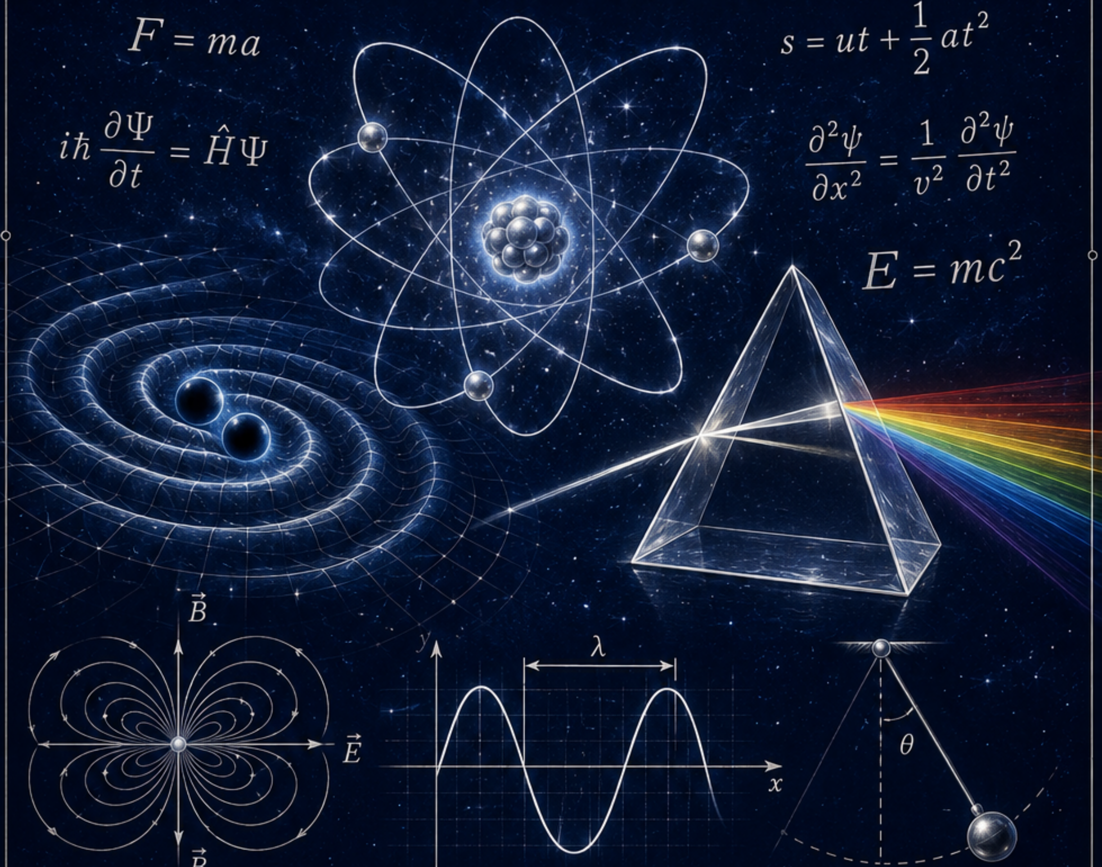
A-LEVEL PHYSICS
100 AI PROMPTS

for Smarter Revision *and* Exam Prep

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



by James R. Martin

This book is an independent educational resource and is not affiliated with, endorsed by, or approved by any examination board or awarding organisation.

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.

ISBN: [TO BE ASSIGNED]

First published 2026

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 for A-Level Physics students studying with AQA, Edexcel, OCR A, OCR B (Advancing Physics), or WJEC/Eduqas. The prompts cover core content that appears across all specifications, ensuring thorough preparation for your final examinations regardless of your exam board.

The core physics topics — mechanics, electricity, waves, materials, fields, and nuclear physics — are covered by all exam boards, though the depth and sequencing may vary. For example, AQA introduces circular motion and simple harmonic motion in the second year, while some boards teach these earlier. The prompts in this book are organised thematically rather than by teaching order, allowing you to use them whenever your course reaches each topic.

Optional topics present the greatest variation between boards. Section 8 of this book covers astrophysics and cosmology, which is the most commonly chosen option across AQA, Edexcel, and OCR. If your specification offers a different option such as medical physics, engineering physics, or turning points in physics, you can still use the prompts in Section 8 for breadth and use the remaining sections for your core revision.

Practical skills and mathematical techniques are examined by all boards, whether through separate practical endorsement or within written papers. The prompts throughout this book integrate these skills naturally, and Section 9 is dedicated to the mathematical and synoptic problem-solving skills that all specifications demand at A-Level.

To make the best use of this book, check your specification to identify which topics are assessed and in which papers. Work through every relevant section, and where a prompt covers content outside your specification, simply move past it. The vast majority of prompts will be directly applicable to your course.

Contents

Section 1

Measurements, Units, and Experimental Physics

Accurate measurement, correct use of SI units, and a thorough understanding of experimental uncertainty are foundational skills that underpin every area of A-Level Physics. Examiners expect you to handle significant figures, estimate uncertainties, and evaluate experimental procedures with confidence.

At A-Level, you must go beyond simply recording results. You need to understand systematic and random errors, calculate percentage uncertainties, combine uncertainties in derived quantities, and assess the quality of experimental conclusions. These skills are tested in both practical endorsement and written papers.

The prompts in this section build from basic unit analysis through to the critical evaluation of experimental methods. Developing strong practical skills early in your course will benefit every other topic you study.

Prompt 1: SI Base Units and Derived Units

Copy this prompt into your AI tool:

Test me on SI base units and derived units. Give me a series of physical quantities and ask me to express their units in terms of SI base units. Include quantities such as force, pressure, energy, power, and electric potential. Check my derivations step by step.

What this helps you practise:

Expressing derived SI units in terms of base units for key physical quantities

How to use it well:

Start from the defining equation of each quantity and substitute base units systematically; this approach works for any quantity, even unfamiliar ones.

Prompt 2: Homogeneity of Equations

Copy this prompt into your AI tool:

Give me five physics equations and ask me to check whether each is homogeneous by analysing the units on both sides. Include at least one equation that is not homogeneous. Ask me to explain what homogeneity tells us and what it does not tell us about an equation.

What this helps you practise:

Checking equations for dimensional homogeneity and understanding its limitations

How to use it well:

A homogeneous equation may still be wrong if a dimensionless constant is incorrect; homogeneity is a necessary but not sufficient condition for correctness.

Prompt 3: Significant Figures and Standard Form

Copy this prompt into your AI tool:

Test me on significant figures and standard form at A-Level Physics standard. Give me measured values and ask me to express them in standard form to a specified number of significant figures. Include calculations where I must determine the appropriate number of significant figures in my answer based on the input data. Ask me to explain the rules for significant figures in addition, subtraction, multiplication, and division. Present one question at a time and give feedback after each answer.

What this helps you practise:
Applying significant figure conventions correctly in multi-step calculations
How to use it well:
In multi-step calculations, carry extra figures through intermediate steps and only round your final answer; premature rounding introduces unnecessary errors.

Prompt 4: Random and Systematic Errors

Copy this prompt into your AI tool:
Present me with descriptions of experimental procedures and ask me to identify sources of random and systematic error. For each, ask me to explain how the error affects the results and suggest methods to reduce or eliminate it. Include at least one zero error scenario.
What this helps you practise:
Identifying, classifying, and mitigating random and systematic errors in experiments
How to use it well:
Random errors affect precision and are reduced by repeating measurements; systematic errors affect accuracy and require changes to the experimental method or calibration.

Prompt 5: Percentage and Absolute Uncertainty

Copy this prompt into your AI tool:
Quiz me on percentage and absolute uncertainty in physics measurements. Give me experimental data and ask me to calculate absolute uncertainty, percentage uncertainty, and the uncertainty in derived quantities. Include calculations involving addition, multiplication, and powers, and test whether I know when to add absolute uncertainties versus percentage uncertainties. After each answer,

check my method and correct any errors. Present one question at a time.

What this helps you practise:

Calculating and combining percentage and absolute uncertainties in derived quantities

How to use it well:

For products and quotients, add percentage uncertainties; for powers, multiply the percentage uncertainty by the power. State these rules explicitly in your working.

Prompt 6: Uncertainty in Gradients and Intercepts

Copy this prompt into your AI tool:

You are an A-Level examiner. Ask me to describe how to determine the uncertainty in the gradient and intercept of a straight-line graph. Ask me to explain the method of drawing worst acceptable lines and calculating the range of gradients. Mark my explanation for completeness.

