

Worksheet 1 - Enzymes as Catalysts and the Basics of Metabolism

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

IB Biology C1.1	Total marks: 24
Suggested time: 40 minutes	Name: _____ Class: _____ Date: _____

Section A - Multiple choice

Q1. Which statement best explains why enzymes are essential in living cells? [1]

- A. They supply energy directly to every reaction.
- B. They lower the activation energy so reactions can proceed rapidly enough for life.
- C. They change the equilibrium position in favour of products.
- D. They are used up as reactants and must be replaced after each reaction.

Q2. Which pair correctly matches a metabolic process with its description? [1]

- A. Anabolism - breakdown of polymers by hydrolysis
- B. Catabolism - synthesis of macromolecules using condensation
- C. Anabolism - building complex molecules and usually requiring energy input
- D. Catabolism - always occurs outside cells only

Q3. Which is a direct role of ATP in cells? [1]

- A. It acts as the active site of enzymes.
- B. It provides energy for active transport and biosynthesis.
- C. It permanently stores genetic information.
- D. It replaces enzymes in metabolic pathways.

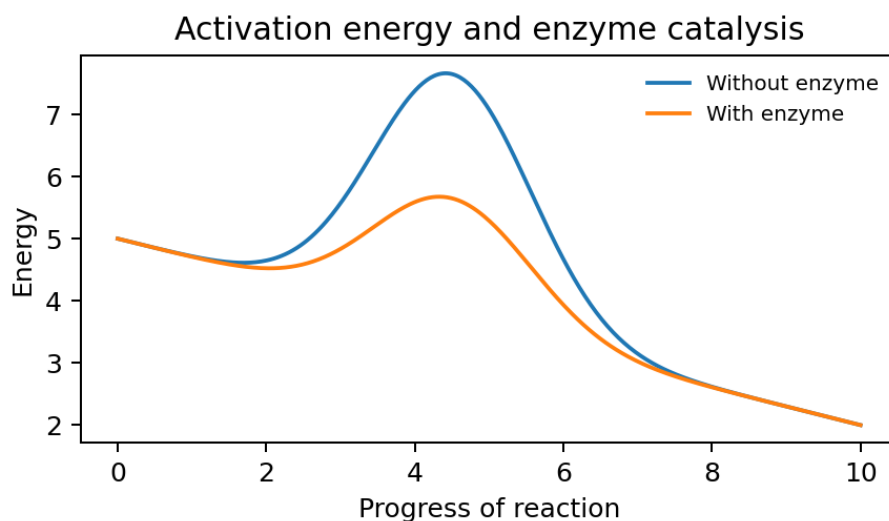
Section B - Short answer

Q4. Explain why many chemical reactions in cells would be unsuitable for life if enzymes were absent. [3]

Q5. Distinguish between anabolic and catabolic reactions, giving one named example of each. [4]

Section C - Data response / case study

A student compares the reaction $A \rightarrow B$ in the absence and presence of an enzyme. The diagram below shows the energy profile for the reaction.



Q6.

- (a) State the name of the energy barrier that must be overcome before the reaction can proceed. [1]
- (b) Explain how the enzyme changes the energy profile shown. [2]
- (c) The products are at a lower energy level than the reactants. What does this indicate about the reaction? [2]
- (d) Predict what would happen to the reaction rate and to the equilibrium position if more enzyme were added. [3]

Section D - Extended response

Q7. Explain how enzymes and ATP together make metabolism possible in living organisms. [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:

- Many reactions would still be possible, but they would proceed too slowly.
- Essential processes such as respiration, photosynthesis, biosynthesis or digestion would not occur at a sufficient rate.
- Cells would fail to maintain metabolism and homeostasis / life functions would not be sustained.

Marking guidance: [1] reaction would be too slow ; [1] reference to essential cellular processes ; [1] consequence for survival/homeostasis

Q5. Indicative answer:

- Anabolic reactions build larger / more complex molecules from smaller units.
- Anabolic reactions require an input of energy.
- Example: protein synthesis / glycogen formation / photosynthesis.
- Catabolic reactions break larger molecules into smaller molecules.
- Catabolic reactions release energy.
- Example: digestion / hydrolysis of polymers / oxidation of substrates in respiration.

Marking guidance: Award up to [2] for a clear distinction between anabolic and catabolic. ; Award up to [2] for one correct named example of each linked to the correct category.

Section C - Data response / case study

Q6.

(a) **Answer:** Activation energy.

(a) **Marking guidance:** [1] activation energy

(b) **Answer:** The enzyme lowers the activation energy / lowers the peak of the energy barrier. It does not provide energy itself and does not change the overall energy difference between reactants and products.

(b) **Marking guidance:** [1] lowers activation energy, [1] no change to overall energy difference / enzyme not used up

(c) **Answer:** The reaction is exergonic because energy is released overall as products form.

(c) **Marking guidance:** [1] identifies exergonic / releases energy, [1] links to lower-energy products

(d) **Answer:** The reaction rate would increase because more active sites are available / more successful collisions occur. The equilibrium position would not change; the enzyme only speeds up the approach to equilibrium in both directions.

(d) **Marking guidance:** [1] faster rate, [1] more available active sites / collisions, [1] equilibrium unchanged

Section D - Extended response

Q7. Indicative content for a high-scoring response:

- Enzymes are specific biological catalysts that lower activation energy.
- They allow many linked reactions in metabolism to occur fast enough at cell temperatures.
- ATP acts as an immediate energy currency for cellular work.
- Energy released by catabolic reactions can be captured in ATP.
- ATP hydrolysis can be coupled to anabolic reactions, active transport or movement.

- Together, enzyme control and ATP transfer link energy release to energy use in the cell.

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.