A-LEVEL BIOLOGY
100 AI PROMPTS

for Smarter Revision *and* Exam Prep

Active recall, exam technique, and mark-scheme thinking — without cheating.

by James R. Martin

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The author has made use of artificial intelligence tools to assist with drafting, structuring, and generating example material. All educational guidance, explanations, and exam-related advice have been reviewed, edited, and curated by the author. Any resemblance to specific published materials is unintentional.

This book is intended to support revision and exam preparation. It does not replace formal teaching, textbooks, or official specifications. Students are responsible for ensuring that all work submitted for assessment is their own.

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How to Use This Book

For a long time, high-quality tutoring has been a major contributor to elite academic achievement. Used well, AI can now act as a powerful tutor that most students and parents could not previously afford.

This book is a **starting point**, not a rulebook. Each prompt is designed to help you revise, test your understanding, and think more clearly — not to give perfect answers. You are encouraged to **adapt, improve, and remix** these prompts.

You are learning how to think carefully about the questions you ask — a skill that will matter far beyond these exams.

Note on Exam Boards and Syllabi

This book is designed to support A-Level Biology students across all major UK exam boards, including AQA, Edexcel (Pearson), OCR A (Biology A), OCR B (Biology B, Advancing Biology), and WJEC/Eduqas. The 100 prompts cover the core content that appears across every specification, ensuring that whichever board you are studying, the vast majority of material will be directly relevant to your course.

While exam boards differ in their sequencing and the specific contexts they use, the fundamental biology at A-Level is highly consistent. Biological molecules, cell biology, genetics, ecology, physiology, and practical skills are examined by every board at a comparable depth. This book addresses all of these areas with prompts that reflect genuine A-Level expectations.

Where specifications diverge, such as OCR B's context-driven approach or the order in which certain physiological systems are taught, the prompts have been written broadly enough to remain useful. A small number of prompts may cover material that sits slightly outside your specific specification, but engaging with this content will deepen your biological understanding and improve your exam performance.

The prompts incorporate the styles of questioning used across A-Level Biology papers, including data analysis, extended response essays, practical-based scenarios, and synoptic questions that require you to draw together knowledge from multiple topics. Command words such as 'explain', 'evaluate', 'suggest', and 'analyse' are used throughout, reflecting the expectations of real exam papers.

You should always cross-reference with your own specification and use your textbook or specification checklist to confirm which topics you need. This book is a powerful revision companion, but your specification document remains the definitive guide to what you will be examined on.

Contents

Section 1

Biological Molecules

Biological molecules form the chemical foundation of all living systems. At A-Level, you must understand the structure, properties, and functions of carbohydrates, lipids, proteins, nucleic acids, and water in far greater detail than at GCSE, including the chemical bonds that hold these molecules together and the reactions that form and break them.

Enzyme kinetics becomes significantly more demanding at A-Level. You need to understand the induced fit model, interpret Michaelis-Menten and Lineweaver-Burk plots, and explain the effects of competitive and non-competitive inhibitors quantitatively. The relationship between enzyme structure and function is a theme that runs throughout the entire course.

The prompts in this section test your ability to recall molecular structures, explain how structure relates to function, and apply your understanding to unfamiliar contexts. Mastering biological molecules gives you the vocabulary and conceptual framework needed for every other topic in A-Level Biology.

Prompt 1: Monosaccharides, Disaccharides, and Polysaccharides

Copy this prompt into your AI tool:

Quiz me on carbohydrate structure. Ask me to name the monomers and bond types in maltose, sucrose, and lactose. Then ask me to compare the structures of starch (amylose and amylopectin), glycogen, and cellulose, and explain how each structure relates to its biological function.

What this helps you practise:

Linking carbohydrate structure to biological function

How to use it well:

Focus on the specific structural features that determine function: branching in glycogen for rapid glucose release, hydrogen bonding between cellulose chains for tensile strength. These precise links earn marks.

Prompt 2: Biochemical Tests for Molecules

Copy this prompt into your AI tool:

Test me on the biochemical tests for reducing sugars, non-reducing sugars, starch, proteins, and lipids. For each test, ask me to state the reagent, the procedure, and the positive result. Then give me a scenario where I must choose and justify which test to use.

What this helps you practise:

Recalling and applying standard biochemical tests

How to use it well:

Know the difference between the test for reducing and non-reducing sugars. The non-reducing sugar test requires hydrolysis with acid first, then neutralisation, before repeating the Benedict's test.

Prompt 3: Lipid Structure and Function

Copy this prompt into your AI tool:

Ask me to describe the structure of a triglyceride, including the ester bond formation by condensation. Then ask me to compare saturated and unsaturated fatty acids, explain how phospholipids differ from triglycerides, and describe the role of phospholipids in cell membranes.

What this helps you practise:

Describing lipid structures and their roles in biological systems

How to use it well:

Draw the structures as you describe them. Being able to draw a triglyceride forming from glycerol and fatty acids, showing the ester bonds and water molecules released, is frequently tested.

Prompt 4: Amino Acids and Protein Structure

Copy this prompt into your AI tool:

Give me an A-Level style question on protein structure. Ask me to draw the general structure of an amino acid, explain peptide bond formation, and describe the four levels of protein structure (primary, secondary, tertiary, quaternary) with the bonds or interactions involved at each level.

What this helps you practise:

Explaining the four levels of protein structure and the bonds involved

How to use it well:

For tertiary structure, know all four types of interaction: ionic bonds, disulfide bridges, hydrogen bonds, and hydrophobic interactions. Examiners expect you to name specific bond types, not just say 'bonds'.

Prompt 5: Enzyme Specificity and the Induced Fit Model

Copy this prompt into your AI tool:

Test me on enzyme action. Ask me to explain the induced fit model of enzyme action and how it differs from the lock-and-key model. Then ask me to describe how the active site changes shape when a substrate binds, and why this model better explains enzyme catalysis.

What this helps you practise:

Comparing the lock-and-key and induced fit models of enzyme action

How to use it well:

The induced fit model is the accepted model at A-Level. Explain that the active site changes shape slightly to fit the substrate, which helps lower the activation energy. The lock-and-key model is a simplification.

Prompt 6: Enzyme Inhibition

Copy this prompt into your AI tool:

You are an A-Level examiner. Ask me to explain the difference between competitive and non-competitive inhibition. Require me to describe how each type of inhibitor affects the rate of reaction at different substrate concentrations, and ask me to sketch and interpret Michaelis-Menten curves showing the effect of each inhibitor type.

What this helps you practise:

Distinguishing competitive and non-competitive inhibition using kinetic data

How to use it well:

The key distinction: competitive inhibitors can be overcome by increasing substrate concentration, so Vmax remains the same. Non-competitive inhibitors reduce Vmax regardless of substrate concentration.

Prompt 7: Factors Affecting Enzyme Activity

Copy this prompt into your AI tool:

Ask me to explain how temperature, pH, and substrate concentration affect the rate of an enzyme-catalysed reaction. Require me to draw and label graphs for each factor and explain the shape of each curve in terms of molecular collisions, denaturation, and active site saturation.

What this helps you practise:

Explaining and graphing the effects of variables on enzyme activity

How to use it well:

For temperature, the key concept is that above the optimum, the rate decreases because hydrogen bonds in the tertiary structure break, altering the active site shape. This is denaturation, not death of the enzyme.

Prompt 8: Nucleotide and DNA Structure

Copy this prompt into your AI tool:

Quiz me on nucleic acid structure. Ask me to draw a nucleotide, label its components, and explain how nucleotides join by phosphodiester bonds. Then ask me to describe the double helix structure of DNA, including complementary base pairing, antiparallel strands, and hydrogen bonding.

What this helps you practise:

Describing the molecular structure of DNA at the nucleotide level

How to use it well:

Know the difference between purines (A, G) and pyrimidines (C, T). Adenine pairs with thymine via two hydrogen bonds; guanine pairs with cytosine via three. This detail is expected at A-Level.

Prompt 9: RNA Structure and Types

Copy this prompt into your AI tool:

Test me on the differences between DNA and RNA. Ask me to compare their sugar, bases, structure, and location. Then ask me to describe the roles of mRNA, tRNA, and rRNA in protein synthesis, and explain why each has a structure suited to its function.

What this helps you practise:

Comparing DNA and RNA structure and explaining the roles of different RNA types

How to use it well:

tRNA's cloverleaf shape, with its anticodon loop and

amino acid binding site, is directly related to its function in translation. Be able to explain this structure-function relationship.

Prompt 10: Water and Inorganic Ions

Copy this prompt into your AI tool:

Present me with a series of biological contexts and ask me to explain the importance of water's properties in each. Cover hydrogen bonding, high specific heat capacity, cohesion, solvent properties, and surface tension. Then ask me about the biological roles of iron and phosphate ions.