What this helps you practise:

Determining uncertainties in gradient and intercept from graphical analysis

How to use it well:

Draw the steepest and shallowest lines that pass through the error bars; the gradient uncertainty is half the difference between these extreme gradients.

Prompt 7: Planning Experiments

Copy this prompt into your AI tool:

Give me a physical relationship to investigate — such as how the length of a pendulum affects its period, or how current varies with resistance. Ask me to design a complete experiment to test it: I should state the independent, dependent, and control variables, describe the method, explain how I would collect and analyse data, and identify sources *of uncertainty. Wait for my answer and assess my experimental design against A-Level practical skills criteria.*

What this helps you practise:

Designing experiments with appropriate variables, controls, and data analysis strategies

How to use it well:

Structure your plan around independent variable, dependent variable, control variables, and method of analysis; examiners mark these elements individually.

Prompt 8: Estimating Physical Quantities

Copy this prompt into your AI tool:

Ask me to estimate various physical quantities to the nearest order of magnitude. Include the mass of a person, the speed of sound, the power output of a light bulb, the wavelength of visible light, and the number of atoms in a human body. Challenge me to justify my estimates.

What this helps you practise:

Making and justifying order-of-magnitude estimates for physical quantities

How to use it well:

Estimation questions test your physical intuition and knowledge of typical values; keep a mental reference list of standard quantities and their approximate magnitudes.

Prompt 9: Graphical Techniques in Physics

Copy this prompt into your AI tool:

Present me with experimental data and ask me to determine what graph to plot to obtain a straight line. Include cases where I need to linearise a non-linear relationship. Then ask me to explain how to extract physical constants from the gradient and intercept.

What this helps you practise:
Linearising relationships and extracting physical quantities from straight-line graphs
How to use it well:
Compare your equation with y = mx + c to identify what to plot on each axis and what the gradient and intercept represent physically.

Prompt 10: Evaluating Experimental Procedures

Copy this prompt into your AI tool:
Give me a description of a completed experiment with its results and ask me to evaluate the procedure. Ask me to identify limitations, suggest specific and realistic improvements, and assess the reliability of the conclusion. Provide realistic data for me to critique.
What this helps you practise:
Critically evaluating experimental procedures, identifying limitations, and suggesting improvements
How to use it well:
Avoid vague improvements like 'use better equipment'; instead, name the specific instrument and explain precisely why it would improve the measurement.

Prompt 11: Practical Skills Under Exam Conditions

Copy this prompt into your AI tool:
Set me a challenge: describe an experiment I have never seen and ask me to predict what sources of uncertainty would be most significant, how I would minimise them, and what graph I would plot. Then ask me to estimate the expected result. Assess the quality of my reasoning.

What this helps you practise:
Applying practical reasoning to unfamiliar experimental scenarios under exam conditions
How to use it well:
Examiners design novel practical questions to test transferable skills; focus on applying general principles rather than memorising specific experiments.

Section 2

Mechanics — Forces and Motion

Mechanics is the study of forces and motion, and it forms one of the largest and most important areas of A-Level Physics. You must be confident applying Newton's laws, conservation of energy, and conservation of momentum to a wide range of situations, from simple linear motion to projectiles and collisions.

At A-Level, mechanics problems demand a structured approach: draw a free-body force diagram, identify the relevant principles, set up equations, and solve. The ability to resolve forces into components and apply Newton's laws systematically distinguishes strong candidates from weaker ones.

These prompts take you from fundamental definitions and laws through to complex problems involving projectiles, connected bodies, and energy transfers. Invest time in drawing clear diagrams and showing logical working, as examiners reward this heavily.

Prompt 12: Scalars and Vectors

Copy this prompt into your AI tool:

Test me on the distinction between scalar and vector quantities. Give me a list of physical quantities and ask me to classify each. Then give me vector addition and resolution problems, including finding the resultant of two forces at an angle. Check my diagram and calculation.

What this helps you practise:

Classifying scalars and vectors and resolving/adding vectors graphically and algebraically

How to use it well:
When adding vectors that are not perpendicular, use the cosine rule or resolve into components; both methods should give the same result, so use one to check the other.

Prompt 13: Equations of Motion for Uniform Acceleration

Copy this prompt into your AI tool:
Test me on the equations of motion for uniform acceleration (SUVAT equations) at A-Level Physics standard. Give me problems requiring me to select the correct equation, identify known and unknown quantities, and solve for the target variable. Include problems with vertical motion under gravity, multi-stage motion, and situations where I need to use two equations together. After each answer, check my equation selection and working. Present one problem at a time.

What this helps you practise:
Applying SUVAT equations to problems with uniform acceleration including vertical free fall

How to use it well:
List the known and unknown quantities before selecting an equation; this prevents you from choosing the wrong formula and wasting time.

Prompt 14: Newton's Laws of Motion

Copy this prompt into your AI tool:
Quiz me on all three of Newton's laws of motion. For each, ask me to state the law precisely and give a real-world example. Then present me with problems where I must apply each law quantitatively. Assess whether my statements of the laws are precise enough for full marks.

What this helps you practise:
Stating Newton's laws precisely and applying them quantitatively to physical scenarios

How to use it well:
Newton's first law must mention the condition of zero resultant force; the second law must reference resultant force and rate of change of momentum; the third law must state equal magnitude, opposite direction, same type, and different objects.

Prompt 15: Free-Body Force Diagrams

Copy this prompt into your AI tool:
Present me with several physical situations — a book on a table, a parachutist at terminal velocity, a car accelerating up a hill, and an object on a slope — and ask me to identify and draw all the forces acting in each case. I should name each force, state its direction, and explain whether the forces are balanced or unbalanced. Wait for my answer each time and check that I have not missed any forces or drawn them incorrectly.

What this helps you practise:
Identifying all forces on a body and constructing accurate free-body diagrams

How to use it well:
Only include forces acting on the object in question, not forces the object exerts on others; this is the most common mistake in free-body diagrams.

Prompt 16: Resolving Forces

Copy this prompt into your AI tool:
Present me with forces acting at angles and ask me to resolve them into perpendicular components. Include problems on inclined planes where I must resolve weight parallel and perpendicular to the slope. Ask me to then apply Newton's second law to find the acceleration.

What this helps you practise:

Resolving forces into perpendicular components on flat and inclined surfaces

How to use it well:

On an inclined plane, resolve parallel and perpendicular to the surface, not horizontally and vertically; this simplifies the equations dramatically.

Prompt 17: Momentum and Conservation

Copy this prompt into your AI tool:

Give me an A-Level style question on conservation of momentum in one dimension. Include a collision between two objects where I must find an unknown velocity. Then ask me to determine whether the collision is elastic or inelastic by calculating kinetic energy before and after.

What this helps you practise:

Applying conservation of momentum and classifying collisions by kinetic energy change

How to use it well:

Define a positive direction clearly and stick to it; velocity is a vector, so objects moving in the negative direction must have negative velocities in your equations.

Prompt 18: Impulse and Force-Time Graphs

Copy this prompt into your AI tool:

Quiz me on impulse and force-time graphs in physics. Ask me to define impulse, state its relationship to change in momentum, and calculate impulse from force-time data. Give me force-time graphs and ask me to determine the impulse by calculating the area under the curve. Include problems with varying forces and multi-step collisions. After each answer, check my calculation method and units. Present one question at a time and wait for my response before proceeding.

What this helps you practise:

Calculating impulse from force-time graphs and linking to momentum change

How to use it well:

The area under a force-time graph equals the impulse, which equals the change in momentum; use this relationship to connect graphical and algebraic approaches.

Prompt 19: Work, Energy, and Power

Copy this prompt into your AI tool:

Set me problems involving work done by a force, kinetic energy, gravitational potential energy, and power. Include a problem where a force acts at an angle to the displacement. Then ask me to use the work-energy theorem to find a final velocity. Verify my use of W = Fs cos(theta).

What this helps you practise:

Calculating work done, energy transfers, and power including forces at angles

How to use it well:

Remember that only the component of force in the direction of motion does work; when force and displacement are perpendicular, no work is done.

Prompt 20: Conservation of Energy

Copy this prompt into your AI tool:

Present me with scenarios involving energy conservation, such as a roller coaster, a pendulum, or a ball rolling down a slope. Ask me to identify the energy transfers and apply conservation of energy to find unknown speeds or heights. Include a problem with friction losses.

What this helps you practise:

Applying conservation of energy to mechanical systems with and without dissipative forces

How to use it well:
When friction is present, include work done against friction as a loss term: initial energy = final energy + energy lost to friction.

