SUMMER HOMEWORK

PHYSICS

YR 11 INTO YR 12
TRANSITION BOOKLET

OCR A PHYSICS A (H156/H556)

Name: ____________________________

BEAL SIXTH FORM

ONE SIXTH FORM - TWO SITES - THREE PATHWAYS

PHYSICS

This bridging work MUST be completed before your first Year 12 Physics lesson. It will be checked and may be used alongside a transition assessment in September.

The aim is to strengthen the mathematical, practical and explanatory skills needed to begin A Level Physics confidently.

What do you do in your first year?

Exam board: OCR A Physics A (H156/H556). Year 12 covers Modules 1-4 and prepares you for the full two-year A Level course.

<table>
<tr><th>Content Overview</th><th colspan="2">Year 12 Assessment Overview</th></tr>
<tr><td rowspan="2">Content is split into four teaching modules:

• Module 1 - Development of practical skills in physics
• Module 2 - Foundations of physics
• Module 3 - Forces and motion
• Module 4 - Electrons, waves and photons

Practical skills and mathematical skills are assessed throughout.</td><td>Breadth in physics (01)
70 marks
1 hour 30 minutes
Modules 1, 2, 3 and 4</td><td>50%</td></tr>
<tr><td>Depth in physics (02)
70 marks
1 hour 30 minutes
Modules 1, 2, 3 and 4</td><td>50%</td></tr>
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During Year 12 you should expect:

- Frequent use of algebra, graphs, trigonometry, standard form and uncertainty.
- Practical work linked to the Practical Endorsement and assessed practical skills.
- Questions that require full explanations, modelling, evaluation and unfamiliar applications.
- Regular retrieval and synoptic assessment across all topics studied.

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Summer Transition Work - ESSENTIAL

1. Open the current OCR A Physics A specification and read the learning outcomes for Modules 1-4. Use the QR code or the official OCR link below.

OCR A Physics A specification (H556)
Current document used for this booklet: version 3.0 (March 2026).

2. Complete every First attempt box independently before using notes, websites or worked examples.
3. Check and improve each response using reliable GCSE resources, the OCR specification and an A Level textbook. Add corrections in a different colour.
4. For every calculation: write the equation, convert to SI units, substitute values, show rearrangement and give an appropriate number of significant figures.
5. Draw diagrams and graphs in pencil. Label axes with quantities and units, use suitable scales and show gradients or areas clearly.
6. Learn the meaning of command words such as calculate, determine, explain, discuss, evaluate, show and suggest.
7. Bring the completed booklet to your first Physics lesson. Incomplete or rushed work will be returned for improvement.

Summer Transition Work - RECOMMENDED

Read or watch one reliable item about a current physics application. Suitable sources include Physics Review, New Scientist, CERN, NASA, ESA, the Institute of Physics or a university physics page. Write down three new ideas and one question you would like to investigate.

Required resources

- A scientific calculator that you know how to use confidently.
- A folder, lined paper and dividers for Modules 1-4.
- Ruler, pencil, protractor and coloured pens for corrections.
- Graph paper and access to spreadsheet software for data analysis.
- Recommended textbook: OCR AS/A Level Physics A, ISBN 9781447990833, or the school-issued equivalent.

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Summer Plan

OCR A PHYSICS A
YEAR 11 INTO YEAR 12

This booklet is organised into six weekly sections. Complete the tasks gradually rather than leaving the work until the end of the holiday.

For each task, write what you know in the 'First attempt' column. Then check your work and add more precise A Level detail in the final column.

The booklet moves from core mathematical and practical skills into the Year 12 OCR scheme of learning for Modules 2, 3 and 4.