What this helps you practise:

Explaining how the properties of water and inorganic ions support biological processes

How to use it well:

Each property of water must be linked to a specific biological function. High specific heat capacity maintains stable body temperature; cohesion supports water transport in xylem. Avoid vague generalizations.

Prompt 11: Biological Molecules Synoptic Challenge

Copy this prompt into your AI tool:

Set me a challenge: give me an unfamiliar biological molecule or scenario and ask me to apply my knowledge of biological molecules to explain its properties and function. For example, present a novel enzyme inhibitor and ask me to predict how it works based on its structure, or give me data about an unusual polysaccharide and ask me to relate its properties to its molecular structure.

What this helps you practise:

Applying biological molecule knowledge to unfamiliar contexts

How to use it well:

A-Level examiners frequently test your ability to apply what you know to new situations. The specific molecule will be unfamiliar, but the principles of structure determining function remain the same.

Section 2

Cells, Transport, and Cell Division

Cell biology at A-Level requires you to understand the detailed ultrastructure of eukaryotic and prokaryotic cells as revealed by electron microscopy. You must be able to identify organelles, explain their functions, and understand how cells are organised into tissues, organs, and organ systems.

Transport across membranes is a major theme, encompassing diffusion, facilitated diffusion, osmosis, active transport, and co-transport. You need to understand the fluid mosaic model of membrane structure and explain how the properties of the phospholipid bilayer and membrane proteins determine what can cross the membrane and how.

Cell division at A-Level covers mitosis, meiosis, and the cell cycle in detail. You must understand the significance of each stage, the role of checkpoints, and how errors in cell division can lead to conditions such as cancer. The prompts in this section progress from structural recall to functional analysis and evaluative thinking.

Prompt 12: Eukaryotic Cell Ultrastructure

Copy this prompt into your AI tool:

Test me on eukaryotic cell ultrastructure. Give me a list of organelles including the nucleus, mitochondria, rough and smooth endoplasmic reticulum, Golgi apparatus, lysosomes, ribosomes, and chloroplasts. Ask me to describe the structure and function of each, and explain how they work together in protein secretion.

What this helps you practise:

Describing organelle structure and function and their cooperative roles

How to use it well:

Learn the protein secretion pathway as a sequence: ribosomes on RER, transport vesicles to Golgi, modification and packaging, secretory vesicles to cell surface membrane. This pathway is tested frequently.

Prompt 13: Prokaryotic versus Eukaryotic Cells

Copy this prompt into your AI tool:

Quiz me on the differences between prokaryotic and eukaryotic cells at A-Level Biology standard. Ask me to compare their structures in detail, including the presence or absence of membrane-bound organelles, ribosome size (70S versus 80S), DNA organisation (circular versus linear, with or without histones), cell wall composition, and reproduction methods. Give me specific scenarios and ask me to identify the cell type. After each answer, check my comparisons and correct any errors. Present one question at a time.

What this helps you practise:

Comparing prokaryotic and eukaryotic cell structure and function

How to use it well:

The difference in ribosome size (70S versus 80S) is a key reason some antibiotics work. This links cell biology to medical applications, which is a common exam context.

Prompt 14: Microscopy and Magnification

Copy this prompt into your AI tool:

Test me on microscopy and magnification at A-Level Biology standard. Ask me to compare light microscopes with transmission and scanning electron microscopes in terms of resolution,

magnification, and specimen preparation. Give me calculation problems using the formula magnification equals image size divided by actual size, and ask me to convert between units. After each answer, check my calculations and unit conversions. Present one question at a time and wait for my response.

What this helps you practise:

Comparing microscope types and performing magnification calculations

How to use it well:

Always show the formula, the substitution, and the rearrangement. When given a scale bar on a micrograph, measure it carefully and use it to calculate the actual size of the specimen.

Prompt 15: The Fluid Mosaic Model

Copy this prompt into your AI tool:

Give me an A-Level style question on the fluid mosaic model of membrane structure. Ask me to describe the arrangement of phospholipids, cholesterol, glycoproteins, glycolipids, and channel and carrier proteins. Then ask me to explain evidence for the model and why the membrane is described as 'fluid' and 'mosaic'.

What this helps you practise:

Describing the fluid mosaic model and explaining its key features

How to use it well:

Cholesterol regulates membrane fluidity at different temperatures. At high temperatures it reduces fluidity; at low temperatures it prevents the membrane from becoming too rigid. This nuance is expected at A-Level.

Prompt 16: Diffusion, Osmosis, and Active Transport

Copy this prompt into your AI tool:

Test me on transport across membranes. Ask me to define and compare diffusion, facilitated diffusion, osmosis, and active transport. For each, ask me to state whether it requires energy, the direction of movement relative to the concentration gradient, and the membrane components involved.

What this helps you practise:

Distinguishing between passive and active membrane transport mechanisms

How to use it well:

Draw a table comparing all four transport types. Include columns for energy requirement, direction, proteins involved, and examples. This visual comparison helps you recall distinctions in an exam.

Prompt 17: Water Potential Calculations

Copy this prompt into your AI tool:

Give me three water potential calculation problems. Ask me to calculate water potential from solute potential and pressure potential values, predict the direction of water movement between cells, and explain what happens to plant cells in solutions of different water potentials, including plasmolysis and turgor.

What this helps you practise:

Calculating water potential and predicting osmotic water movement

How to use it well:

Water always moves from higher (less negative) to lower (more negative) water potential. Practise until this direction is automatic, as confusing the direction is a very common error.

Prompt 18: Co-transport in the Ileum

Copy this prompt into your AI tool:

You are an A-Level examiner. Ask me to describe the absorption of glucose in the ileum, including the roles of sodium-potassium pumps, sodium-glucose co-transport proteins, and facilitated diffusion into the blood. Require me to explain how the sodium ion gradient drives glucose absorption against its concentration gradient.

What this helps you practise:

Explaining the co-transport mechanism for glucose absorption

How to use it well:

This is a multi-step process. Explain each step in order: sodium ions pumped out by active transport, creating a gradient; sodium ions flow back in through co-transport proteins, dragging glucose with them; glucose exits by facilitated diffusion.

Prompt 19: The Cell Cycle and Mitosis

Copy this prompt into your AI tool:

Quiz me on the cell cycle. Ask me to describe the stages of interphase (G1, S, G2) and the four stages of mitosis. For each mitotic stage, ask me to describe what happens to the chromosomes and identify the stage from a description or diagram. Then ask me about the significance of mitosis.

What this helps you practise:

Describing the stages of the cell cycle and mitosis in sequence

How to use it well:

Learn to identify each stage from a description: prophase (chromosomes condense, nuclear envelope breaks down), metaphase (chromosomes line up at equator), anaphase (centromeres split, chromatids pulled apart), telophase (nuclear envelopes reform).

Prompt 20: Meiosis and Genetic Variation

Copy this prompt into your AI tool:

Test me on meiosis. Ask me to explain the key events of meiosis I and meiosis II, including crossing over and independent assortment. Then ask me to compare meiosis with mitosis and explain how meiosis generates genetic variation through three specific mechanisms.

What this helps you practise:

Explaining how meiosis produces genetically varied haploid cells

How to use it well:

The three sources of variation in meiosis are: crossing over (prophase I), independent assortment (metaphase I), and random fusion of gametes at fertilisation. Be able to explain each mechanism clearly.

Prompt 21: Cancer and Cell Division Control

Copy this prompt into your AI tool:

Ask me to explain how the cell cycle is normally regulated by tumour suppressor genes and proto-oncogenes. Then ask me to describe how mutations in these genes can lead to uncontrolled cell division and cancer. Include a question about the role of p53 and the significance of multiple mutations.

What this helps you practise:

Explaining the genetic basis of cancer as a failure of cell cycle control

How to use it well:

Understand the two-hit hypothesis: usually multiple mutations are needed for cancer to develop. One mutation in a proto-oncogene creates an oncogene; another may disable a tumour suppressor. Explain both.

Prompt 22: Investigating Osmosis Practically

Copy this prompt into your AI tool:

Present me with an experimental scenario for investigating the effect of solute concentration on plant tissue mass. Ask me to describe the method, identify the variables, explain how to calculate percentage change in mass, sketch the expected graph, and identify the isotonic point.

What this helps you practise:

Designing and interpreting an osmosis investigation

How to use it well:

Use percentage change in mass, not absolute change, because this accounts for differences in the initial mass of each piece of tissue. This is a common source of marks lost if you use raw mass change instead.

Section 3

Exchange and Transport Systems

All organisms must exchange substances with their environment, and larger organisms require specialised exchange surfaces and transport systems to do this efficiently. At A-Level, you study gas exchange in detail across different organisms, the mammalian circulatory system, and mass transport in plants.

Gas exchange surfaces share common features: large surface area, thin diffusion distance, and a maintained concentration gradient. You must understand how these features are achieved in the lungs, gills, and insect tracheal systems, and be able to apply Fick's law to explain rates of diffusion.