Prompt 21: Projectile Motion

Copy this prompt into your AI tool:

Give me an A-Level projectile motion problem. Ask me to resolve the initial velocity, find the time of flight, maximum height, and horizontal range. Then ask me to find the velocity at a specific time and the angle it makes with the horizontal. Assess my vector reasoning.

What this helps you practise:
Analysing projectile trajectories using independent horizontal and vertical components

How to use it well:
Horizontal and vertical motions are independent; apply SUVAT separately in each direction using the appropriate acceleration (zero horizontally, g vertically).

Prompt 22: Moments and Couples

Copy this prompt into your AI tool:

You are an A-Level examiner. Set me a question involving moments about a pivot point. Include a non-uniform beam with multiple forces and ask me to find unknown forces or the position of the centre of mass. Then ask me to define a couple and calculate its moment. Mark my response.

What this helps you practise:
Calculating moments about pivot points and understanding couples in equilibrium problems

How to use it well:
Take moments about the point where the most unknown forces act to eliminate them from your equation; this simplifies the algebra significantly.

Section 3

Materials and Waves

The study of materials at A-Level involves understanding how solid materials deform under stress, characterised by properties such as the Young modulus, ultimate tensile strength, and elastic limit. You must be able to interpret stress-strain curves and relate them to the behaviour of real materials.

Waves is a topic that bridges mechanics and the more abstract areas of physics. At A-Level, you need to understand progressive and stationary waves, superposition, interference, diffraction, and refraction. These concepts require both mathematical precision and strong conceptual understanding.

This section combines materials science and wave physics, taking you from definitions and basic calculations through to analysis of interference patterns, diffraction gratings, and the physical properties that determine how materials behave under load.

Prompt 23: Density and Material Properties

Copy this prompt into your AI tool:

Test me on density calculations and the properties of materials. Give me problems involving density, mass, and volume for regular and irregular objects. Then ask me to describe the difference between elastic and plastic deformation with examples. Check my definitions for precision.

What this helps you practise:

Calculating density and distinguishing elastic from plastic deformation in materials

How to use it well:
Know the definitions of elastic limit, yield point, and ultimate tensile strength precisely; exam questions often require you to identify these on a graph.

Prompt 24: Hooke's Law and Springs

Copy this prompt into your AI tool:
Quiz me on Hooke's law and its application to springs. Ask me to calculate force, extension, and spring constant. Include problems involving springs in series and in parallel. Then ask me to find the elastic potential energy stored in a stretched spring.

What this helps you practise:
Applying Hooke's law and calculating elastic potential energy in spring systems

How to use it well:
Remember that Hooke's law only applies up to the limit of proportionality; beyond this point, the material no longer obeys $F = kx$.

Prompt 25: Stress, Strain, and Young Modulus

Copy this prompt into your AI tool:
Give me an A-Level style question where I must calculate stress, strain, and the Young modulus from experimental data. Ask me to describe an experiment to determine the Young modulus of a wire. Then give me a stress-strain graph and ask me to extract information from it.

What this helps you practise:
Calculating stress, strain, and Young modulus and interpreting stress-strain curves

How to use it well:
The Young modulus is the gradient of the linear region of the stress-strain graph, not the force-extension graph; be careful to use the correct quantities.

Prompt 26: Progressive Waves

Copy this prompt into your AI tool:

Present me with questions on progressive waves. Ask me to define wavelength, frequency, amplitude, period, and wave speed. Then give me problems using the wave equation v = f lambda and ask me to distinguish between transverse and longitudinal waves with examples.

What this helps you practise:

Defining wave properties and applying the wave equation to transverse and longitudinal waves

How to use it well:

Be precise in your definitions: amplitude is the maximum displacement from equilibrium, not the distance from peak to trough, which is twice the amplitude.

Prompt 27: Wave Displacement Graphs

Copy this prompt into your AI tool:

Give me displacement-distance and displacement-time graphs for waves. Ask me to extract wavelength, period, frequency, amplitude, and wave speed from the graphs. Then ask me to determine the phase difference between two points on the wave. Check my readings and calculations.

What this helps you practise:

Reading and interpreting displacement-distance and displacement-time wave graphs

How to use it well:

Phase difference can be expressed in degrees, radians, or fractions of a wavelength; be ready to convert between these and use whichever the question demands.

Prompt 28: Superposition and Interference

Copy this prompt into your AI tool:

Ask me to explain the principle of superposition and the conditions for constructive and destructive interference. Then give me Young's double slit experiment problems where I must calculate fringe spacing using the formula w = lambda D / s. Assess my understanding of path difference and coherence.

What this helps you practise:

Applying the principle of superposition and calculating double-slit interference fringe spacing

How to use it well:

Coherent sources have a constant phase relationship; this is why single-slit illumination or a laser is needed for Young's experiment rather than two independent sources.

Prompt 29: Diffraction Gratings

Copy this prompt into your AI tool:

Set me problems on diffraction gratings using d sin(theta) = n lambda. Ask me to find the angle for different orders, determine the maximum order visible, and calculate the grating spacing from given data. Include a question on the advantages of gratings over double slits.

What this helps you practise:

Calculating diffraction grating angles and orders using the grating equation

How to use it well:

The maximum order is found by setting sin(theta) = 1 in the grating equation; since sin(theta) cannot exceed 1, this gives the upper limit on n.

Prompt 30: Stationary Waves

Copy this prompt into your AI tool:

You are an A-Level examiner. Ask me to explain how stationary waves form and how they differ from progressive waves. Then give me problems on stationary waves on strings and in pipes, asking me *to identify harmonics and calculate frequencies. Mark my diagrams and answers.*

What this helps you practise:

Explaining stationary wave formation and calculating harmonics on strings and in air columns

How to use it well:

For a string fixed at both ends, both ends are nodes; for an open pipe, both ends are antinodes; for a closed pipe, the closed end is a node and the open end is an antinode.

Prompt 31: Refraction and Total Internal Reflection

Copy this prompt into your AI tool:

Give me problems on refraction using Snell's law n1 sin(theta1) = n2 sin(theta2). Ask me to calculate the critical angle for total internal reflection and describe applications such as optical fibres. Include a problem where light passes through multiple boundaries.

What this helps you practise:

Applying Snell's law and calculating critical angles for total internal reflection

How to use it well:

Total internal reflection occurs only when light travels from a more optically dense medium to a less dense one and the angle of incidence exceeds the critical angle.

Prompt 32: Wave-Particle Duality and de Broglie Wavelength

Copy this prompt into your AI tool:

Test me on wave-particle duality at A-Level standard. Ask me to explain the evidence for the wave nature of particles, including electron diffraction experiments, and the evidence for the particle nature of waves from the photoelectric *effect. Then quiz me on the de Broglie equation lambda equals h over p and give me calculation problems involving the de Broglie wavelength of electrons and other particles at given energies. After each answer, check my reasoning and calculations. Present one question at a time.*

What this helps you practise:

Explaining wave-particle duality with evidence from electron diffraction and the photoelectric effect, and calculating de Broglie wavelengths using lambda equals h over p

How to use it well:

Wave-particle duality links the photoelectric effect (light as particles) with electron diffraction (particles as waves); the de Broglie equation connects momentum to wavelength and is frequently tested in calculations.

Prompt 33: Electromagnetic Spectrum and Polarisation

Copy this prompt into your AI tool:

Quiz me on the electromagnetic spectrum. Ask me to order the regions by wavelength and frequency, state typical wavelengths, and describe how different regions are produced and detected. Then ask me to explain polarisation and why it provides evidence that electromagnetic waves are transverse.

What this helps you practise:

Properties of the electromagnetic spectrum and the physics of polarisation

How to use it well:

Polarisation can only occur with transverse waves because the oscillations must have a direction perpendicular to propagation; this is a key piece of evidence for the transverse nature of light.

Section 4

Electricity and Circuits

Electricity is a core topic at A-Level that builds from the fundamental definitions of charge, current, and potential difference through to the analysis of complex circuits. You must understand not only how to apply circuit laws but also the microscopic physics of charge carriers and resistivity.

Key concepts include Ohm's law, Kirchhoff's laws, the behaviour of resistors in series and parallel, potential dividers, and the relationship between electromotive force (emf) and internal resistance. These topics are tested both theoretically and through practical circuit analysis.

The prompts in this section develop your circuit analysis skills progressively, from basic definitions and calculations through to multi-component circuits and the interpretation of I-V characteristics. Strong circuit skills are essential for understanding more advanced topics such as capacitance and electromagnetic induction.

