
IB Biology B2.2 - Organelles and Compartmentalization

Worksheet 1: Foundations of organelles and compartmentalization

Name:	_____	Class:	_____	Date:	_____
Time suggested:	55-65 minutes	Total marks:	34	Level:	SL/HL mixed

Instructions: Answer all questions. Show biological reasoning clearly. HL questions are included where the topic requires HL understanding. The answer key and marking guidance are provided at the end for teacher/student review.

Section A: Multiple choice (6 marks)

A1. Which statement best defines cell compartmentalization? [1 mark]

- A. The use of DNA to store genetic information
- B. The division of the cell into regions separated by membranes
- C. The movement of organelles by the cytoskeleton
- D. The production of ATP by all living cells

A2. Which cell component is NOT considered an organelle in this topic? [1 mark]

- A. Nucleus
- B. Ribosome
- C. Cytoplasm
- D. Vesicle

A3. Which pair is correctly matched? [1 mark]

- A. Ribosome - protein synthesis
- B. Chloroplast - ATP production only
- C. Cell wall - genetic control
- D. Lysosome - photosynthesis

A4. A cell specialized for secretion would be expected to contain many... [1 mark]

- A. lysosomes only
- B. Golgi apparatus and rough ER
- C. cell walls and chloroplasts
- D. free ribosomes only

A5. The main advantage of membranes around organelles is that they... [1 mark]

- A. make all reactions happen in the cytoplasm
- B. prevent cells from using enzymes
- C. separate reactions that might interfere with one another
- D. remove the need for DNA

A6. Which structure regulates movement into and out of the whole cell? [1 mark]

- A. Plasma membrane
- B. Cytoskeleton
- C. Ribosome
- D. Nucleolus

Section B: Short answer

B1. State two features that make a structure an organelle in this topic, and give two examples. [4 marks]

B2. Explain why the number and type of organelles can differ between cell types. [4 marks]

B3. Distinguish between cytoplasm, cytoskeleton and a ribosome. [4 marks]

Section C: Data response / case study (8 marks)

C1. Data response: organelles in specialized cells

A student counted selected organelles in electron micrographs of three eukaryotic cell types. Values are relative abundance scores from 0 to 5.

Cell type	Mitochondria	Rough ER	Golgi apparatus	Chloroplasts	Lysosomes
Palisade mesophyll cell	3	2	2	5	1
Pancreatic acinar cell	3	5	5	0	2
White blood cell	2	2	2	0	5

C1a. Identify the cell type most adapted for photosynthesis. Give one reason. **[2 marks]**

C1b. Suggest why the pancreatic acinar cell has high rough ER and Golgi scores. **[3 marks]**

C1c. Explain why the white blood cell has a high lysosome score. **[2 marks]**

C1d. State one limitation of using relative abundance scores rather than actual organelle counts. **[1 mark]**

Section D: Extended response (8 marks)

D1. Evaluate the claim: compartmentalization makes eukaryotic cells more efficient but also creates coordination challenges. **[8 marks]**

Answer key and marking guidance

Worksheet 1: Foundations of organelles and compartmentalization - Total: 34 marks

Use the guidance below flexibly. Award credit for scientifically correct equivalent wording. Do not award marks for vague statements unless they are supported by a correct biological explanation.

Section A: Multiple choice

Question	Answer	Guidance
A1	B	Compartmentalization means dividing the cell into membrane-separated regions.
A2	C	Cytoplasm is a cell region, not an organelle in this syllabus point.
A3	A	Ribosomes synthesize proteins.
A4	B	Secreting cells require rough ER and Golgi apparatus for secretory proteins.
A5	C	Membranes separate incompatible or specialized reactions.
A6	A	The plasma membrane controls exchange with the external environment.

Section B: Short answer

B1. [4 marks] Award 1 mark for each valid feature/example: specialized cell subunit; performs a specific function; may be membrane-bound or discrete; examples include nucleus, ribosome, vesicle, plasma membrane, mitochondrion, chloroplast, lysosome, Golgi apparatus.

B2. [4 marks] Award marks for: cell function determines organelle demand; secretory cells need more rough ER/Golgi/vesicles; muscle cells need more mitochondria; plant photosynthetic cells need chloroplasts; structure-function correlation.

B3. [4 marks] Cytoplasm is the region where many metabolic reactions occur; cytoskeleton maintains shape/anchors organelles/facilitates movement; ribosome is an organelle made of rRNA and proteins that synthesizes proteins.

Section C: Data response / case study

C1. C1a: Palisade mesophyll cell; high chloroplast score. C1b: It secretes digestive enzymes/proteins; bound ribosomes on rough ER synthesize secretory proteins; Golgi modifies/packages proteins into vesicles. C1c: White blood cells digest pathogens/material taken in by phagocytosis; lysosomes contain digestive enzymes. C1d: Scores are less precise, may hide variation between cells, and do not give exact organelle numbers.

Marking guidance: Award marks according to the mark allocations shown in the question. For data questions, credit both correct interpretation of the data and correct biological explanation.

Section D: Extended response

D1. [8 marks] Award up to 8 marks for a balanced response. Efficiency points: concentrates enzymes/substrates, separates incompatible processes, protects cytoplasm from lysosomal enzymes, permits mRNA processing in nucleus, supports specialized organelle functions. Coordination challenge points: substances must move between compartments, vesicle transport is needed, membranes require pumps/carriers/pores, organelles must function in series. Award a final mark for a clear judgement supported by examples.

Suggested extended-response marking bands: 0-2 limited statements with major omissions; 3-4 some relevant ideas but weak links; 5-6 mostly accurate with examples and links to function; 7-8/10 detailed, well-organized, balanced and fully linked to the question. For 10-mark questions, use 9-10 for exceptionally thorough synthesis and evaluation.