The transport systems of mammals and plants are studied in considerable depth. You need to understand the structure and function of the heart, blood vessels, and blood, as well as the mechanisms of transpiration, translocation, and water uptake by roots. The prompts in this section build from structural knowledge to functional understanding and application.

Prompt 23: Gas Exchange in the Lungs

Copy this prompt into your AI tool:

Test me on gas exchange in the mammalian lungs. Ask me to describe the structure of the alveoli and explain how they are adapted for efficient gas exchange. Require me to reference surface area, diffusion distance, ventilation, and blood supply, and to apply Fick's law to explain the rate of diffusion.

What this helps you practise:

Explaining alveolar adaptations for gas exchange using Fick's law

How to use it well:

Fick's law states that rate of diffusion is proportional to surface area times concentration difference divided by diffusion distance. Link each factor to a specific adaptation of the alveoli.

Prompt 24: Ventilation Mechanism

Copy this prompt into your AI tool:

Quiz me on the ventilation mechanism in mammals. Ask me to describe the roles of the diaphragm, intercostal muscles, and pleural membranes during inspiration and expiration. Then ask me to explain how pressure changes drive air movement and distinguish between normal and forced breathing.

What this helps you practise:

Describing the mechanics of ventilation and pressure changes

How to use it well:

Use the sequence: muscles contract, thorax volume increases, intrapulmonary pressure decreases below atmospheric pressure, air flows in. The pressure change is the cause of airflow, not the result.

Prompt 25: Gas Exchange in Insects and Fish

Copy this prompt into your AI tool:

Give me an A-Level style comparative question. Ask me to describe gas exchange in insects (tracheal system) and fish (countercurrent flow over gills), and explain the specific adaptations of each system. Then ask me to explain why the countercurrent mechanism is more efficient than parallel flow.

What this helps you practise:

Comparing gas exchange adaptations across different organisms

How to use it well:

The countercurrent system maintains a concentration gradient along the entire length of the

gill lamella. Draw the parallel and countercurrent diagrams side by side to understand why countercurrent extracts more oxygen.

Prompt 26: Heart Structure and Cardiac Cycle

Copy this prompt into your AI tool:

Ask me to describe the structure of the mammalian heart, including all four chambers, valves, and major blood vessels. Then ask me to describe the cardiac cycle, explaining the pressure and volume changes in the atria and ventricles, and when each valve opens and closes.

What this helps you practise:

Describing heart structure and the pressure changes during the cardiac cycle

How to use it well:

Practise interpreting cardiac cycle graphs showing pressure in the left atrium, left ventricle, and aorta simultaneously. The points where lines cross indicate valve opening and closing.

Prompt 27: Blood Vessel Structure and Function

Copy this prompt into your AI tool:

Test me on the structure and function of arteries, arterioles, capillaries, and veins. Ask me to explain how the structure of each vessel relates to its function, and describe the formation of tissue fluid at the arterial end of a capillary bed and its reabsorption at the venous end.

What this helps you practise:

Linking blood vessel structure to function and explaining tissue fluid formation

How to use it well:

Tissue fluid formation depends on the balance between hydrostatic pressure (pushing fluid out) and

oncotic pressure (drawing fluid back in). Understand the Starling forces at both ends of the capillary bed.

Prompt 28: Haemoglobin and the Oxygen Dissociation Curve

Copy this prompt into your AI tool:

You are an A-Level examiner. Ask me to describe the structure of haemoglobin and explain the significance of its oxygen dissociation curve, including cooperative binding. Then ask me to explain the Bohr effect and how it ensures efficient oxygen delivery to respiring tissues.

What this helps you practise:

Interpreting oxygen dissociation curves and explaining the Bohr effect

How to use it well:

The sigmoid shape of the curve reflects cooperative binding: the first oxygen molecule is hard to bind, but each subsequent one binds more easily. The Bohr effect shifts the curve right in active tissues. Know both concepts.

Prompt 29: Comparing Haemoglobins

Copy this prompt into your AI tool:

Present me with oxygen dissociation curves for human adult haemoglobin, fetal haemoglobin, and myoglobin. Ask me to explain why fetal haemoglobin has a higher affinity for oxygen than adult haemoglobin, and why myoglobin's curve sits to the left of haemoglobin's.

What this helps you practise:

Comparing oxygen dissociation curves of different respiratory pigments

How to use it well:

A curve to the left means higher affinity. Fetal haemoglobin must pick up oxygen from maternal

blood at the placenta, so it needs higher affinity. This is a common extended response question.

Prompt 30: Water Transport in Plants

Copy this prompt into your AI tool:

Quiz me on water transport in plants. Ask me to describe how water moves from the soil into the root by the apoplast and symplast pathways, through the endodermis via the Casparian strip, and up the xylem by cohesion-tension theory. Require me to explain each driving force.

What this helps you practise:

Describing the pathway and mechanisms of water transport in plants

How to use it well:

The Casparian strip forces water through the symplast pathway, allowing selective ion uptake. This is a crucial detail that many students miss. Make sure you understand why the endodermis is important.

Prompt 31: Transpiration and Stomatal Control

Copy this prompt into your AI tool:

Ask me to explain the factors that affect transpiration rate and describe how stomata open and close. Give me a potometer experiment scenario and ask me to interpret the results, explaining how environmental conditions influenced the rate of water loss.

What this helps you practise:

Explaining transpiration, stomatal control, and potometer experiments

How to use it well:

A potometer measures water uptake, not water loss directly. Most water taken up is lost by transpiration, but this assumption should be stated. Examiners

credit students who show awareness of this distinction.

Prompt 32: Translocation in the Phloem

Copy this prompt into your AI tool:

Give me an A-Level style question on translocation. Ask me to describe the mass flow hypothesis for phloem transport, including the roles of companion cells, sieve tube elements, active loading of sucrose, and the pressure gradient from source to sink. Then ask me to evaluate the evidence for and against this model.

What this helps you practise:

Explaining the mass flow hypothesis and evaluating the evidence for it

How to use it well:

Evidence for the model includes the effect of metabolic inhibitors on loading and the positive pressure in sieve tubes. Evidence against includes bidirectional flow in the same sieve tube. A balanced evaluation scores highest.

Prompt 33: Exchange and Transport Synoptic Challenge

Copy this prompt into your AI tool:

Set me a challenge: give me a scenario involving exercise and ask me to explain the coordinated changes in the respiratory, circulatory, and muscular systems. Require me to link increased heart rate, ventilation rate, vasodilation, and oxygen delivery to the increased metabolic demands of muscle tissue.

What this helps you practise:

Integrating knowledge of exchange and transport systems in a physiological context

How to use it well:

Synoptic questions in this area test whether you can

connect systems. During exercise, link increased ventilation to more oxygen in blood, increased heart rate to faster delivery, and vasodilation to greater blood flow to muscles.

Section 4

Genetics and Gene Expression

Genetics at A-Level requires a detailed understanding of DNA replication, the genetic code, and the processes of transcription and translation by which genes are expressed as proteins. You must be able to describe these processes at the molecular level, including the roles of specific enzymes and RNA molecules.

Gene expression is not simply about turning genes on and off. At A-Level, you study the regulation of transcription by transcription factors, the role of epigenetics in modifying gene expression without changing the DNA sequence, and how these mechanisms contribute to cell differentiation and disease.

This section also covers mutations and their consequences, from point mutations affecting single proteins to larger chromosomal mutations. The prompts progress from describing the mechanics of DNA replication and protein synthesis to analysing how gene expression is controlled and what happens when it goes wrong.

Prompt 34: DNA Replication

Copy this prompt into your AI tool:

Test me on semi-conservative DNA replication. Ask me to describe the process step by step, naming the enzymes involved (DNA helicase, DNA polymerase, DNA ligase) and their specific roles. Then ask me to describe the Meselson-Stahl experiment and explain how it provided evidence for semi-conservative replication.

What this helps you practise:

Describing DNA replication and the evidence supporting the semi-conservative model

How to use it well:

The Meselson-Stahl experiment is a classic piece of evidence. Understand what each generation of DNA looked like in the centrifuge and why the results ruled out conservative and dispersive models.

Prompt 35: The Genetic Code

Copy this prompt into your AI tool:

Quiz me on the features of the genetic code. Ask me to explain what is meant by 'degenerate', 'non-overlapping', 'universal', and 'read in triplets'. Then give me a short mRNA sequence and ask me to use a codon table to determine the amino acid sequence.

What this helps you practise:

Describing the features of the genetic code and using codon tables

How to use it well:

The genetic code being degenerate means that most amino acids are coded by more than one codon. This provides some protection against the effects of point mutations. Make this link in your answers.