Prompt 34: Charge, Current, and Potential Difference

Copy this prompt into your AI tool:

Test me on the definitions of charge, current, and potential difference at A-Level standard. Ask me to state each definition precisely, give the relevant equations, and solve problems involving charge flow and energy transfer. Check that my definitions would earn full marks.

What this helps you practise:

Defining and calculating charge, current, and potential difference with precision

How to use it well:
Current is the rate of flow of charge (I = Q/t) and potential difference is energy transferred per unit charge (V = W/Q); these definitions must be stated precisely for full marks.

Prompt 35: Resistance and Ohm's Law

Copy this prompt into your AI tool:
Give me problems on resistance and Ohm's law. Ask me to calculate resistance, state Ohm's law precisely, and explain what it means for a component to be ohmic. Then give me I-V characteristics for different components and ask me to identify which are ohmic.

What this helps you practise:
Applying Ohm's law and interpreting I-V characteristics for different components

How to use it well:
Ohm's law states that current is proportional to potential difference at constant temperature; it is a law about specific materials, not a universal definition of resistance.

Prompt 36: Resistivity

Copy this prompt into your AI tool:
Quiz me on resistivity. Ask me to state the relationship R = rho L / A and solve problems involving wires of different lengths, cross-sectional areas, and materials. Then describe an experiment and ask me to explain how I would determine the resistivity of a wire.

What this helps you practise:
Calculating resistance from resistivity and determining resistivity experimentally

How to use it well:
Remember that cross-sectional area for a circular wire is pi r^2 or pi d^2/4; converting diameter to

area is a frequent source of error in resistivity calculations.

Prompt 37: I-V Characteristics

Copy this prompt into your AI tool:

Present me with I-V characteristic graphs for a filament lamp, a diode, a thermistor, and a fixed resistor. Ask me to describe and explain the shape of each graph in terms of the physics of the component. Then ask me to describe how to obtain these graphs experimentally.

What this helps you practise:

Describing and explaining I-V characteristics for standard components

How to use it well:

For the filament lamp, explain that resistance increases because temperature increases as current flows, which reduces the mean drift velocity of charge carriers.

Prompt 38: Series and Parallel Circuits

Copy this prompt into your AI tool:

Test me on series and parallel circuits at A-Level standard. Give me circuit diagrams combining resistors, cells, and other components in series and parallel arrangements and ask me to calculate total resistance, current through each component, and potential difference across each component. Include circuits with mixed series-parallel combinations. After each answer, check my working and correct any errors in applying the rules. Present one problem at a time.

What this helps you practise:

Analysing resistor combinations in series and parallel to find currents and voltages

How to use it well:

Work systematically from the innermost combination outwards when simplifying complex networks; redraw the circuit at each stage to keep track of your simplification.

Prompt 39: Kirchhoff's Laws

Copy this prompt into your AI tool:

You are an A-Level examiner. Set me a circuit problem requiring the application of Kirchhoff's first and second laws. Ask me to state both laws, set up simultaneous equations for the circuit, and solve for the unknown currents. Mark my solution step by step.

What this helps you practise:

Applying Kirchhoff's current and voltage laws to solve complex circuit problems

How to use it well:

Label assumed current directions on your circuit diagram; if your solution gives a negative current, it simply means the actual direction is opposite to your assumption.

Prompt 40: EMF and Internal Resistance

Copy this prompt into your AI tool:

Give me an A-Level style question on electromotive force and internal resistance. Ask me to use the equation emf = I(R + r) to find unknown values. Then ask me to explain how a graph of terminal pd against current can be used to find the emf and internal resistance of a cell.

What this helps you practise:

Solving problems involving emf, internal resistance, and terminal potential difference

How to use it well:

The y-intercept of a V against I graph gives the emf, and the magnitude of the gradient gives the internal resistance; know how to derive this from the equation.

Prompt 41: Potential Dividers

Copy this prompt into your AI tool:

Present me with potential divider circuits and ask me to calculate the output voltage. Include examples with fixed resistors, then introduce a thermistor or LDR as one component. Ask me to explain how the output voltage changes with temperature or light intensity.

What this helps you practise:

Calculating potential divider output voltages and analysing sensor circuits

How to use it well:

For sensor circuits, think about how the sensor's resistance changes with the physical quantity, then determine whether the output voltage increases or decreases as a result.

Prompt 42: Energy and Power in Circuits

Copy this prompt into your AI tool:

Ask me to derive and use the equations P = IV, P = I^2R, and P = V^2/R. Give me problems where I must calculate power dissipated in individual components and in complete circuits. Include a problem on the efficiency of energy transfer from a battery with internal resistance.

What this helps you practise:

Calculating electrical power dissipation and energy efficiency in circuits

How to use it well:

Maximum power is delivered to the external load when the load resistance equals the internal resistance; this is a useful result for optimisation problems.

Prompt 43: Charge Carrier Drift Velocity

Copy this prompt into your AI tool:

Set me a challenge: give me the equation $I = nAqv$ and ask me to define each term. Then present problems where I must calculate drift velocity for current-carrying conductors. Ask me to explain why drift velocity is so slow compared with the speed at which a circuit responds.

What this helps you practise:

Using the drift velocity equation and understanding charge carrier behaviour in conductors

How to use it well:

The number density n varies hugely between conductors and semiconductors; understanding this explains why metals conduct so much better than semiconductors.

Prompt 44: Circuit Analysis Under Exam Conditions

Copy this prompt into your AI tool:

Give me a complex A-Level circuit containing a battery with internal resistance, a potential divider, and multiple resistors. Ask me to find the current from the battery, the pd across each component, and the power dissipated in a specific resistor. Present this as a full exam question with marks allocated.

What this helps you practise:

Solving multi-component circuit problems under exam-style conditions

How to use it well:

Read the entire question before starting and identify which circuit principles you need; many marks are lost by students who rush into calculations without a clear plan.

Section 5

Further Mechanics and Thermal Physics

Further mechanics at A-Level introduces circular motion and simple harmonic motion, two topics that extend your understanding of forces and energy into oscillating and rotating systems. These concepts require fluent use of trigonometric and calculus-based descriptions of motion.

Thermal physics brings together the macroscopic properties of gases and the microscopic kinetic theory. You must understand the ideal gas law, the relationship between temperature and molecular kinetic energy, and the specific heat capacity and specific latent heat of materials.

The prompts in this section cover both the mathematical framework and the physical reasoning behind these topics. Many exam questions require you to link the mathematical description of oscillations with energy considerations, or to connect gas laws with molecular behaviour.

Prompt 45: Circular Motion — Angular Velocity and Period

Copy this prompt into your AI tool:

Test me on circular motion fundamentals. Ask me to define angular velocity, relate it to linear speed and period, and solve problems involving objects moving in horizontal and vertical circles. Include conversions between rpm and rad/s. Check my unit handling.

What this helps you practise:

Defining and calculating angular velocity, period, and linear speed in circular motion

How to use it well:

Always convert angular velocity to rad/s before using it in equations; exam questions sometimes give values in revolutions per minute to test unit conversion.

Prompt 46: Centripetal Force and Acceleration

Copy this prompt into your AI tool:

Quiz me on centripetal force and acceleration at A-Level standard. Give me problems involving objects moving in circular paths and ask me to calculate centripetal acceleration and the centripetal force required. Include scenarios such as cars on banked tracks, conical pendulums, and objects at the top and bottom of vertical loops. Test whether I understand that centripetal force is a resultant, not a separate force. Present one problem at a time and give feedback.

What this helps you practise:

Calculating centripetal force and acceleration and identifying the physical force providing it

How to use it well:

Centripetal force is not a new type of force; it is always provided by a real force such as tension, friction, gravity, or normal reaction. Always identify which force provides it.

Prompt 47: Simple Harmonic Motion — Definition and Equations

Copy this prompt into your AI tool:

Quiz me on the definition of SHM and its mathematical description. Ask me to state the condition for SHM, write the displacement, velocity, and acceleration equations, and sketch graphs of each against time. Verify that my definition includes the key terms.

What this helps you practise:

Defining SHM precisely and applying its displacement, velocity, and acceleration equations

How to use it well:

The defining condition is that acceleration is proportional to displacement and directed towards the equilibrium position; both parts of this statement must be included for full marks.

