

IB Biology SL Paper 2 Practice Paper

(structured questions)

Total: 50 marks · 1 h 15 min · 7 questions · 20 parts

Data and formulae

Item	Formula / value
Magnification	magnification = image size / actual size
Surface area : volume	cube of side s: $6s^2$: s^3
Percentage change	$(\text{new} - \text{old}) / \text{old} \times 100\%$
Chi-squared test	$\chi^2 = \sum (O - E)^2 / E$; df = 1, critical value 3.84 at $p = 0.05$
Energy transfer efficiency	energy in next level / energy in previous level $\times 100\%$

Section A (30 marks)

Q 1 · Data question: photosynthesis and light intensity [8]

A student used the same aquatic plant to measure the volume of oxygen released in 10 minutes at different light intensities. The results are shown below:

Light intensity (klx)	Oxygen released in 10 min (cm ³)
0	2
5	14
10	28
20	42
30	46
40	47

- (a) Calculate the percentage increase in oxygen released when light intensity rises from 5 klx to 10 klx. [2]
- (b) Calculate the mean rate of oxygen release at 30 klx in cm³ per minute. [2]
- (c) Describe how the curve changes above 30 klx and suggest one limiting factor. [2]
- (d) At 0 klx a volume of 2 cm³ was still recorded. Suggest one possible explanation. [2]

Q 2 · Cell membranes and transport [6]

- (a) Explain why large molecules such as proteins cannot enter a cell by diffusion alone. [2]
- (b) Spinach leaf discs lost mass from 2.40 g to 2.10 g in 0.4 mol dm⁻³ sucrose solution. Calculate the percentage change in mass and state whether the solution is hypotonic, isotonic or hypertonic to the cells. [2]
- (c) Explain why ATP is needed when root hair cells absorb mineral ions. [2]

Q 3 · DNA structure and protein synthesis [6]

- (a) A DNA fragment has 240 base pairs and adenine makes up 30%. Calculate the number of cytosine bases. [2]
- (b) A mRNA molecule has 183 bases including a stop codon. Calculate the maximum number of amino acids it can code for. [2]
- (c) The same gene can produce different proteins in a muscle cell and a pancreatic cell. Explain why. [2]

Q 4 · Genetics and chi-squared test [5]

- (a) Two heterozygotes (Tt x Tt) produced 400 offspring. Using a 3:1 ratio, state the expected numbers of dominant and recessive offspring. [2]
- (b) The observed numbers were 310 dominant and 90 recessive. Calculate chi-squared and decide whether the result deviates significantly from 3:1 (df = 1, critical value at p = 0.05 is 3.84). [2]
- (c) Explain why a recessive phenotype disappears in F₁ and reappears in F₂. [1]

Q 5 · Energy flow in ecosystems [5]

- (a) Producers in an ecosystem contain $45,000 \text{ kJ m}^{-2} \text{ yr}^{-1}$ and primary consumers $4,500 \text{ kJ m}^{-2} \text{ yr}^{-1}$. Calculate the efficiency of energy transfer. [1]
- (b) Tertiary consumers contain $45 \text{ kJ m}^{-2} \text{ yr}^{-1}$. Calculate the percentage of energy lost between producers and tertiary consumers. [2]
- (c) Explain two reasons why so much energy is lost between trophic levels. [2]

Section B (20 marks)

Q 6 · Section B question 1: gas exchange and oxygen transport [20]

- (a) Describe and explain three features of alveoli that make gas exchange efficient. [8]
- (b) Explain the role of haemoglobin in oxygen transport and why the oxygen dissociation curve shifts right during exercise. [12]

Q 7 · Section B question 2: coordination and osmoregulation [20]

- (a) Compare nervous and endocrine coordination (four points). [10]
- (b) Explain ultrafiltration and selective reabsorption in the nephron, and how water balance is maintained after drinking a lot of water. [10]