a cell release heat only.

B. Energy from exergonic processes is transferred so endergonic processes can occur.

C. ATP is made only during fermentation.

D. Hydrolysis always requires energy input.

Section B - Short answer

Q4. Explain the difference between ATP synthesis and ATP hydrolysis. [4]

Q5. Outline how energy released from nutrient oxidation becomes available for movement in a cell. [3]

Section C - Data response / case study

The table shows ATP and ADP concentrations measured in a tissue before and after intense activity.

Table 1. ATP/ADP concentrations in active tissue

Condition	ATP / mmol dm^-3	ADP / mmol dm^-3
Resting	6.2	1.1
Immediately after activity	5.5	1.9
Two minutes recovery	6.0	1.2

Q6.

(a) State how ADP concentration changes immediately after activity. [1]

(b) Explain why ATP concentration falls while ADP concentration rises during intense activity. [2]

(c) Explain the pattern seen after two minutes of recovery. [2]

(d) Use the data to support the idea that ATP is continually recycled rather than stored in large amounts. [3]

Section D - Extended response

Q7. Discuss how ATP links catabolic and anabolic processes in cells. [6]

Continue on extra paper if needed.

Answer key and marking guidance

Teacher guidance is indicative and is designed for classroom assessment practice rather than as an official IB markscheme.

Section A - Multiple choice

Q1. Correct answer: **B**. Award [1] for B only.

Q2. Correct answer: **C**. Award [1] for C only.

Q3. Correct answer: **B**. Award [1] for B only.

Section B - Short answer

Q4. Indicative answer:

- ATP synthesis combines ADP with inorganic phosphate.
- This requires an energy input, so it is endergonic.
- ATP hydrolysis splits ATP to ADP and phosphate using water.
- This releases energy, so it is exergonic.

Marking guidance: [1] ATP synthesis from ADP + Pi ; [1] energy input / endergonic ; [1] hydrolysis to ADP + Pi ; [1] energy release / exergonic

Q5. Indicative answer:

- Energy from oxidation is used to synthesise ATP from ADP and phosphate.
- ATP is then hydrolysed when energy is needed.
- The released energy drives movement such as cilia, flagella or chromosome motion.

Marking guidance: Award [1] each for storing energy in ATP, ATP hydrolysis, and use in movement.

Section C - Data response / case study

Q6.

(a) **Answer:** It increases from 1.1 to 1.9 mmol dm^-3.

(a) **Marking guidance:** [1] increases / correct data

(b) **Answer:** ATP is being hydrolysed to provide energy for cellular work. This produces ADP and phosphate, so ATP decreases while ADP increases.

(b) **Marking guidance:** [1] ATP hydrolysed for energy, [1] ADP produced

(c) **Answer:** Respiration regenerates ATP from ADP and phosphate. Therefore ATP rises again and ADP falls toward resting levels.

(c) **Marking guidance:** [1] ATP regenerated by respiration, [1] linked rise/fall in concentrations

(d) **Answer:** ATP changes only by a relatively small amount and is restored quickly during recovery. ADP rises then falls as ATP is hydrolysed and then resynthesised. This shows rapid turnover rather than long-term storage.

(d) **Marking guidance:** [1] ATP changes only moderately, [1] ADP rises then falls, [1] conclusion of rapid recycling

Section D - Extended response

Q7. Indicative content for a high-scoring response:

- Catabolic reactions release energy as nutrients are oxidised.
- Some of this energy is captured by synthesising ATP from ADP and phosphate.
- ATP hydrolysis provides energy for anabolic reactions.
- These include polymer synthesis and other endergonic processes.
- ATP also powers active transport and movement, distributing energy to where it is needed.
- Thus ATP is the immediate link between energy release and energy use.

Suggested level guidance:

- 5-6: Scientifically accurate, well linked explanation using correct terminology and relevant examples or evidence.
- 3-4: Some correct biology with partial linkage between ideas; minor omissions or limited detail.

- 1-2: Limited or fragmented response with a few correct points only.
- 0: No relevant content.