

Exercise walk-through

Cell Compartmentalization ■ 2.9

eXercise

You must be able to

- explain how **membrane-bound organelles** 膜结合细胞器 create separate compartments
- state the advantages of compartmentalization
- give examples (lysosome, mitochondrion) of specialized environments

Method — Compartments inside the cell

Membrane-bound organelles divide the eukaryotic cell into **compartments**, each with its own conditions. This lets different, even incompatible, reactions happen at once.

Method — Advantages

- **Separate conditions** — e.g. a lysosome can be acidic inside without harming the rest of the cell.
- **Higher efficiency** — reactants and enzymes are concentrated together.
- **Protection** — dangerous reactions (digestion) are kept contained.

Method — A worked example

The **lysosome** keeps its digestive enzymes and low pH inside its membrane, so they break down waste without damaging the cytoplasm.

Method — Mitochondria

The **mitochondrion's** inner membrane holds a proton gradient used to make ATP — only possible because the membrane separates two regions.

Practice 2.1 ■ 1 mark

What creates separate compartments in a eukaryotic cell?

Solution 2.1

Method: Compartments inside the cell

Worked steps

Membrane-bound organelles **B1**.

Practice 2.2 ■ 1 mark

State one advantage of compartmentalization.

Solution 2.2

Worked steps

Any one: separate conditions, greater efficiency, protection/containment of harmful reactions **B1**.

Practice 2.3 ■ 1 mark

Why is it useful for a lysosome to be enclosed by a membrane?

Solution 2.3

Method: A worked example

Worked steps

So its digestive enzymes and acid are contained and do not damage the rest of the cell **B1**.

Exam-style 3.1 ■ 1 mark

Compartmentalization allows a cell to

- A** carry out only one reaction at a time
- B** maintain different conditions in different regions
- C** avoid using membranes
- D** remove its DNA

Solution 3.1

- A** carry out only one reaction at a time
- B** maintain different conditions in different regions 
- C** avoid using membranes
- D** remove its DNA

Worked steps

B — maintain different conditions in different regions.

Exam-style 3.2 ■ 2 marks

A lysosome contains digestive enzymes and has an acidic interior.

- (a) Explain why enclosing these in a membrane is important.
- (b) State one other advantage of keeping reactions in a compartment.

Solution 3.2

Worked steps

(a) The membrane keeps the enzymes and acid contained, protecting the cytoplasm from being digested **M1 A1**. (b) Reactants and enzymes are concentrated together, raising efficiency (or: different reactions can occur at once) **B1**.

Exam-style 3.3 ■ 2 marks

Explain how compartmentalization increases the efficiency of a metabolic reaction.

Solution 3.3

Worked steps

Concentrating the enzymes and substrates in one small compartment increases the chance they meet and react, speeding the reaction **M1** **A1**.