

Biology HL

IB HL — Answer Key

Q1.

Answer: The mitochondrion is **2.4 μm** long.

Q2.

Q3.

Q4.

Answer: K_m is the $[S]$ at which $v = V_{\max}/2$, reflecting enzyme-substrate affinity. Halving enzyme concentration halves $V_{\max}$ but does not change K_m .

Q5.

Answer: X is competitive (binds active site, increases K_m); Y is non-competitive (binds allosteric site, decreases $V_{\max}$). High $[S]$ outcompetes inhibitor X for active site binding.

Q6.

Answer: Denaturation permanently disrupts tertiary structure and active site shape (irreversible). Competitive inhibition temporarily blocks the active site without structural change (reversible, overcome by excess substrate).

Q7.

Answer: The light-dependent reactions (thylakoid membranes) produce ATP and NADPH, which are consumed by the Calvin cycle (stroma) to fix CO_2 into organic molecules. Inhibiting the light reactions halts ATP/NADPH supply, stopping the Calvin cycle.

Q8.

Answer: The plateau occurs because CO_2 concentration or temperature becomes limiting. Increasing CO_2 supply or raising temperature (within optimal range) would increase the maximum rate.

Q9.

Answer: The liquid moves toward the seeds because O₂ is consumed and CO₂ is absorbed by KOH, reducing gas volume. At 35 °C, enzyme activity increases, so respiration rate and liquid movement are both faster.

Q10.

Answer: A = 28%, T = 28%, G = 22%, C = 22%.

Check: 28 + 28 + 22 + 22 = 100%. Correct.

Q11.

Q12.

Answer: The polypeptide is **Met-Ala** (translation stops at UAA; UGA is never read).

Key point: Translation always starts at AUG and stops at the first stop codon encountered.

Q13.

Q14.

Answer: The lac operon uses a repressor/inducer system to ensure lactose-metabolising enzymes are only produced when lactose is present, conserving cellular energy and resources.

Q15.

Answer: Translation involves mRNA providing the codon sequence, tRNA delivering amino acids, and ribosomes catalysing peptide bond formation. Multiple ribosomes on one mRNA (a polysome) allow efficient parallel protein synthesis.

Q16.

Answer: The UUU → UAU change is a missense mutation (Phe → Tyr). Its effect depends on the amino acid's position in the protein. Nonsense mutations differ by producing a premature stop codon.

Q17.

Q18.

Q19.

Q20.

Q21.

Q22.

Q23.

Q24.

Q25.

Q26.

Q27.

Q28.

Q29.

Q30.

Q31.

Q32.

Q33.

Q34.

Q35.

Q36.

Q37.

Q38.

Q39.

Q40.

Q41.

Q42.

Q43.

Q44.

Q45.

Q46.

Q47.

Q48.

Q49.

Q50.

Q51.

Q52.

Q53.

Q54.