Prompt 36: Transcription

Copy this prompt into your AI tool:

Ask me to describe the process of transcription in detail. Require me to explain the role of RNA polymerase, the template and coding strands, the direction of synthesis, and how the pre-mRNA is processed (splicing of introns, addition of poly-A tail and 5' cap) to form mature mRNA in eukaryotes.

What this helps you practise:

Describing eukaryotic transcription and post-transcriptional modification

How to use it well:

The processing of pre-mRNA is a distinctly A-Level topic. Know that introns are removed by splicing and that this allows alternative splicing, where different combinations of exons produce different proteins from the same gene.

Prompt 37: Translation

Copy this prompt into your AI tool:

You are an A-Level examiner. Ask me to describe translation at the ribosome, including the roles of mRNA, tRNA, ribosomes, and peptide bonds. Require me to explain how the anticodon on tRNA base-pairs with the codon on mRNA, and describe elongation of the polypeptide chain.

What this helps you practise:

Describing the process of translation and the roles of molecular components

How to use it well:

Describe translation as a sequence: mRNA binds to ribosome, tRNA with correct anticodon brings amino acid, peptide bond forms, ribosome moves along one codon, process repeats. Each step should name the relevant molecules.

Prompt 38: Types of Mutation

Copy this prompt into your AI tool:

Test me on gene mutations. Ask me to define and give examples of substitution, insertion, and deletion mutations. For each type, ask me to explain the effect on the amino acid sequence, distinguishing between silent, missense, and nonsense mutations. Include the concept of frameshift.

What this helps you practise:

Classifying gene mutations and predicting their effects on protein structure

How to use it well:

Insertion and deletion cause frameshifts, which alter every codon downstream and usually produce a non-functional protein. Substitutions may be silent due to the degenerate code. Explain both scenarios.

Prompt 39: Sickle Cell Mutation

Copy this prompt into your AI tool:

Give me an A-Level style question about sickle cell anaemia. Ask me to describe the specific mutation (substitution in the beta-globin gene), explain how it changes the amino acid from glutamic acid to valine, how this affects protein structure and red blood cell shape, and why the sickle cell allele persists in malaria-endemic regions.

What this helps you practise:

Tracing the effects of a point mutation from DNA to phenotype

How to use it well:

This is a classic example of linking genotype to phenotype through multiple levels. Practise the complete chain: DNA change, mRNA codon change, amino acid change, protein shape change, cell shape change, symptoms.

Prompt 40: Gene Expression and Transcription Factors

Copy this prompt into your AI tool:

Ask me to explain how gene expression is regulated by transcription factors. Require me to describe how activators and repressors control the rate of transcription, and give examples of how this regulation allows cell differentiation from a single set of DNA.

What this helps you practise:

Explaining transcriptional regulation and its role in cell differentiation

How to use it well:

All cells in an organism contain the same DNA, but different cells express different genes. Transcription factors are the key to this differential gene expression. Make sure you can explain this concept clearly.

Prompt 41: Epigenetics

Copy this prompt into your AI tool:

Quiz me on epigenetics. Ask me to define epigenetic modification and describe two mechanisms: DNA methylation and histone modification. For each, ask me to explain how it affects gene expression without changing the base sequence, and discuss whether epigenetic changes can be inherited.

What this helps you practise:

Describing epigenetic mechanisms and their effects on gene expression

How to use it well:

DNA methylation silences genes by preventing transcription factor binding. Histone acetylation loosens chromatin structure, allowing transcription. These are the two mechanisms you must know for A-Level.

Prompt 42: Genome Projects and Bioinformatics

Copy this prompt into your AI tool:

Present me with questions about the Human Genome Project. Ask me to describe the methods used to sequence the genome, the key findings (such as the surprisingly small number of coding genes), and the applications of genomic data in medicine, including pharmacogenomics and personalised medicine.

What this helps you practise:

Describing genome sequencing methods and applications of genomic data

How to use it well:

Be prepared to discuss both the benefits and ethical concerns of genome projects. Exam questions often require you to evaluate the implications of knowing an individual's genetic makeup.

Prompt 43: Gene Technology and Genetic Engineering

Copy this prompt into your AI tool:

Ask me to describe the process of genetic engineering, including the use of restriction enzymes, ligase, vectors, and marker genes. Then ask me to explain a specific application (such as producing insulin in bacteria) and evaluate the ethical and practical issues involved.

What this helps you practise:

Describing genetic engineering techniques and evaluating their applications

How to use it well:

Know the steps in order: isolation of the gene, insertion into a vector, transformation of the host organism, selection of transformed cells. Each step uses specific enzymes or techniques that you must name.

Prompt 44: Genetics and Gene Expression Synoptic Problem

Copy this prompt into your AI tool:

Set me a challenge: give me a scenario involving a newly discovered protein linked to a disease. Ask me to explain how researchers could identify the gene, determine its DNA sequence, investigate how its expression is regulated, and develop a potential

gene therapy approach. Require me to draw on knowledge from across this section.

What this helps you practise:

Applying genetics knowledge to a novel research scenario

How to use it well:

This type of question tests whether you can apply techniques and concepts to new situations. Think about what each technique reveals and choose the most appropriate one for each part of the investigation.

Section 5

Inheritance, Selection, and Evolution

Inheritance at A-Level extends well beyond simple Mendelian ratios. You must be able to work with monohybrid and dihybrid crosses, codominance, multiple alleles, sex-linkage, epistasis, and autosomal linkage. The chi-squared test becomes an essential statistical tool for testing whether observed ratios match expected Mendelian ratios.

Natural selection and evolution are central themes that connect genetics to ecology and biodiversity. You need to understand how allele frequencies change in populations, the conditions for Hardy-Weinberg equilibrium, and how different types of selection lead to speciation over time.

The prompts in this section cover the full range of inheritance patterns, statistical analysis of genetic data, and the mechanisms of evolutionary change. They progress from performing genetic crosses and calculations to evaluating evidence for evolution and the significance of genetic diversity.

Prompt 45: Monohybrid Crosses

Copy this prompt into your AI tool:

Test me on monohybrid inheritance. Give me a genetics problem involving a dominant and recessive allele and ask me to construct a genetic diagram showing parental genotypes, gametes, a Punnett square, and the expected genotypic and phenotypic ratios of the offspring.

What this helps you practise:

Constructing and interpreting monohybrid genetic diagrams

How to use it well:

Always use a standardised layout: state the parents' phenotypes and genotypes, show the gametes, draw the Punnett square, and list the offspring ratios. This consistent format prevents errors and earns full method marks.

Prompt 46: Dihybrid Crosses

Copy this prompt into your AI tool:

Give me a dihybrid cross problem involving two unlinked genes. Ask me to determine the expected 9:3:3:1 ratio and draw the full genetic diagram. Then modify the problem to include one parent that is heterozygous for both genes crossed with a double homozygous recessive, and ask me to predict the offspring ratios.

What this helps you practise:

Performing dihybrid crosses and predicting offspring ratios

How to use it well:

The test cross (crossing with a homozygous recessive) reveals the genotype of the unknown parent. If the offspring show a 1:1:1:1 ratio, the parent was heterozygous for both genes.

Prompt 47: Codominance and Multiple Alleles

Copy this prompt into your AI tool:

Quiz me on codominance using the ABO blood group system. Ask me to explain the genetic basis of blood types A, B, AB, and O, construct crosses between parents of specified blood types, and predict the possible blood types of their offspring.

What this helps you practise:

Applying codominance and multiple alleles to blood group inheritance

How to use it well:

In the ABO system, IA and IB are codominant with

each other, and both are dominant over IO. Practise all possible parental combinations to ensure you can handle any exam question on this topic.

Prompt 48: Sex-Linked Inheritance

Copy this prompt into your AI tool:

Present me with a sex-linked inheritance problem such as haemophilia or red-green colour blindness. Ask me to construct a genetic diagram using X-linked notation, explain why males are more commonly affected, and predict the probability of affected offspring from a given cross.

What this helps you practise:

Constructing genetic diagrams for X-linked inheritance patterns

How to use it well:

Use the notation XH and Xh for the alleles on the X chromosome. Males have only one X, so one copy of the recessive allele is sufficient to cause the phenotype. Always show the Y chromosome in male genotypes.

Prompt 49: Epistasis

Copy this prompt into your AI tool:

Ask me to explain epistasis using a specific example. Give me offspring data that does not fit a standard 9:3:3:1 ratio and ask me to identify the modified ratio (such as 9:3:4 or 9:7) and explain which gene is epistatic to which. Then ask me to construct the crosses that would produce these ratios.

What this helps you practise:

Identifying and explaining epistatic gene interactions from offspring data

How to use it well:

Epistasis modifies the dihybrid ratio. A 9:3:4 ratio suggests recessive epistasis; a 9:7 ratio suggests

complementary gene interaction. Learn the common modified ratios and what each one means.