Prompt 48: SHM — Mass-Spring and Pendulum Systems

Copy this prompt into your AI tool:

Present me with problems on mass-spring systems and simple pendulums undergoing SHM. Ask me to calculate the period using T = 2pi sqrt(m/k) and T = 2pi sqrt(l/g). Then ask me to explain what factors affect the period and which do not. Include a problem requiring me to find the spring constant from experimental data.

What this helps you practise:

Calculating periods of mass-spring and pendulum systems and identifying factors affecting oscillation

How to use it well:

Note that the period of a simple pendulum is independent of mass and amplitude (for small oscillations); these are common misconceptions that examiners target.

Prompt 49: Energy in SHM

Copy this prompt into your AI tool:

Ask me to describe and sketch graphs showing how kinetic energy and potential energy vary with displacement and time during SHM. Then give me a problem where I must calculate the maximum speed and the total energy of an oscillating system. Check my energy conservation reasoning.

What this helps you practise:
Analysing energy transfers during SHM and calculating maximum kinetic and potential energies

How to use it well:
Total energy in SHM is constant and equals the maximum kinetic energy (at equilibrium) or maximum potential energy (at maximum displacement); use this to link speed and displacement.

Prompt 50: Damping and Resonance

Copy this prompt into your AI tool:
Give me an A-Level style question on damped oscillations. Ask me to describe light, heavy, and critical damping and sketch displacement-time graphs for each. Then ask me to explain resonance, sketch a resonance curve, and describe the effect of damping on the resonance peak.

What this helps you practise:
Describing types of damping and explaining resonance with frequency response curves

How to use it well:
Resonance occurs when the driving frequency equals the natural frequency; increasing damping reduces the amplitude at resonance and broadens the peak.

Prompt 51: Thermal Energy and Specific Heat Capacity

Copy this prompt into your AI tool:
Present me with problems on thermal energy transfer using Q = mc delta T. Include problems involving mixtures reaching thermal equilibrium, continuous flow heating, and the identification of specific heat capacity from experimental data. Check my use of temperature differences.

What this helps you practise:

Calculating thermal energy transfers using specific heat capacity in various scenarios

How to use it well:

In mixing problems, the energy lost by the hotter substance equals the energy gained by the cooler one; set up this equation carefully, noting that delta T is always positive.

Prompt 52: Specific Latent Heat

Copy this prompt into your AI tool:

Ask me to define specific latent heat of fusion and vaporisation. Then give me problems involving phase changes where I must calculate the energy required. Include a problem combining both heating and phase change. Assess my understanding of why temperature remains constant during a phase change.

What this helps you practise:

Calculating energy for phase changes using specific latent heat

How to use it well:

During a phase change, energy goes into breaking intermolecular bonds rather than increasing kinetic energy, which is why temperature remains constant.

Prompt 53: Ideal Gas Law

Copy this prompt into your AI tool:

You are an A-Level examiner. Give me problems on the ideal gas law $pV = nRT$ and $pV = NkT$. Ask me to convert between moles and number of molecules, solve for unknown variables, and explain the conditions under which real gases approximate ideal behaviour. Mark my solutions.

What this helps you practise:

Applying the ideal gas law and understanding the assumptions of the ideal gas model

How to use it well:

Know both forms of the ideal gas equation and be confident converting between them using N = nN_A and k = R/N_A.

Prompt 54: Molecular Kinetic Theory

Copy this prompt into your AI tool:

Ask me to derive or explain the steps in the derivation of pV = (1/3)Nm<c^2> for an ideal gas. Then ask me to use this result to show that the average kinetic energy of a gas molecule is (3/2)kT. Test my understanding of each assumption in the derivation.

What this helps you practise:

Understanding the kinetic theory derivation of pressure and the link between temperature and molecular energy

How to use it well:

Examiners often ask you to state the assumptions of kinetic theory; memorise these precisely, as they form the basis of several standard proof and explanation questions.

Prompt 55: Gas Laws and Experimental Verification

Copy this prompt into your AI tool:

Give me problems on Boyle's law, Charles's law, and the pressure law as special cases of the ideal gas equation. Ask me to describe experiments to verify each law and to plot appropriate graphs. Then ask me to explain why absolute zero is the lower limit of temperature.

What this helps you practise:

Applying individual gas laws and understanding the concept of absolute zero from experimental evidence

How to use it well:

Each gas law holds one variable constant; always state which variable is constant and ensure your graph axes reflect the correct relationship.

Section 6

Fields — Gravitational and Electric

Field theory is one of the most intellectually demanding areas of A-Level Physics, requiring you to think abstractly about forces that act at a distance. Gravitational and electric fields share remarkably similar mathematical structures, and understanding the parallels between them deepens your understanding of both.

At A-Level, you must work with field strength, potential, and potential energy for both gravitational and electric fields. You must also understand the behaviour of capacitors, including charging and discharging through resistors, and the energy stored in capacitors.

These prompts progress from definitions and basic field calculations through to orbital mechanics, Coulomb's law problems, and exponential capacitor discharge. Drawing clear field line diagrams and understanding the graphical representation of fields are essential skills.

Prompt 56: Gravitational Field Strength

Copy this prompt into your AI tool:

Test me on gravitational field strength. Ask me to define it, state the equation g = F/m, and solve problems involving gravitational field strength at the surface of planets. Then ask me about the variation of g with distance from the centre of a planet. Check my inverse square law reasoning.

What this helps you practise:

Defining and calculating gravitational field strength near surfaces and at distance

How to use it well:

Near the surface, g is approximately uniform; at greater distances, use g = GM/r^2 and remember that r is measured from the centre of the mass, not from the surface.

Prompt 57: Gravitational Potential and Potential Energy

Copy this prompt into your AI tool:

Test me on gravitational potential and potential energy at A-Level standard. Give me problems involving the gravitational potential at a distance from a point mass and the gravitational potential energy of a system. Ask me to explain the significance of the negative sign in gravitational potential, calculate escape velocity, and sketch potential-distance graphs. After each answer, check my calculations, signs, and physical reasoning. Present one question at a time.

What this helps you practise:

Calculating gravitational potential and energy, including understanding of negative values and escape velocity

How to use it well:

Gravitational potential is always negative because we define zero potential at infinity; understand this convention thoroughly, as it underpins energy arguments for orbits and escape.

Prompt 58: Orbital Mechanics

Copy this prompt into your AI tool:

Quiz me on orbital mechanics at A-Level standard. Give me problems involving satellites in circular orbits and ask me to derive and use the relationship between orbital speed, radius, and the mass of the central body. Include calculations of orbital period, geostationary orbit conditions, and total energy of *an orbiting satellite. Test whether I understand why orbital speed is independent of satellite mass. After each answer, check my derivations and working. Present one problem at a time.*

What this helps you practise:

Deriving and applying orbital mechanics equations for satellite motion

How to use it well:

Set gravitational force equal to centripetal force (GMm/r^2 = mv^2/r) to derive the orbital speed; this is the starting point for almost every orbital mechanics problem.

Prompt 59: Electric Field Strength — Uniform Fields

Copy this prompt into your AI tool:

Present me with problems on uniform electric fields between parallel plates. Ask me to calculate field strength using E = V/d, find the force on a charge, and describe the motion of a charged particle entering the field perpendicular to the field lines. Check my projectile motion analogy.

What this helps you practise:

Calculating uniform electric field strength and analysing charged particle motion between plates

How to use it well:

A charged particle in a uniform electric field follows a parabolic path, just like a projectile in a gravitational field; use the same mathematical framework with F = qE replacing mg.

Prompt 60: Coulomb's Law and Radial Fields

Copy this prompt into your AI tool:

Give me an A-Level style question on Coulomb's law. Ask me to calculate the force between two point charges and the electric field strength at a point due to one or more charges. Include a problem where I *must find the position where the resultant field is zero between two charges.*

What this helps you practise:

Applying Coulomb's law to calculate forces and field strengths for point charge configurations

How to use it well:

When finding the null point between two charges, set the magnitudes of the two field contributions equal and solve for position; the null point is always between like charges.

Prompt 61: Electric Potential

Copy this prompt into your AI tool:

Ask me to define electric potential and calculate it at a point due to one or more point charges. Then ask me to find the potential difference between two points and the work done moving a charge between them. Include both positive and negative charges.

What this helps you practise:

Calculating electric potential due to point charges and work done moving charges in electric fields

How to use it well:

Electric potential is a scalar quantity, so potentials from multiple charges add algebraically without needing vector resolution; this makes potential calculations simpler than field calculations.