Week	Task
1	Modules 1-2: quantities, units, uncertainty, graphs and practical skills
2	3.1-3.2: motion and forces in action
3	3.3-3.4: work, energy, power and materials
4	3.5 and 4.1: Newton's laws, momentum, charge and current
5	4.2-4.3: resistance, electrical energy and circuits
6	4.4-4.5: waves and quantum physics

Foundations of Physics

2.1: physical quantities, SI units, prefixes and mathematical notation

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 1

Question	First attempt	Any additional detail?
State the seven SI base quantities and units. Express the newton, joule and volt using base units where possible.		
Convert 72 km h^{-1} to m s^{-1}, 450 mg to kg, 3.2 GHz to Hz and 640 nm to m. Give answers in standard form.		
Explain why 3.40 m and 3.4 m do not communicate the same measurement precision. Round 0.0078462 to three significant figures.		
Distinguish scalar and vector quantities. Classify distance, displacement, speed, velocity, mass, weight, energy and momentum.		
Use dimensional or unit analysis to decide whether $v^2 = u^2 + 2as$ and $P = Fv$ are dimensionally consistent.		
Write the meaning of Δ, λ, μ, ρ, θ and Σ in physics. Give one example of where each symbol may be used.		

Practical Skills and Data

Modules 1 and 2.2: measurement, uncertainty, errors and graph analysis

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 1

Question	First attempt	Any additional detail?
Define accuracy, precision, repeatability, reproducibility, resolution, uncertainty and anomaly. Give one practical example of each.		
Compare random and systematic errors. Explain how repeats, calibration, zero checks and larger measured intervals can improve data.		
A ruler reading is 84.0 ± 0.5 mm. Calculate percentage uncertainty. Explain how percentage uncertainty changes when a larger length is measured.		
For y = mx + c, explain how to determine gradient and intercept using a large triangle. State how units for the gradient are found.		
A spring gives extensions 3.0, 3.1, 3.2 cm at 2.0 N and 6.0, 5.9, 5.8 cm at 4.0 N. Calculate means and comment on proportionality.		
Plan a Hooke's law investigation. Include variables, apparatus, zero measurement, range, repeats, graph, limit of proportionality and safety.		

Motion

3.1: kinematics, graphs, constant acceleration and projectile motion

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 2

Question	First attempt	Any additional detail?
Explain the difference between distance and displacement, and between speed and velocity. Give one example where distance is non-zero but displacement is zero.		
A car increases speed uniformly from 6.0 to 24.0 m s^{-1} in 8.0 s. Calculate acceleration and distance travelled during this interval.		
Sketch displacement-time and velocity-time graphs for an object that accelerates, moves at constant velocity and then decelerates to rest.		
State the four SUVAT equations. Explain the conditions that must be satisfied before they can be used.		
A ball is projected vertically upward at 18 m s^{-1}. Calculate its time to maximum height and maximum height. Ignore air resistance.		
A projectile leaves a horizontal bench at 3.6 m s^{-1} and falls 1.25 m. Calculate time of flight and horizontal range.		

Forces in Action

3.2: free-body diagrams, moments, equilibrium, drag and pressure

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 2

Question	First attempt	Any additional detail?
Draw a free-body diagram for a box pulled along a rough horizontal floor. Distinguish contact and non-contact forces.		
Resolve a 120 N force acting at 35° above the horizontal into horizontal and vertical components.		
State the two conditions for equilibrium. A uniform 4.0 m beam of weight 180 N is supported at its centre: determine an unknown load using moments.		
Explain centre of mass and stability. Describe how base width and centre-of-mass height affect the likelihood of toppling.		
Explain how drag changes as a falling object speeds up and how terminal velocity is reached. Include resultant force and acceleration.		
Calculate the pressure 8.0 m below the surface of water using $p = \rho g h$. Explain why liquid pressure acts in all directions.		

Work, Energy and Power

3.3: energy transfers, efficiency and mechanical power

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 3

Question	First attempt	Any additional detail?
Define work done and explain when $W = Fs$ and $W = Fs\cos\theta$ should be used. State the unit of work.		
A 24 kg crate is pulled 7.5 m by a 95 N force at 28° above the horizontal. Calculate the work done by the pulling force.		
A 0.80 kg ball falls from a height of 12 m. Calculate its loss of gravitational potential energy and ideal impact speed.		
A car of mass 1250 kg increases speed from 12 to 22 m s^{-1}. Calculate the increase in kinetic energy.		
Define power and efficiency. A motor lifts 65 kg through 4.2 m in 8.0 s while taking 4.5 kW. Calculate useful power and efficiency.		
Explain conservation of energy in a pendulum and why its amplitude decreases in a real experiment.		