Prompt 50: The Chi-Squared Test

Copy this prompt into your AI tool:

You are an A-Level examiner. Give me observed offspring data from a genetic cross and an expected Mendelian ratio. Ask me to perform a chi-squared test, calculate the chi-squared value, compare it to the critical value at p = 0.05, and state whether the difference between observed and expected is significant.

What this helps you practise:

Performing and interpreting chi-squared tests on genetic data

How to use it well:

State the null hypothesis clearly before calculating. If your chi-squared value is less than the critical value, you accept the null hypothesis that there is no significant difference between observed and expected ratios.

Prompt 51: Hardy-Weinberg Principle

Copy this prompt into your AI tool:

Test me on the Hardy-Weinberg principle. Ask me to state the five conditions required for allele frequencies to remain constant, then give me data about the frequency of a recessive phenotype in a population and ask me to calculate allele frequencies, genotype frequencies, and the number of carriers.

What this helps you practise:

Applying the Hardy-Weinberg equations to calculate allele and genotype frequencies

How to use it well:

Start with the frequency of the recessive phenotype (q squared), take the square root to find q, then

calculate p. Use p squared, 2pq, and q squared to find all genotype frequencies. Show every step.

Prompt 52: Natural Selection and Types of Selection

Copy this prompt into your AI tool:

Quiz me on natural selection. Ask me to explain the mechanism of natural selection using Darwin's four observations and inferences. Then ask me to distinguish between stabilising, directional, and disruptive selection, giving an example of each and explaining the effect on allele frequency distribution.

What this helps you practise:

Explaining the mechanism and types of natural selection

How to use it well:

Draw the bell curve before and after selection for each type. Stabilising narrows the curve, directional shifts it, and disruptive creates two peaks. These diagrams are powerful exam revision tools.

Prompt 53: Speciation

Copy this prompt into your AI tool:

Ask me to define speciation and explain the difference between allopatric and sympatric speciation. Require me to describe the role of reproductive isolation mechanisms (geographic, temporal, behavioural) and explain how isolated populations diverge genetically over time to become separate species.

What this helps you practise:

Explaining allopatric and sympatric speciation mechanisms

How to use it well:

The sequence for allopatric speciation is: geographical isolation, different selection pressures, different mutations, genetic drift, reproductive

isolation, speciation. Practise writing this sequence with explanations at each step.

Prompt 54: Genetic Drift and the Founder Effect

Copy this prompt into your AI tool:

Give me an A-Level style question about genetic drift. Ask me to explain what genetic drift is, why it has a larger effect in small populations, and describe the founder effect and the bottleneck effect with examples. Then ask me to explain how drift can lead to fixation or loss of alleles.

What this helps you practise:

Explaining genetic drift, founder effect, and bottleneck effect

How to use it well:

Genetic drift is a random process, unlike natural selection which is non-random. In small populations, chance events can significantly alter allele frequencies regardless of whether alleles are beneficial or not.

Prompt 55: Evidence for Evolution

Copy this prompt into your AI tool:

Set me a challenge: ask me to evaluate the evidence for evolution from multiple sources, including the fossil record, comparative anatomy, molecular biology (DNA and protein sequence comparisons), and biogeography. For each source, ask me to explain what it shows and assess its strength as evidence.

What this helps you practise:

Evaluating multiple lines of evidence supporting the theory of evolution

How to use it well:

Molecular evidence is particularly strong because it is quantitative: the more similar the DNA sequences

of two species, the more recently they shared a common ancestor. Be able to explain how molecular clocks work.

Section 6

Energy Transfer and Ecosystems

Energy transfer in living systems is a unifying theme at A-Level. Photosynthesis and respiration are studied at the biochemical level, requiring you to understand the light-dependent and light-independent reactions of photosynthesis, and glycolysis, the link reaction, the Krebs cycle, and oxidative phosphorylation in respiration.

At the ecosystem level, you must understand how energy flows through trophic levels, why energy transfer between levels is inefficient, and how nutrient cycling maintains the availability of essential elements. Ecological concepts such as succession, productivity, and the factors that limit photosynthetic rate are also assessed.

The prompts in this section take you from the molecular details of ATP synthesis through to ecosystem-level energy budgets. The later prompts challenge you to link the biochemistry to ecological processes and evaluate human impacts on ecosystems.

Prompt 56: ATP: Structure and Role

Copy this prompt into your AI tool:

Test me on ATP. Ask me to describe the structure of ATP, explain how it is synthesised by ATP synthase through chemiosmosis, and describe its roles in the cell. Then ask me to explain why ATP is described as the universal energy currency and why cells cannot store large amounts of it.

What this helps you practise:

Describing ATP structure, synthesis, and its role as an energy currency

How to use it well:

ATP is an immediate energy source, not an energy store. Distinguish it from glucose (short-term store) and glycogen or fat (longer-term stores). Examiners test this distinction regularly.

Prompt 57: Photosynthesis: Light-Dependent Reactions

Copy this prompt into your AI tool:

Quiz me on the light-dependent reactions of photosynthesis. Ask me to describe what happens in photosystem II and photosystem I, the role of the electron transport chain, photolysis of water, and the production of ATP and NADPH. Require me to explain where these reactions occur.

What this helps you practise:

Describing the light-dependent reactions and their products

How to use it well:

The light-dependent reactions take place on the thylakoid membranes. Trace the path of electrons from water through PSII, the electron transport chain, PSI, and finally to NADP+. This electron flow is central to understanding the process.

Prompt 58: Photosynthesis: The Calvin Cycle

Copy this prompt into your AI tool:

Ask me to describe the Calvin cycle (light-independent reactions). Require me to name the key molecules (RuBP, GP, GALP), the enzyme rubisco, and explain how carbon dioxide is fixed, reduced using NADPH and ATP, and how RuBP is regenerated. Ask me where the Calvin cycle occurs.

What this helps you practise:

Describing the Calvin cycle and the role of each key molecule

How to use it well:

Remember that for every three molecules of CO2 fixed, one molecule of GALP leaves the cycle and five are used to regenerate RuBP. This stoichiometry is important for understanding the cycle's efficiency.

Prompt 59: Limiting Factors in Photosynthesis

Copy this prompt into your AI tool:

Give me an A-Level style question with graphs showing the effect of light intensity, carbon dioxide concentration, and temperature on the rate of photosynthesis. Ask me to explain the shape of each graph, identify the limiting factor at each point, and explain how growers use this knowledge in greenhouses.

What this helps you practise:

Interpreting limiting factor graphs for photosynthesis

How to use it well:

When a graph plateaus, another factor has become limiting. Practise identifying which factor is limiting at different points on multi-factor graphs. This is one of the most common A-Level Biology question types.

Prompt 60: Glycolysis and the Link Reaction

Copy this prompt into your AI tool:

Test me on the first stages of respiration. Ask me to describe glycolysis, including the inputs and outputs, where it occurs, and why it does not require oxygen. Then ask me to describe the link reaction, including the conversion of pyruvate to acetyl CoA and the production of CO2 and reduced NAD.

What this helps you practise:

Describing glycolysis and the link reaction with correct molecular detail

How to use it well:

Glycolysis occurs in the cytoplasm and produces a

net gain of 2 ATP and 2 reduced NAD per glucose. The link reaction occurs in the mitochondrial matrix. Know the locations, inputs, and outputs precisely.

Prompt 61: The Krebs Cycle

Copy this prompt into your AI tool:

You are an A-Level examiner. Ask me to describe the Krebs cycle, naming the key molecules and stating the products per turn. Then ask me to explain why the cycle must turn twice for each glucose molecule, and calculate the total yield of reduced NAD, reduced FAD, and ATP from both turns.

What this helps you practise:

Describing the Krebs cycle and calculating its products per glucose molecule

How to use it well:

Per glucose molecule, the Krebs cycle produces 6 NADH, 2 FADH2, and 2 ATP (via GTP). Be confident with these numbers and know that they represent two turns of the cycle because each glucose yields two acetyl CoA.

Prompt 62: Oxidative Phosphorylation and Chemiosmosis

Copy this prompt into your AI tool:

Ask me to describe oxidative phosphorylation, including the electron transport chain on the inner mitochondrial membrane, the role of oxygen as the final electron acceptor, the pumping of protons to create a gradient, and the synthesis of ATP by ATP synthase via chemiosmosis.

What this helps you practise:

Explaining the electron transport chain and chemiosmotic ATP synthesis

How to use it well:

The proton gradient across the inner mitochondrial membrane drives ATP synthesis. This is the same

principle as in the thylakoid membrane during photosynthesis. Making this comparison demonstrates synoptic understanding.

Prompt 63: Anaerobic Respiration

Copy this prompt into your AI tool:

Quiz me on anaerobic respiration. Ask me to compare alcoholic fermentation in yeast with lactate fermentation in mammals. For each, ask me to write the pathway from pyruvate, explain why NAD must be regenerated, and calculate the ATP yield compared to aerobic respiration.