Prompt 62: Comparing Gravitational and Electric Fields

Copy this prompt into your AI tool:

Set me a challenge: ask me to draw a comparison table between gravitational and electric fields, covering field strength, potential, force laws, and the nature of the fields. Then ask me to identify the key differences. Assess the depth and accuracy of my comparisons.

What this helps you practise:
Drawing systematic parallels and identifying differences between gravitational and electric fields
How to use it well:
The key difference is that gravitational fields are always attractive while electric fields can be attractive or repulsive; this affects the sign of potential and energy.

Prompt 63: Capacitance and Energy Storage
Copy this prompt into your AI tool:
You are an A-Level examiner. Give me problems on capacitance. Ask me to use C = Q/V, calculate the charge stored, and find the energy stored using E = (1/2)QV = (1/2)CV^2 = Q^2/(2C). Include capacitors in series and parallel. Mark my working.
What this helps you practise:
Calculating capacitance, charge, and energy for single capacitors and combinations
How to use it well:
Capacitors in parallel add directly (C_total = C1 + C2); in series, reciprocals add (1/C_total = 1/C1 + 1/C2). This is the opposite rule to resistors.

Prompt 64: Capacitor Charge and Discharge
Copy this prompt into your AI tool:
Present me with problems on capacitor charging and discharging through a resistor. Ask me to use the exponential equations Q = Q0 e^(-t/RC), sketch the graphs, and calculate the time constant. Then ask me to find the charge remaining after a given time.
What this helps you practise:
Modelling exponential capacitor charge and discharge and calculating time constants
How to use it well:
The time constant RC is the time for charge (or voltage) to fall to 1/e (about 37%) of its initial value;

after 5 time constants, the capacitor is effectively fully discharged.

Prompt 65: Capacitor Discharge — Logarithmic Analysis

Copy this prompt into your AI tool:

Give me experimental discharge data for a capacitor and ask me to plot a graph of ln(Q) or ln(V) against time. Ask me to use the gradient to determine the time constant and hence the capacitance. Check my logarithmic manipulation and graph interpretation.

What this helps you practise:

Using logarithmic graphs to analyse capacitor discharge data and determine circuit parameters

How to use it well:

Taking natural logs of the exponential equation linearises it; the gradient equals -1/RC, so you can extract C if R is known, or vice versa.

Prompt 66: Electromagnetic Induction — Faraday's and Lenz's Laws

Copy this prompt into your AI tool:

Quiz me on electromagnetic induction at A-Level standard. Ask me to state and explain Faraday's law, defining magnetic flux and flux linkage, and to explain Lenz's law including the reason for the negative sign in the induced emf equation. Give me problems involving a conductor moving through a magnetic field, a changing magnetic field through a coil, and the effect of changing the number of turns or rate of flux change. After each answer, check my reasoning and calculations. Present one problem at a time.

What this helps you practise:

Applying Faraday's law to calculate induced emf from changing flux linkage, and using Lenz's law to predict the direction of induced currents

How to use it well:

Electromagnetic induction is central to generators and transformers; understanding Faraday's law quantitatively and Lenz's law qualitatively is essential for A-Level exam questions on this topic.

Section 7

Nuclear and Particle Physics

Nuclear and particle physics takes you from the structure of the atom through to the fundamental building blocks of matter. At A-Level, you must understand atomic models, radioactive decay, nuclear energy, and the Standard Model of particle physics including quarks, leptons, and exchange particles.

This topic combines conceptual understanding with quantitative problem-solving. You need to work with nuclear equations, binding energy calculations, decay constants, and half-life mathematics, while also understanding the conservation laws that govern particle interactions.

The prompts in this section cover the full range from atomic structure and radioactivity through to the classification of particles and the evidence for the quark model. Many of these topics require you to learn specific facts and classifications, so systematic revision using these prompts is particularly valuable.

Prompt 67: Atomic Structure and Isotopes

Copy this prompt into your AI tool:

Test me on atomic structure at A-Level. Ask me to define proton number, nucleon number, and isotopes. Then give me nuclear notation and ask me to identify the composition of specific nuclei. Include a question on the evidence from Rutherford's alpha scattering experiment.

What this helps you practise:

Defining atomic structure terminology and explaining evidence for the nuclear model

How to use it well:

Rutherford's experiment showed that the atom has a small, dense, positively charged nucleus; be able to explain how each observation leads to each conclusion.

Prompt 68: Fundamental Particles — The Standard Model

Copy this prompt into your AI tool:

Quiz me on the Standard Model of particle physics. Ask me to name the three generations of quarks and leptons, their charges, and the exchange particles for each fundamental force. Test whether I can correctly identify which particles feel which forces.

What this helps you practise:

Identifying quarks, leptons, and exchange particles in the Standard Model

How to use it well:

Create a reference grid of all particles, their charges, and their interactions; systematic memorisation of the Standard Model is essential for this topic.

Prompt 69: Quark Composition of Hadrons

Copy this prompt into your AI tool:

Give me hadrons (baryons and mesons) and ask me to state their quark compositions. Then give me quark compositions and ask me to identify the particle and its properties. Include particles and antiparticles. Check my charge calculations from quark charges.

What this helps you practise:

Determining quark compositions of baryons and mesons and verifying properties from quark content

How to use it well:

Baryons contain three quarks and mesons contain a quark-antiquark pair; verify your composition by checking that the charges add up to the known particle charge.

Prompt 70: Conservation Laws in Particle Interactions

Copy this prompt into your AI tool:

Present me with particle interaction equations and ask me to determine which conservation laws are satisfied or violated. Test conservation of charge, baryon number, lepton number, and strangeness. Ask me to identify which interactions are possible and which are forbidden.

What this helps you practise:

Applying conservation laws to determine whether particle interactions are allowed or forbidden

How to use it well:

Strangeness is conserved in strong interactions but can change by one unit in weak interactions; this distinction is a common exam discriminator.

Prompt 71: Radioactive Decay — Alpha, Beta, Gamma

Copy this prompt into your AI tool:

Test me on radioactive decay including alpha, beta, and gamma radiation at A-Level standard. Ask me to describe the nature, penetrating power, ionising ability, and range of each type. Give me nuclear equations to complete for alpha and beta decay, checking that I conserve mass number and atomic number. Include questions on the effects of electric and magnetic fields on each type of radiation. Present one question at a time and give feedback after each answer.

What this helps you practise:

Describing radioactive emissions and writing balanced nuclear decay equations

How to use it well:
Check that nucleon number and proton number are conserved in every nuclear equation you write; this is the equivalent of balancing a chemical equation.

Prompt 72: Radioactive Decay Law and Half-Life

Copy this prompt into your AI tool:
Give me an A-Level style question on radioactive decay. Ask me to use the equations N = N0 e^(-lambda t) and A = lambda N. Then ask me to calculate half-life from the decay constant and vice versa. Include a problem using a decay graph.

What this helps you practise:
Applying the exponential decay law and calculating half-life and decay constant

How to use it well:
The relationship t_half = ln2 / lambda connects half-life and decay constant; know this derivation, as examiners sometimes ask you to show where it comes from.

Prompt 73: Nuclear Binding Energy

Copy this prompt into your AI tool:
You are an A-Level examiner. Ask me to define binding energy and binding energy per nucleon. Then ask me to calculate the binding energy of a specific nucleus from given atomic masses. Finally, ask me to use a binding energy per nucleon curve to explain why fusion of light nuclei and fission of heavy nuclei both release energy. Mark my explanation.

What this helps you practise:
Calculating nuclear binding energy and explaining the energetics of fission and fusion

How to use it well:
Binding energy per nucleon peaks around iron-56; nuclei lighter than iron release energy by fusion, and

heavier nuclei release energy by fission. This single graph explains both processes.

Prompt 74: Mass-Energy Equivalence

Copy this prompt into your AI tool:

Present me with nuclear reactions and ask me to calculate the mass defect and the energy released using E = mc^2. Include a fission reaction and a fusion reaction. Ask me to convert between atomic mass units, kilograms, and MeV. Check my unit conversions.

What this helps you practise:

Calculating energy released in nuclear reactions using mass-energy equivalence

How to use it well:

Use the conversion 1 u = 931.5 MeV/c^2 to convert mass defect directly to energy in MeV without needing to convert to kilograms first.

Prompt 75: Nuclear Fission and Fusion

Copy this prompt into your AI tool:

Ask me to explain the processes of nuclear fission and fusion, including the conditions required for each. Then give me specific reactions and ask me to calculate the energy released. Ask me about the challenges of achieving controlled fusion and the design of fission reactors.