Materials

3.4: springs, stress, strain, Young modulus and deformation

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 3

Question	First attempt	Any additional detail?
State Hooke’s law and define spring constant. Explain the limit of proportionality and elastic limit.		
A spring extends 42 mm under a force of 7.5 N. Calculate spring constant and elastic potential energy stored.		
Distinguish elastic and plastic deformation. Describe what happens to atomic arrangements in each case.		
Define tensile stress and tensile strain, including equations and units. Explain why strain has no unit.		
A wire of length 1.80 m and area 1.6 × 10^{-7} m^2 extends 1.2 mm under 28 N. Calculate Young modulus.		
Sketch and annotate stress-strain curves for a ductile metal and a brittle material. Identify stiffness, yield, ultimate tensile stress and fracture.		

Newton's Laws and Momentum

3.5: dynamics, impulse, collisions and conservation laws

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 4

Question	First attempt	Any additional detail?
State Newton's three laws and give a different real-world example of each. Identify the interacting objects in a third-law pair.		
A 920 kg car has a driving force of 3200 N and resistive forces of 1100 N. Calculate resultant force and acceleration.		
Explain momentum and impulse. Show how impulse equals change in momentum and relate this to the area under a force-time graph.		
A 0.16 kg ball travelling at 18 m s^{-1} rebounds at 12 m s^{-1}. Calculate its change in momentum using a clear sign convention.		
Two trolleys of masses 0.50 kg and 0.80 kg collide and stick together. Use conservation of momentum to determine their common velocity from given initial velocities of +2.4 and -0.60 m s^{-1}.		
Explain how seat belts, airbags and crumple zones reduce injury using momentum, impulse, stopping time, force and pressure.		

Charge and Current

4.1: charge carriers, current, drift velocity and Kirchhoff’s first law

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 4

Question	First attempt	Any additional detail?
Define electric charge and current. Calculate the charge passing a point when a current of 0.85 A flows for 3.5 min.		
Explain conventional current and electron flow in a metal. State the charge on one electron and what is meant by quantisation of charge.		
A current of 2.4 A flows in a wire with 1.5×10^{29} free electrons m^{-3} and area 1.2×10^{-6} m^2. Use $I = Anev$ to calculate drift speed.		
State Kirchhoff’s first law and explain how it follows from conservation of charge.		
At a junction, currents of 1.8 A and 0.65 A enter. One branch carries 0.90 A away. Calculate the current in the remaining branch and state its direction.		
Compare charge carriers and current in metals, electrolytes and semiconductors.		

Energy, Power and Resistance

4.2: potential difference, emf, resistivity and component characteristics

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 5

Question	First attempt	Any additional detail?
Define potential difference and electromotive force in terms of energy per unit charge. Explain their difference.		
A component transfers 540 J when 45 C passes through it. Calculate p.d. and then the current if this occurs in 30 s.		
Derive $P = IV$, $P = I^2R$ and $P = V^2/R$. State when each form is most useful.		
Sketch and explain I-V characteristics for an ohmic resistor, filament lamp and semiconductor diode.		
Define resistivity. A wire is 1.8 m long, area 2.4×10^{-7} m^2 and resistance 0.095 Ω. Calculate resistivity.		
Explain why the resistance of a metal usually increases with temperature and why the resistance of an NTC thermistor decreases.		

Electrical Circuits

4.3: series and parallel networks, internal resistance and potential dividers

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 5

Question	First attempt	Any additional detail?
State the rules for current, p.d. and resistance in series and parallel circuits. Explain each using conservation ideas.		
Calculate the equivalent resistance of 4.0 Ω and 6.0 Ω resistors in series and then in parallel.		
A 12 V supply is connected to 3.0 Ω and 6.0 Ω resistors in parallel. Calculate total current and power in each branch.		
Define emf and internal resistance. A cell has emf 1.50 V, internal resistance 0.20 Ω and current 0.80 A. Calculate terminal p.d. and lost volts.		
Explain how a potential divider works. Derive an expression for output voltage across one resistor in a two-resistor divider.		
Design a temperature-sensing potential divider using an NTC thermistor. Explain how output p.d. changes as temperature rises.		