What this helps you practise:

Comparing anaerobic pathways and explaining why NAD regeneration is essential

How to use it well:

NAD must be regenerated so that glycolysis can continue. Without it, glycolysis stops and no ATP can be produced at all. This is the fundamental reason why anaerobic pathways exist.

Prompt 64: Energy Flow Through Ecosystems

Copy this prompt into your AI tool:

Give me an A-Level style question about energy flow. Ask me to calculate net primary productivity from gross primary productivity and respiration, explain why only about 10% of energy is transferred between trophic levels, and describe how energy transfer can be measured in a given ecosystem.

What this helps you practise:

Calculating productivity and explaining inefficient energy transfer between trophic levels

How to use it well:

The key equation is NPP = GPP - R. Energy is lost between trophic levels through respiration, excretion, and uneaten material. Be specific about which losses occur and their relative importance.

Prompt 65: Nutrient Cycling

Copy this prompt into your AI tool:

Test me on the carbon and nitrogen cycles. Ask me to describe the key processes in each cycle, name the organisms involved, and explain how human activities are disrupting both cycles. Include specific questions about nitrogen fixation, nitrification, denitrification, and the role of decomposers.

What this helps you practise:

Describing nutrient cycling processes and the organisms involved

How to use it well:

Learn the nitrogen cycle as a sequence of conversions: N2 to NH4+ (fixation), NH4+ to NO2- to NO3- (nitrification), NO3- back to N2 (denitrification). Name the bacteria responsible for each step.

Prompt 66: Ecological Succession

Copy this prompt into your AI tool:

Present me with a scenario describing primary or secondary succession and ask me to describe the stages of succession, explain how pioneer species modify the environment to allow later species to colonise, and distinguish between the intermediate stages and the climax community. Ask me to evaluate the concept of a climax community.

What this helps you practise:

Describing the stages of ecological succession and evaluating climax community concepts

How to use it well:

Succession involves changes in both the abiotic environment and the species community. Each stage modifies the environment (adding soil, nutrients, shade) which enables the next stage. This causal chain is what examiners look for.

Section 7

Organisms and Their Environment

Ecology at A-Level requires you to understand population dynamics, species interactions, and the factors that influence biodiversity. You must be able to describe how populations grow, fluctuate, and interact through competition and predation, and understand the ecological principles that underpin conservation strategies.

Biodiversity is a major topic, encompassing species richness, genetic diversity within species, and ecosystem diversity across landscapes. You need to understand how biodiversity is measured, why it matters, and what threatens it. Classification and taxonomy provide the framework for organising and understanding biodiversity.

The prompts in this section cover population ecology, species interactions, biodiversity measurement, conservation, and classification. They progress from describing ecological concepts to evaluating conservation strategies and discussing the ethical dimensions of environmental management.

Prompt 67: Population Growth and Carrying Capacity

Copy this prompt into your AI tool:

Test me on population ecology. Ask me to describe and sketch sigmoid (logistic) and exponential growth curves, explain the phases of population growth, and define carrying capacity. Then ask me to explain the factors that determine carrying capacity and how density-dependent and density-independent factors affect population size.

What this helps you practise:

Describing population growth curves and the concept of carrying capacity

How to use it well:

The sigmoid curve has four phases: lag, log (exponential), deceleration, and stationary. Know what is happening to birth rate and death rate in each phase and why the curve levels off at carrying capacity.

Prompt 68: Sampling Techniques

Copy this prompt into your AI tool:

Quiz me on ecological sampling methods. Ask me to describe how to use quadrats and transects to estimate population size and distribution. Then ask me to explain the mark-release-recapture method, including the Lincoln index calculation, and state the assumptions that must be met for the estimate to be valid.

What this helps you practise:

Describing sampling methods and performing mark-release-recapture calculations

How to use it well:

The assumptions of mark-release-recapture are critical: no immigration/emigration, no births/deaths, marks do not affect survival, marked individuals mix randomly. If any assumption is violated, explain which way the estimate would be biased.

Prompt 69: Interspecific and Intraspecific Competition

Copy this prompt into your AI tool:

Ask me to define and compare interspecific and intraspecific competition. Give me examples of each and ask me to explain how each type of competition affects population size and species distribution. Then ask me about the competitive exclusion principle

and how niche differentiation allows species to coexist.

What this helps you practise:

Distinguishing types of competition and explaining competitive exclusion

How to use it well:

Intraspecific competition is density-dependent and regulates population size. Interspecific competition can lead to competitive exclusion or niche partitioning. Be clear about the different outcomes of each type.

Prompt 70: Predator-Prey Relationships

Copy this prompt into your AI tool:

Give me an A-Level style question with predator-prey population data presented as a graph. Ask me to describe the cyclical relationship, explain the time lag between predator and prey population changes, and suggest factors other than predation that might influence the observed patterns.

What this helps you practise:

Interpreting predator-prey population cycles and explaining time-lag effects

How to use it well:

The prey population peaks before the predator population because it takes time for the increased food supply to result in increased predator numbers. Practise describing this cause-and-effect relationship precisely.

Prompt 71: Biodiversity and Species Richness

Copy this prompt into your AI tool:

Test me on biodiversity. Ask me to define biodiversity at three levels (genetic, species, ecosystem), explain the difference between species richness and species evenness, and describe how to

calculate Simpson's Index of Diversity. Give me data and ask me to calculate the index.

What this helps you practise:

Defining biodiversity levels and calculating Simpson's Index of Diversity

How to use it well:

Simpson's Index ranges from 0 to 1, where values closer to 1 indicate greater diversity. Practise the calculation with real data and ensure you can interpret what the resulting value means in ecological terms.

Prompt 72: Measuring Genetic Diversity

Copy this prompt into your AI tool:

Ask me to explain what genetic diversity is and why it is important for the survival of a species. Then ask me to describe methods for measuring genetic diversity, including the proportion of polymorphic gene loci and the use of DNA sequencing. Include a question about how bottleneck events reduce genetic diversity.

What this helps you practise:

Explaining the importance and measurement of genetic diversity

How to use it well:

Low genetic diversity means a population is less able to adapt to environmental change. Link this to specific examples such as cheetah populations or crop monocultures to make your answers concrete.

Prompt 73: Classification and Taxonomy

Copy this prompt into your AI tool:

Quiz me on the taxonomic hierarchy. Ask me to list the taxonomic ranks from domain to species and explain the three-domain system (Bacteria, Archaea, Eukarya). Then ask me to explain the difference

between phylogenetic and phenotypic classification and why molecular phylogenetics is now preferred.

What this helps you practise:

Describing taxonomic classification systems and modern phylogenetic methods

How to use it well:

The shift from morphological to molecular classification is an important development. Molecular evidence can reveal relationships that morphology misses, such as convergent evolution producing similar features in unrelated species.

Prompt 74: Conservation Strategies

Copy this prompt into your AI tool:

Quiz me on conservation strategies at A-Level Biology standard. Ask me to explain and evaluate different conservation methods including in-situ strategies such as nature reserves and wildlife corridors, and ex-situ strategies such as seed banks, captive breeding programmes, and zoos. Test whether I can discuss the advantages and limitations of each approach and explain the role of international agreements such as CITES. After each answer, check my depth of evaluation. Present one question at a time.

What this helps you practise:

Evaluating the effectiveness of different conservation strategies

How to use it well:

Examiners want balanced evaluation. For each strategy, discuss what it achieves and what its limitations are. Captive breeding maintains genetic diversity but is expensive and may not address habitat loss.

Prompt 75: Human Impact on Biodiversity

Copy this prompt into your AI tool:

Ask me to describe the main threats to biodiversity: habitat destruction, climate change, overexploitation, pollution, and invasive species. For each threat, ask me to explain the mechanism by which it reduces biodiversity and give a specific example. Then ask me to evaluate which threat is most significant globally.

What this helps you practise:

Explaining and evaluating the major threats to global biodiversity

How to use it well:

Habitat destruction is generally considered the greatest threat to biodiversity. But in an evaluative question, you must consider multiple perspectives and evidence before reaching a justified conclusion.

Prompt 76: Sustainability and Agriculture

Copy this prompt into your AI tool:

Test me on sustainability and agriculture at A-Level Biology standard. Ask me to explain how modern agricultural practices can be managed sustainably, covering topics such as crop rotation, biological pest control versus chemical pesticides, the environmental impact of fertilisers on aquatic ecosystems through eutrophication, and the role of hedgerows and field margins. After each answer, check whether I link ecological principles to practical farming decisions. Present one question at a time.

What this helps you practise:

Evaluating the ecological impact of agriculture and sustainable alternatives

How to use it well:

Sustainability questions require you to balance food production needs against environmental costs. A good answer acknowledges the genuine need to feed

people while proposing realistic strategies to reduce environmental harm.