What this helps you practise:

Explaining fission and fusion processes and calculating associated energy releases

How to use it well:

Fusion requires extremely high temperatures to overcome the electrostatic repulsion between nuclei; this is the fundamental engineering challenge for fusion power.

Prompt 76: Particle Accelerators and Detectors

Copy this prompt into your AI tool:

Set me a challenge: ask me to explain how a linear accelerator and a cyclotron work. Then ask me to describe how particle detectors identify different types of particles. Include a question on why higher energies are needed to probe smaller structures.

What this helps you practise:

Explaining the principles of particle accelerators and detection methods

How to use it well:

The de Broglie wavelength decreases with increasing momentum; higher-energy particles have shorter wavelengths and can therefore resolve finer structural details.

Prompt 77: Photoelectric Effect and Wave-Particle Duality

Copy this prompt into your AI tool:

Give me an A-Level style question on the photoelectric effect. Ask me to explain the observations, use Einstein's photoelectric equation, and calculate the maximum kinetic energy of emitted electrons. Then ask me to explain how the photoelectric effect provides evidence for the particle nature of light.

What this helps you practise:

Applying Einstein's photoelectric equation and explaining wave-particle duality evidence

How to use it well:

The photoelectric effect cannot be explained by the wave model because increasing intensity increases the number of electrons but not their maximum energy; this is the key argument for photons.

Prompt 78: Energy Levels and Photon Emission

Copy this prompt into your AI tool:

Present me with an energy level diagram for an atom. Ask me to calculate the wavelengths of photons emitted during transitions between levels. Then ask me to explain absorption and emission spectra and why they provide evidence for discrete energy levels in atoms.

What this helps you practise:

Calculating photon wavelengths from energy level transitions and interpreting line spectra

How to use it well:

Use E = hf = hc/lambda to convert between energy differences and photon wavelengths; remember to convert eV to joules when using SI values of h and c.

Section 8

Astrophysics and Cosmology

Astrophysics is one of the most popular optional topics at A-Level and covers stellar classification, stellar evolution, cosmological distances, and the large-scale structure and evolution of the universe. It draws together concepts from across the entire physics specification.

At A-Level, you must understand the Hertzsprung-Russell diagram, stellar luminosity and temperature relationships, the Doppler effect for light, Hubble's law, and the evidence for the Big Bang theory including cosmic microwave background radiation and the observed abundance of light elements.

These prompts take you from the classification and life cycle of stars through to the deepest questions about the origin and fate of the universe. Astrophysics questions often require you to combine knowledge from multiple areas, so ensure your core physics is strong before focusing on this section.

Prompt 79: Stellar Classification and Luminosity

Copy this prompt into your AI tool:

Test me on the classification of stars. Ask me to describe the spectral classes (O, B, A, F, G, K, M) and their relationship to surface temperature. Then give me problems using the inverse square law for intensity and Stefan's law for luminosity. Check my calculations.

What this helps you practise:

Classifying stars by spectral type and calculating stellar luminosity and intensity

How to use it well:

Stefan's law L = 4 pi r^2 sigma T^4 links luminosity to surface temperature and radius; this allows you to compare stars of different types quantitatively.

Prompt 80: The Hertzsprung-Russell Diagram

Copy this prompt into your AI tool:

Give me an A-Level question on the Hertzsprung-Russell diagram. Ask me to sketch the diagram, label the main sequence, red giants, white dwarfs, and supergiants. Then ask me to describe the evolutionary path of a star like the Sun and a star much more massive than the Sun on the HR diagram.

What this helps you practise:

Interpreting the HR diagram and tracing stellar evolutionary paths

How to use it well:

Remember that the HR diagram has temperature decreasing from left to right on the horizontal axis; this is counterintuitive and a common source of misreading.

Prompt 81: Stellar Evolution — Low and High Mass Stars

Copy this prompt into your AI tool:

Quiz me on the life cycle of stars. Ask me to describe the stages from protostar to final remnant for both a solar-mass star and a star with more than eight solar masses. Include the role of nuclear fusion at each stage and the conditions for supernovae.

What this helps you practise:

Describing complete stellar life cycles for different initial masses

How to use it well:

The mass of the original star determines its fate: low-mass stars end as white dwarfs, while high-mass stars end as neutron stars or black holes after supernova explosions.

Prompt 82: Astronomical Distances — Parallax and Standard Candles

Copy this prompt into your AI tool:

Quiz me on astronomical distances, parallax, and standard candles at A-Level standard. Ask me to explain the parallax method for measuring stellar distances, define the parsec, and describe its limitations. Then ask about standard candles including Cepheid variables and Type Ia supernovae, and how they extend the distance ladder. Give me calculation problems involving parallax angle and distance. After each answer, check my reasoning and correct any errors. Present one question at a time.

What this helps you practise:

Measuring astronomical distances using parallax and standard candle methods

How to use it well:

Parallax works for nearby stars (up to a few hundred parsecs); for greater distances, standard candles such as Cepheid variables and Type Ia supernovae are needed.

Prompt 83: The Doppler Effect for Light

Copy this prompt into your AI tool:

Ask me to explain the Doppler effect for electromagnetic radiation. Then give me problems where I must calculate the recession velocity of a galaxy from its observed redshift using the formula delta lambda / lambda = v/c. Include a question linking redshift to the expansion of the universe.

What this helps you practise:

Calculating galactic recession velocities from observed redshift using the Doppler equation

How to use it well:

Redshift means the galaxy is moving away from us; the greater the redshift, the faster the recession velocity and, via Hubble's law, the greater the distance.

Prompt 84: Hubble's Law and the Age of the Universe

Copy this prompt into your AI tool:

You are an A-Level examiner. Set me a question on Hubble's law v = H0 d. Ask me to use it to estimate distances to galaxies from their recession velocities, and to estimate the age of the universe from the Hubble constant. Ask me to explain the assumptions involved. Mark my solution.

What this helps you practise:

Applying Hubble's law to estimate galactic distances and the age of the universe

How to use it well:

The age of the universe is approximately 1/H0; ensure you convert H0 to SI units (s^-1) before calculating, as it is often given in km/s/Mpc.

Prompt 85: Evidence for the Big Bang

Copy this prompt into your AI tool:

Ask me to describe the two key pieces of evidence for the Big Bang theory: cosmic microwave background radiation and the observed abundance of hydrogen and helium. Then ask me to explain why these observations support the Big Bang and are difficult to explain with a steady-state model.

What this helps you practise:

Explaining observational evidence supporting the Big Bang theory

How to use it well:

The CMB radiation has a near-perfect black-body spectrum at 2.7 K, consistent with the cooled remnant of an extremely hot early universe; this specificity is powerful evidence.

Prompt 86: Wien's Law and Black-Body Radiation

Copy this prompt into your AI tool:

Give me problems using Wien's displacement law lambda_max T = constant. Ask me to calculate the peak wavelength of radiation from stars of different temperatures and to determine the temperature of a star from its peak wavelength. Then ask me how black-body radiation relates to the CMB.

What this helps you practise:

Applying Wien's law to determine stellar temperatures from peak emission wavelengths

How to use it well:

Wien's law tells you the wavelength at which a black body emits most strongly; hotter objects peak at shorter wavelengths, which is why hot stars appear blue.

Prompt 87: Dark Matter and Dark Energy

Copy this prompt into your AI tool:

Present me with the evidence for dark matter, including galaxy rotation curves, and ask me to explain why the observed rotation velocities are inconsistent with the visible mass alone. Then ask me about dark energy and the accelerating expansion of the universe. Assess my explanation.

What this helps you practise:

Explaining the evidence for dark matter from galaxy rotation curves and the concept of dark energy

How to use it well:

Galaxy rotation curves show that stars far from the centre orbit faster than expected from visible matter alone; this implies additional mass that does not emit or absorb light.

Prompt 88: Supernova Types and Neutron Stars

Copy this prompt into your AI tool:

Test me on supernova types and neutron stars at A-Level standard. Ask me to explain the difference between Type Ia and Type II supernovae, including their progenitors and mechanisms. Then quiz me on the formation and properties of neutron stars, including their density, rotation, and how pulsars emit detectable radiation. Include questions on why Type Ia supernovae are useful as standard candles. After each answer, check my understanding and give feedback. Present one question at a time.

What this helps you practise:

Distinguishing supernova types and understanding neutron star formation

How to use it well:

Type Ia supernovae have consistent peak luminosity because they all occur at the same mass (the Chandrasekhar limit); this makes them reliable distance indicators.