Waves

4.4: wave properties, superposition, standing waves, refraction and polarisation

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 6

Question	First attempt	Any additional detail?
Define amplitude, wavelength, period, frequency, phase difference and wave speed. State the relation between frequency and period.		
A wave has frequency 420 Hz and wavelength 0.82 m. Calculate wave speed and the time for 25 complete oscillations.		
Compare transverse and longitudinal waves. Explain why polarisation provides evidence that electromagnetic waves are transverse.		
Explain superposition, constructive interference and destructive interference using phase difference.		
Describe how standing waves form on a string. Define nodes and antinodes and relate string length to wavelength for the first three harmonics.		
Explain diffraction and refraction. Calculate refractive index when light slows from 3.00×10^8 to 2.03×10^8 m s^{-1}.		

Quantum Physics

4.5: photons, the photoelectric effect and wave-particle duality

1. Complete the 'First attempt' column without notes.
2. Use reliable GCSE/A Level resources and the OCR specification to correct and extend your answer.

WEEK 6

Question	First attempt	Any additional detail?
State $E = hf$ and $c = f\lambda$. Calculate the energy of a photon with wavelength 480 nm.		
Define the electronvolt and convert 3.2 eV into joules. Explain why electronvolts are convenient in atomic physics.		
Describe the observations of the photoelectric effect that cannot be explained by a classical wave model.		
Define work function and threshold frequency. Use $hf = \Phi + KE_{max}$ to explain how frequency and intensity affect emitted electrons.		
Light of frequency 8.0×10^{14} Hz illuminates a metal with work function 2.2 eV. Calculate the maximum kinetic energy of emitted electrons.		
Explain wave-particle duality and state the de Broglie relation. Describe how electron diffraction supports the wave model of matter.		

Mathematical and Practical Skills

A Level Physics readiness challenge

Complete each task without notes first. Show equations, conversions, algebra, units, significant figures and reasoning. Then check and correct your work.

Question	First attempt	Correction / improvement
Convert 4.75 mm^2 to m^2, 86 km h^{-1} to m s^{-1} and 520 nm to m. Give each answer in standard form.		
A length is measured as (0.842 ± 0.003) m and a time as (1.26 ± 0.02) s. Calculate speed and estimate its percentage uncertainty.		
Rearrange $E = 1/2\ mv^2$ to make v the subject, V = IR to make R the subject, and n = c/v to make v the subject.		
A force-extension graph has points (0.020 m, 3.1 N) and (0.080 m, 12.4 N). Determine the gradient, its unit and the physical quantity it represents.		
Plan an investigation using light gates to determine the acceleration of a trolley down a ramp. Include variables, measurements, repeats, graph choice, uncertainty and safety.		
A student records 4.28, 4.31, 4.29, 4.80 and 4.30 s. Identify the anomaly, calculate the best mean, comment on precision and suggest one source of systematic error.		

Unified Physics Challenge

Synoptic data analysis: a solar-powered model car

A model car uses a photovoltaic panel to power a motor. Use the data and ideas from across Modules 1-4.

Quantity	Value
Solar-panel area	0.050 m^2
Light intensity at panel	650 W m^{-2}
Panel efficiency	18%
Battery emf / internal resistance	12.0 V / 0.40 Ω
Motor resistance	5.6 Ω
Car mass / final speed	1.20 kg / 7.5 m s^{-1}
Representative wavelength	550 nm

Question	First attempt	Any additional detail?
Calculate the incident power and useful electrical power produced by the panel. State two reasons why the real output may be lower.		
Treat the motor as the external load. Calculate the current, terminal p.d. and power transferred to the motor by the battery.		
Calculate the kinetic energy of the car at 7.5 m s^{-1}. Estimate the minimum time needed to reach this speed using the motor power, then explain why the real time is longer.		
Calculate the energy of one 550 nm photon using $E = hc/\lambda$. Explain why photon energy depends on frequency rather than intensity.		
Plan an investigation to test how the acceleration of the car depends on light intensity. Include measurements, control variables, repeats, graph choice, uncertainty and risk management.		

Completion and reflection

My strongest GCSE Physics area is:	
The area I most need to revisit is:	
My specific Year 12 target is:	