Prompt 77: Ecology Fieldwork Design

Copy this prompt into your AI tool:

Set me a challenge: describe an ecological investigation and ask me to design a sampling strategy. I must choose appropriate sampling methods, explain how to control variables, calculate the sample size needed, and describe how to present and analyse the data using appropriate statistical tests.

What this helps you practise:

Designing rigorous ecological field investigations

How to use it well:

Random sampling requires using random number tables or coordinates. Systematic sampling uses transects at regular intervals. Know when each is appropriate and how to justify your choice for the specific investigation.

Section 8

Control and Communication

Organisms must detect and respond to changes in their internal and external environments to survive. At A-Level, you study the nervous and hormonal systems in detail, including the structure and function of neurones, synaptic transmission, hormonal signalling, and the homeostatic mechanisms that maintain a stable internal environment.

Homeostasis is a central concept, and you must understand how negative feedback loops maintain conditions such as blood glucose concentration, body temperature, and water potential within narrow limits. The kidney is studied as a detailed example of a homeostatic organ, and you need to understand ultrafiltration, selective reabsorption, and the role of ADH.

The prompts in this section cover the full range of control and communication topics, from the molecular events at a synapse to the whole-organism coordination of physiological responses. The later prompts challenge you to link nervous and hormonal systems and evaluate how disruptions to these systems cause disease.

Prompt 78: Neurone Structure and Function

Copy this prompt into your AI tool:

Test me on neurone structure. Ask me to draw and label a motor neurone, describe the function of each part (cell body, dendrites, axon, myelin sheath, nodes of Ranvier, axon terminal), and explain how myelination increases the speed of nerve impulse transmission via saltatory conduction.

What this helps you practise:

Describing motor neurone structure and the mechanism of saltatory conduction

How to use it well:

Saltatory conduction means the action potential jumps between nodes of Ranvier, which is much faster than continuous conduction along an unmyelinated axon. Explain this mechanism, not just that myelination speeds up transmission.

Prompt 79: The Resting Potential and Action Potential

Copy this prompt into your AI tool:

Quiz me on the resting potential and action potential. Ask me to explain how the resting potential is maintained by the sodium-potassium pump, and describe the sequence of events during an action potential, including depolarisation, repolarisation, and the refractory period. Require me to link these events to specific ion channel behaviour.

What this helps you practise:

Explaining the ionic basis of resting and action potentials

How to use it well:

Trace the sequence: sodium channels open, Na+ rushes in (depolarisation), sodium channels close, potassium channels open, K+ rushes out (repolarisation). The refractory period ensures one-way transmission. Know every step.

Prompt 80: Synaptic Transmission

Copy this prompt into your AI tool:

Give me an A-Level style question on synaptic transmission. Ask me to describe the events at a cholinergic synapse in sequence, from the arrival of an action potential at the presynaptic membrane to

the generation of a new action potential in the postsynaptic neurone. Ask me to name the neurotransmitter and the enzyme that breaks it down.

What this helps you practise:

Describing the sequence of events during cholinergic synaptic transmission

How to use it well:

The sequence is: action potential arrives, calcium ions enter, vesicles fuse with presynaptic membrane, acetylcholine released into cleft, binds to receptors, sodium channels open, new action potential generated, acetylcholinesterase breaks down ACh.

Prompt 81: Summation and the Role of Synapses

Copy this prompt into your AI tool:

Ask me to explain spatial and temporal summation at synapses, and describe the roles of excitatory and inhibitory postsynaptic potentials. Then ask me to discuss the wider significance of synapses, including their role in ensuring one-way transmission, integration, and as targets for drugs.

What this helps you practise:

Explaining synaptic summation and the functional significance of synapses

How to use it well:

Spatial summation involves multiple presynaptic neurones converging on one postsynaptic neurone. Temporal summation involves repeated stimulation from one presynaptic neurone. Both mechanisms determine whether the threshold is reached.

Prompt 82: The Reflex Arc

Copy this prompt into your AI tool:

Test me on the reflex arc. Ask me to name and describe the function of each component: receptor,

sensory neurone, relay neurone, motor neurone, and effector. Then ask me to explain the biological advantage of reflex actions being rapid, involuntary, and protective.

What this helps you practise:

Describing the reflex arc and explaining the adaptive value of reflexes

How to use it well:

Reflexes are rapid because they involve few synapses and do not require conscious processing. Always link the structural simplicity (short pathway, few synapses) to the functional advantage (speed of response).

Prompt 83: Hormonal Communication

Copy this prompt into your AI tool:

Ask me to compare nervous and hormonal communication in terms of speed, duration, specificity, and mode of transmission. Then ask me to describe a specific hormonal pathway, such as the control of blood glucose by insulin and glucagon, including the target cells and their responses.

What this helps you practise:

Comparing nervous and hormonal communication and describing hormonal pathways

How to use it well:

Create a comparison table with rows for speed, duration, specificity, and transmission method. This direct comparison is a favourite A-Level question format and the table format ensures you cover all the key differences.

Prompt 84: Blood Glucose Regulation

Copy this prompt into your AI tool:

You are an A-Level examiner. Ask me to describe how blood glucose concentration is regulated by negative feedback, including the roles of the

pancreas, insulin, glucagon, glycogenesis, glycogenolysis, and gluconeogenesis. Then give me a graph of blood glucose after a meal and ask me to explain the changes.

What this helps you practise:

Explaining blood glucose homeostasis through negative feedback mechanisms

How to use it well:

Know the difference between glycogenesis (glucose to glycogen), glycogenolysis (glycogen to glucose), and gluconeogenesis (non-carbohydrate sources to glucose). Using the correct terminology demonstrates A-Level understanding.

Prompt 85: Kidney Structure and Ultrafiltration

Copy this prompt into your AI tool:

Quiz me on kidney structure and function. Ask me to describe the structure of a nephron and explain ultrafiltration in the Bowman's capsule, including the roles of blood pressure, the basement membrane, and the podocytes. Then ask me what is present in the filtrate and what is retained in the blood.

What this helps you practise:

Describing nephron structure and the ultrafiltration process

How to use it well:

The basement membrane acts as a molecular filter: small molecules (water, glucose, urea, ions) pass through, while large molecules (proteins, blood cells) are retained. Be precise about what passes through and what does not.

Prompt 86: Selective Reabsorption and the Loop of Henle

Copy this prompt into your AI tool:

Ask me to describe selective reabsorption in the proximal convoluted tubule and the role of the loop of Henle in creating a concentration gradient in the medulla. Require me to explain the countercurrent multiplier mechanism and how it enables the production of concentrated urine.

What this helps you practise:

Explaining selective reabsorption and the countercurrent multiplier in the kidney

How to use it well:

The descending limb is permeable to water but not ions. The ascending limb actively pumps out ions but is impermeable to water. This creates an increasing osmotic gradient in the medulla. Trace the fluid through each section.

Prompt 87: Osmoregulation and ADH

Copy this prompt into your AI tool:

Test me on osmoregulation. Ask me to describe how the water potential of the blood is detected by osmoreceptors in the hypothalamus, how ADH release from the posterior pituitary is controlled by negative feedback, and how ADH increases the permeability of the collecting duct to water.

What this helps you practise:

Describing the role of ADH in osmoregulation through negative feedback

How to use it well:

When blood water potential is low, more ADH is released, more aquaporins are inserted into the collecting duct, more water is reabsorbed, and concentrated urine is produced. Trace this complete pathway.

Prompt 88: Muscle Contraction and the Sliding Filament Theory

Copy this prompt into your AI tool:

Give me an A-Level style question on muscle contraction. Ask me to describe the sliding filament theory, including the roles of actin, myosin, tropomyosin, troponin, calcium ions, and ATP. Then ask me to explain how a nerve impulse triggers contraction, including the role of the neuromuscular junction and the sarcoplasmic reticulum.

What this helps you practise:

Describing the sliding filament mechanism and excitation-contraction coupling

How to use it well:

The sequence is: calcium ions bind to troponin, tropomyosin moves to expose binding sites on actin, myosin heads attach and undergo power stroke, ATP breaks the cross-bridge, cycle repeats. Practise this cycle until it flows naturally.

Prompt 89: Control Systems Evaluation

Copy this prompt into your AI tool:

Set me a challenge: ask me to evaluate the importance of homeostasis for organisms, using examples from thermoregulation, osmoregulation, and blood glucose control. Require me to explain what happens when homeostatic mechanisms fail, referencing conditions such as diabetes, hypothermia, or kidney failure.

What this helps you practise:

Evaluating the biological importance of homeostasis with pathological examples

How to use it well:

Link the failure of each homeostatic mechanism to specific symptoms and consequences. For diabetes, explain how a lack of insulin leads to high blood glucose, glucose in urine, and the long-term complications of uncontrolled blood sugar.

Section 9

Practical Skills and Synoptic Biology

Practical biology is assessed both through the practical endorsement and through questions on exam papers that test your understanding of experimental methods. You must be familiar with the required practicals for your specification and be able to design investigations, process data, and evaluate methods and results.