Prompt 89: Synoptic Astrophysics Problem

Copy this prompt into your AI tool:

Give me an extended astrophysics problem that combines multiple topics: using Wien's law to find a star's temperature, Stefan's law to find its luminosity, placing it on the HR diagram, and using Hubble's law to estimate its distance from redshift data. Present this as a full exam question.

What this helps you practise:

Solving multi-step astrophysics problems combining stellar physics with cosmological calculations

How to use it well:

These questions test your ability to chain calculations together; each answer feeds into the next part, so check each intermediate result carefully before proceeding.

Section 9

Mathematical Skills and Synoptic Problem-Solving

A-Level Physics requires a strong mathematical toolkit. You must be confident with algebra, trigonometry, logarithms, exponentials, and basic calculus as applied to physical problems. Around 40% of the marks in A-Level Physics examinations depend on mathematical skills.

Synoptic problem-solving is the ability to draw on knowledge and techniques from across the entire specification to solve unfamiliar problems. Examiners increasingly design questions that cross topic boundaries, requiring you to identify which areas of physics are relevant and how they connect.

This final section focuses on the mathematical techniques that underpin the whole course and on developing your ability to tackle problems that span multiple topics. Building these skills will improve your performance across every paper.

Prompt 90: Rearranging Physics Equations

Copy this prompt into your AI tool:

Quiz me on rearranging physics equations at A-Level standard. Give me standard physics formulae and ask me to rearrange them to make different variables the subject. Include equations with squares, square roots, fractions, and reciprocals. Start with straightforward single-step rearrangements and progress to multi-step ones. After each answer, check my algebraic steps and correct any errors. Present one equation at a time and wait for my response before giving feedback.

What this helps you practise:

Rearranging complex physics equations to isolate specified variables

How to use it well:

Always perform the same operation to both sides simultaneously and write each step clearly; marks are awarded for correct algebraic manipulation even if the final answer has an error.

Prompt 91: Using Logarithms in Physics

Copy this prompt into your AI tool:

Test me on the use of logarithms in A-Level Physics. Ask me to take logs of exponential equations, linearise data for log-linear and log-log plots, and determine unknown exponents from experimental data. Include problems on radioactive decay and capacitor discharge.

What this helps you practise:

Applying logarithmic techniques to linearise data and solve exponential physics problems

How to use it well:

A log-log graph gives a straight line for power law relationships (y = ax^n), while a log-linear graph works for exponential relationships (y = ae^(bx)); choose the correct one.

Prompt 92: Trigonometry in Physics Problems

Copy this prompt into your AI tool:

Test me on trigonometry as applied in physics problems. Give me problems requiring me to resolve forces into components, calculate angles of incidence or refraction, and analyse vector triangles. Include problems involving small angle approximations and when they are valid. After each answer, check whether I use the correct trigonometric ratio and whether my calculator is in *the right mode. Present one problem at a time and wait for my response before proceeding.*

What this helps you practise:

Applying trigonometric functions to resolve vectors and solve angular physics problems

How to use it well:

Always check whether angles are measured from the horizontal or the vertical in a problem; using the wrong reference direction leads to sin and cos being swapped.

Prompt 93: Calculus in Physics — Differentiation

Copy this prompt into your AI tool:

Quiz me on differentiation as used in physics at A-Level standard. Give me physical situations where I must find a rate of change, such as velocity from a displacement-time function or the rate of decay of charge on a capacitor. Ask me to set up and evaluate the derivative, interpret the result physically, and check units. After each answer, verify my calculus and physical interpretation. Present one problem at a time and wait for my response.

What this helps you practise:

Using differentiation to find rates of change and turning points in physics contexts

How to use it well:

In physics, differentiation gives you the instantaneous rate of change; the gradient of any quantity-time graph at a point equals the derivative at that time.

Prompt 94: Calculus in Physics — Integration

Copy this prompt into your AI tool:

Test me on integration as used in A-Level Physics. Give me problems where I must integrate a function to find a physical quantity, such as displacement *from a velocity-time function, work done from a force-distance function, or charge from a current-time function. Ask me to set up limits and evaluate definite integrals. After each answer, check my integration, limits, and units. Present one problem at a time and wait for my response before giving feedback.*

What this helps you practise:

Using integration to calculate cumulative quantities from rate functions in physics

How to use it well:

Integration gives you the area under a curve; in physics, this always has a physical meaning — displacement, work, charge, impulse — so always state what your integral represents.

Prompt 95: Exponential Functions in Physics

Copy this prompt into your AI tool:

Present me with the key exponential relationships in A-Level Physics: radioactive decay, capacitor discharge, and absorption of radiation. For each, ask me to state the equation, sketch the graph, and solve problems involving time constants or half-lives. Test my understanding of the common mathematical structure.

What this helps you practise:

Recognising and applying exponential models across different physics contexts

How to use it well:

All these processes share the mathematical form N = N0 e^(-t/tau); recognising this common structure allows you to transfer problem-solving techniques between topics.

Prompt 96: Estimating and Checking Answers

Copy this prompt into your AI tool:

Quiz me on estimating and checking answers in physics at A-Level standard. Give me physical scenarios and ask me to estimate quantities using reasonable approximations and Fermi estimation techniques. Then give me completed calculations and ask me to check whether the answer is physically reasonable by considering units, order of magnitude, and limiting cases. After each answer, discuss my reasoning and suggest improvements. Present one task at a time.

What this helps you practise:

Developing estimation skills and using physical reasoning to verify calculated answers

How to use it well:

If your calculated speed is faster than light, or your calculated mass is negative, something has gone wrong; developing a sense for reasonable answers catches many errors.

Prompt 97: Interpreting Graphs Across Physics Topics

Copy this prompt into your AI tool:

You are an A-Level examiner. Present me with graphs from different areas of physics and ask me to interpret them. Include a force-extension graph, a V-I characteristic, a velocity-time graph, a decay curve, and a potential-distance graph. Ask me what information can be extracted from each.

What this helps you practise:

Interpreting and extracting physical information from graphs across all specification areas

How to use it well:

For every graph, consider what the gradient, the intercepts, and the area under the curve represent physically; these are the three standard pieces of information examiners ask about.

Prompt 98: Multi-Topic Problem — Mechanics and Fields

Copy this prompt into your AI tool:

Set me a synoptic problem linking mechanics with gravitational fields. For example, a satellite in orbit where I must use both Newton's laws and gravitational field theory to analyse the motion. Require me to identify which principles apply at each stage.

What this helps you practise:

Solving synoptic problems that link mechanics with gravitational field theory

How to use it well:

Synoptic questions reward students who can see connections between topics; when you learn a new topic, always ask yourself how it relates to what you already know.

Prompt 99: Multi-Topic Problem — Electricity and Fields

Copy this prompt into your AI tool:

Test me on a multi-topic problem combining electricity and fields in A-Level Physics. Present a problem that requires knowledge from both the electricity and fields topics, such as the motion of a charged particle in a uniform electric field, or the energy stored in a capacitor placed in a gravitational field context. Ask me to identify the relevant principles, set up equations, and solve step by step. Check my reasoning at each stage before proceeding.

What this helps you practise:

Solving synoptic problems linking electrical circuits with electric field theory

How to use it well:

These problems test depth of understanding rather than breadth of knowledge; focus on understanding the physics deeply in each topic rather than memorising isolated facts.

Prompt 100: Extended Open-Response Problem

Copy this prompt into your AI tool:

Present me with a six-mark extended response question typical of A-Level Physics papers. Ask me to construct a logical, well-structured argument using correct physics terminology. The topic should require me to link ideas from at least two different areas of the specification. Assess my quality of written communication.

What this helps you practise:

Constructing extended written responses with clear physics reasoning across topics

How to use it well:

Plan your extended response before writing; identify the key physics points, arrange them in logical order, and use linking phrases to create a coherent argument.

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.

GCSE
- English Language
- English Literature
- Mathematics
- Physics
- Biology
- Chemistry
- Geography
- History
- Computer Science
- Economics
- Business Studies
- Religious Studies
- Psychology
- French
- Spanish
- German

A-Level
- Mathematics
- Further Mathematics
- Physics
- Chemistry
- Biology
- Economics
- History
- Geography
- English Literature
- Psychology
- Computer Science

- Politics
- Business

IBDP

- Mathematics: Analysis & Approaches
- Mathematics: Applications & Interpretation
- Physics
- Chemistry
- Biology
- Economics
- Geography
- History
- English A: Literature
- English A: Language & Literature
- Psychology
- Business Management
- Computer Science