Worksheet 2 - ATP, Energy Transfers, Anabolism and Catabolism

IB Biology C1.1 - Trimester assessment practice
SL core emphasis with IB-style questioning.

IB Biology C1.1	**Total marks:** 24
Suggested time: 45 minutes	**Name:** _____ **Class:** _____ **Date:** _____

Section A - Multiple choice

Q1. Which statement about ATP is correct? [1]

A. ATP contains one phosphate group more than glucose.

B. ATP releases usable energy when the terminal phosphate bond is hydrolysed.

C. ATP can only be made in chloroplasts.

D. ATP is a structural polysaccharide.

Q2. Which process is catabolic? [1]

A. Condensation of amino acids to form a polypeptide

B. Hydrolysis of starch to maltose

C. Formation of glycogen from glucose

D. Reduction of carbon dioxide in photosynthesis

Q3. Why are endergonic reactions useful to cells? [1]

A. They destroy ATP so heat is never produced.

B. They allow cells to store energy in more complex molecules.

C. They always occur without enzymes.

D. They reduce molecules to release immediate heat only.

Section B - Short answer

Q4. Describe the structure of ATP and explain why it is suitable as the energy currency of the cell. [4]

Q5. Explain why photosynthesis is described as anabolic and endergonic. [3]

Section C - Data response / case study

Muscle cells were monitored during a short sprint. The table shows changes in glycogen content and ATP concentration in the cells.

Table 1. Changes in fuel reserves during a sprint

Time / s	Glycogen / arbitrary units	ATP / arbitrary units
0	100	9.8
20	91	9.4
40	79	9.1
60	67	8.9
80	56	8.8

Q6.

(a) Identify the variable that shows the greatest overall decrease during the sprint. [1]

(b) Use the data to explain why ATP is described as an immediate but short-term energy source. [2]

(c) State one catabolic reaction and one anabolic reaction that could be linked by ATP in these cells. [2]

(d) Explain how ATP links energy-releasing and energy-requiring reactions in a cell. [3]

Section D - Extended response

Q7. Discuss the relationship between catabolism, ATP production and anabolic processes in living 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: **B**. Award [1] for B only.

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

Section B - Short answer

Q4. Indicative answer:

- ATP consists of adenine, ribose and three phosphate groups.
- The bond between the second and third phosphate is especially associated with energy transfer.
- Hydrolysis of ATP to ADP + Pi releases usable energy in small, manageable amounts.
- ATP can be regenerated repeatedly and rapidly within cells.

Marking guidance: [1] adenine + ribose + three phosphates ; [1] identifies terminal phosphate bond / ATP -> ADP + Pi ; [1] releases usable energy ; [1] can be regenerated rapidly

Q5. Indicative answer:

- It builds larger organic molecules such as glucose from smaller molecules such as carbon dioxide and water.
- This is synthesis / building up, so it is anabolic.
- It requires an energy input from light, so it is endergonic.

Marking guidance: Award [1] each for synthesis/building up, example of molecules, and energy input.

Section C - Data response / case study

Q6.

(a) **Answer:** Glycogen.

(a) **Marking guidance:** [1] glycogen

(b) **Answer:** ATP concentration changes only slightly (9.8 to 8.8), showing it is kept relatively constant. In contrast, glycogen falls much more strongly (100 to 56), indicating glycogen is broken down to help regenerate ATP as ATP is used.

(b) **Marking guidance:** [1] ATP remains fairly constant / small decrease, [1] glycogen falls markedly and is used to regenerate ATP

(c) **Answer:** Catabolic example: glycogen breakdown / glucose oxidation in respiration. Anabolic example: glycogen synthesis / protein synthesis.

(c) **Marking guidance:** [1] valid catabolic example, [1] valid anabolic example

(d) **Answer:** Energy released by catabolic reactions is used to convert ADP + Pi to ATP. ATP hydrolysis then transfers energy to processes such as active transport, movement or biosynthesis. This couples energy release to cellular work.

(d) **Marking guidance:** [1] ATP regenerated using catabolic energy, [1] ATP hydrolysis releases usable energy, [1] coupling to cellular work

Section D - Extended response

Q7. Indicative content for a high-scoring response:

- Catabolic pathways break down molecules and release energy.
- Some of this energy is captured in ATP rather than all being lost immediately as heat.
- ATP transfers energy in a form the cell can use directly.
- Anabolic reactions such as protein synthesis or glycogen formation require energy input.
- ATP hydrolysis supplies this energy and may also provide phosphate for coupling.
- Heat is also produced because metabolic energy transfers are not 100 percent efficient.

Suggested level guidance:

- 5-6: Scientifically accurate, well linked explanation using correct terminology and at least two relevant examples.
- 3-4: Some correct biology with partial linkage between ideas; minor omissions or weak examples.
- 1-2: Limited or fragmented response; little connection between concepts.
- 0: No relevant content.