Statistical tests are an essential part of A-Level Biology. You need to know when and how to use the chi-squared test, the Student's t-test, the Spearman rank correlation coefficient, and the Mann-Whitney U test. Understanding which test to use and being able to interpret the results is vital for both coursework and exam questions.

Synoptic questions draw together ideas from across the entire specification and are a defining feature of A-Level Biology papers. The prompts in this section prepare you for the full range of practical and synoptic challenges, from designing experiments and selecting statistical tests to writing extended essays that demonstrate deep, interconnected understanding.

Prompt 90: Required Practical: Microscopy

Copy this prompt into your AI tool:

Test me on using a light microscope. Ask me to describe how to prepare a temporary mount of a specimen, how to use the microscope to view cells at different magnifications, and how to produce a calibrated drawing with scale bar. Then ask me to calculate actual cell size from a micrograph measurement.

What this helps you practise:

Describing microscopy techniques and calculating actual specimen sizes

How to use it well:

Biological drawings should have clear, continuous lines with no shading. Labels should be written horizontally with straight label lines that do not cross. These conventions are assessed in the practical endorsement.

Prompt 91: Required Practical: Enzyme Investigation

Copy this prompt into your AI tool:

Give me an A-Level style practical question about investigating the effect of a factor on enzyme activity. Ask me to describe the method, identify the independent, dependent, and controlled variables, explain how I would make my results reliable, and predict the expected results.

What this helps you practise:

Designing controlled experiments to investigate enzyme activity

How to use it well:

Controlled variables are crucial. If you are investigating temperature, you must control pH, enzyme concentration, substrate concentration, and volume. State how you would control each one for full marks.

Prompt 92: Required Practical: Chromatography

Copy this prompt into your AI tool:

Ask me to describe how to separate plant pigments using thin-layer chromatography. Require me to explain the method, calculate Rf values from results, and identify pigments by comparing Rf values to a

reference table. Then ask me to explain the principles behind chromatographic separation.

What this helps you practise:

Performing chromatography and calculating Rf values

How to use it well:

Rf = distance moved by pigment divided by distance moved by solvent front. Always measure from the origin (pencil line) to the centre of each spot. Practise calculating and interpreting these values.

Prompt 93: Selecting Statistical Tests

Copy this prompt into your AI tool:

Quiz me on choosing the correct statistical test. Give me four different experimental scenarios and ask me to select the appropriate test (chi-squared, Student's t-test, Spearman's rank correlation, or Mann-Whitney U). For each, ask me to justify my choice based on the type of data and the hypothesis being tested.

What this helps you practise:

Selecting and justifying appropriate statistical tests for biological data

How to use it well:

Chi-squared tests whether observed data fits expected ratios. Student's t-test compares means of two groups. Spearman's tests for correlation. Mann-Whitney U compares medians of two groups. Learn which data type and hypothesis suits each test.

Prompt 94: Performing the Student's t-Test

Copy this prompt into your AI tool:

Give me two datasets from a biological investigation and ask me to perform a Student's t-test. Require me to state the null hypothesis, calculate the t-value step by step, compare it to the critical value at p =

0.05, and state whether to accept or reject the null hypothesis.

What this helps you practise:

Performing the Student's t-test and interpreting the results

How to use it well:

State the null hypothesis before calculating: 'There is no significant difference between the means of the two groups.' If your calculated t-value exceeds the critical value, reject the null hypothesis.

Prompt 95: Experimental Design Principles

Copy this prompt into your AI tool:

You are an A-Level examiner. Present me with a research question and ask me to design a complete experiment. I must state the hypothesis, identify all variables, describe the method, explain how to make results reliable and valid, suggest appropriate sample sizes, and describe how I would analyse the data.

What this helps you practise:

Designing rigorous biological experiments from a research question

How to use it well:

A well-designed experiment addresses validity (does it test what it claims to?), reliability (are results reproducible?), and precision (how close are repeated measurements?). Address all three in your experimental designs.

Prompt 96: Error Analysis and Evaluation

Copy this prompt into your AI tool:

Ask me to evaluate a described experimental procedure. Give me a method with several sources of error and ask me to identify random and systematic errors, explain how they affect the

results, and suggest specific improvements to reduce each error.

What this helps you practise:

Identifying and evaluating sources of experimental error

How to use it well:

Random errors affect precision and can be reduced by repeating. Systematic errors affect accuracy and cannot be reduced by repeating, only by changing the method. Know the difference and give specific examples.

Prompt 97: Data Presentation and Interpretation

Copy this prompt into your AI tool:

Present me with raw biological data and ask me to choose the most appropriate graph type, explain why I chose it, and describe what the graph shows. Include scenarios where a bar chart, line graph, scatter plot, or histogram would be most appropriate.

What this helps you practise:

Selecting appropriate data presentation methods and interpreting biological graphs

How to use it well:

Line graphs are for continuous data, bar charts for categoric data, histograms for continuous frequency data, and scatter plots for correlation. Always label axes with units and give the graph an informative title.

Prompt 98: Ethical Considerations in Biology

Copy this prompt into your AI tool:

Ask me to discuss the ethical considerations involved in three different biological scenarios: animal testing, genetic screening, and conservation triage (deciding which species to save with limited

resources). For each, ask me to present arguments for and against and give a reasoned conclusion.

What this helps you practise:

Evaluating ethical issues in biological research and application

How to use it well:

Ethics questions require balanced discussion. Never present only one side. State the argument, the counterargument, and a conclusion that acknowledges the complexity. This mirrors the approach expected in extended response questions.

Prompt 99: Synoptic Essay: Cycles in Biology

Copy this prompt into your AI tool:

Set me a challenge: give me the A-Level essay title 'The importance of cycles in biology' and ask me to plan and write an essay that covers examples from at least five different areas of the specification. Examples might include the cell cycle, the cardiac cycle, nutrient cycles, the Calvin cycle, and the Krebs cycle.

What this helps you practise:

Planning and writing synoptic essays that link diverse biological topics

How to use it well:

Synoptic essays are marked on the range of biological content and the quality of the links you make. Plan before writing: list five to six examples, write one focused paragraph per example, and ensure each paragraph makes a clear biological point.

Prompt 100: Synoptic: Linking Molecules to Whole Organisms

Copy this prompt into your AI tool:

Give me an A-Level style synoptic question that requires me to trace a biological process from the

molecular level to the whole organism level. For example, ask me to explain how a change in one gene can lead to a change in an organism's phenotype, behaviour, and evolutionary fitness, linking genetics, biochemistry, physiology, and ecology.

What this helps you practise:

Connecting molecular, cellular, organismal, and ecological levels in extended reasoning

How to use it well:

The best synoptic answers show a chain of reasoning from one level to the next: gene to protein to cell function to tissue to organ to organism to population. Practise building these chains for different biological examples.

Final Closing Note

You have now worked through 100 prompts designed to help you think more clearly, revise more effectively, and prepare more confidently for your GCSE.

Remember: the goal was never to rely on AI for answers. The goal was to use it as a tool to test, challenge, and strengthen your own understanding.

The strongest students are not those who avoid difficulty, but those who engage with it deliberately. Each mistake you identified, each explanation you improved, and each gap you filled has strengthened your thinking.

As you continue your studies, aim to depend less on prompts and more on your own judgement. AI can support you — but your reasoning, clarity, and persistence are what earn marks.
Approach your exams calmly. Think carefully. Write clearly.
You are more prepared than you think.

Using AI Beyond This Book

The prompts in this book are starting points, not final forms.

As you grow more confident, begin modifying them:

- Add constraints (for example, “limit to three key points”).
- Increase difficulty gradually.
- Ask the AI to challenge your reasoning.
- Request alternative explanations.
- Ask it to critique your thinking rather than provide answers.

The most powerful use of AI is not asking it to tell you things — it is asking it to test and refine your thinking.

In the future, those who understand how to use tools intelligently will have an advantage. Treat AI as a tutor, not a shortcut. The skill of asking better questions will continue to matter long after your exams are over.

About the Author

James R. Martin holds an MSci in Physics from the University of Bristol and a PGCE with a Physics focus from the University of Oxford. He has over a decade of experience teaching and tutoring students aged 11–18 across a range of subjects, including Physics, Biology, Chemistry, Mathematics, Economics, and Electronics.

He has worked with multiple syllabi, including GCSE, A-Level, KS3, and the International Baccalaureate Diploma Programme (IBDP), supporting students of varying abilities to develop clarity, confidence, and exam success.

His work focuses on effective revision strategies, independent thinking, and the responsible use of artificial intelligence as a tool to strengthen — not replace — understanding.

Other Titles in This Series

The *100 AI Prompts for Smarter Revision* series supports students across GCSE, A-Level, and IBDP subjects.

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