Senior -Physics II

Course Overview

Physics II is an intensive one-week program designed for motivated students who have completed Physics I or have a strong foundation in mechanics, and are preparing for advanced Year 11 and 12 Physics. It offers a comprehensive and logically structured overview of the non-mechanical components of senior Physics across NSW, ACT, and IB curricula, exploring the fundamental forces and phenomena that shape our universe from the quantum to the cosmic scale.

Stepping away from purely computational approaches, students will explore the conceptual frameworks and elegant theories that unify seemingly disparate phenomena. From the statistical nature of heat to the quantum behaviour of light, from Einstein's relativity to the fundamental particles that constitute matter, students will develop an appreciation for physics as a coherent and beautiful description of reality.

The course emphasises how modern physics emerged from classical foundations, showing students the historical development of ideas whilst building intuitive understanding of concepts that often seem counterintuitive. Students will engage with the profound questions that physics addresses: What is the nature of light? How do fundamental forces shape the cosmos? What happens at the smallest scales of matter and energy?

Every student will receive a Wise Minds bespoke course book containing clear explanations, worked examples, real-world applications, and structured exercises—including conceptual problems and quantitative analyses that develop both mathematical skills and physical insight. By the end of the course, students will have not only mastered advanced physics content, but gained appreciation for the elegance and power of modern physical theories.

Course Delivery:

- Lecture-style classrooms
- Small group tutorials
- Workbooks and additional worksheets
- Examinations

Target students:

- Year 11 Students
- Year 12 Students
- Year 10 Students who have completed Physics I
- *Note: Year 11 and 12 Students do not need to have completed Physics I to enrol in Physics II.*

Key Course Information

Length: 40 Hours total

Dates: Monday 19th Jan to 23rd Jan

Times: 9am to 5pm daily

Positions: 20 students (First in best dressed)

Price: $800 for the entire week (Including GST)
Can be paid in two equal instalments

Relevant School Subjects

- 10, 11 and 12 Physics for the ACT, NSW or IB.
- Covers the core content of Year 11 and 12 and acts as a solid bridge between school and University Physics.

Enrolment:

Please email the course director below expressing your interest and request to be enrolled in the course.

Please note a deposit will be required to confirm your slot.

Course Director: Rhys@WiseMindsTutoring.com.au (Ph: 0489089919)

Course Convenor: Lachlan@WiseMindsTutoring.com.au (Ph: 0489071014)

Course Overview

1. Thermodynamics and Statistical Mechanics
- What is Statistical Mechanics
- Heat and Temperature
- Specific Heat Capacity
- Latent Heat
- Conduction, Convection, Radiation
- Modelling a Gas (Diffusion, Brownian Motion, Ideal Gas)
- Black Body Radiation
- Wien's Displacement Law and the Stefan-Boltzmann Law
- First Law of Thermodynamics
- Isobaric, Isothermal, Adiabatic, and Isovolumetric Changes
- Cycles and Engines
- Second Law of Thermodynamics and Entropy

2. Motion in Gravitational Fields
- Gravity and Satellite Motion
- Gravitational Potential Energy
- Describing Fields and Fields at Work
- Matter and Energy
- Particle Models and Field Models
- Fields and Field Lines

3. Electricity
- Electric Charge and Electric Fields
- Coulomb's Law
- Electric Current and Electric Circuits
- The Heating Effect of Electric Current
- Energy in Electric Circuits
- Resistance and Resistivity
- Series and Parallel Circuits
- Kirchhoff's First and Second Laws
- Electric Cells
- Capacitance

4. Magnetism
- Magnetic Materials
- Magnetic Fields
- Calculating Magnetic Fields

5. Electromagnetism
- Unified Electricity and Magnetism
- Particles in Electric and Magnetic Fields
- The Motor Effect (Force on Conductors)
- Electromagnetic Induction and EMF
- Faraday's and Lenz's Laws
- Magnetic Flux
- Transformers
- Applications: Motors and Generators

6. Electromagnetic Spectrum
- Electromagnetism and Light
- Spectroscopy

7. Light as Wave and Particle
- Review of Diffraction and Interference
- Young's Double Slit Experiment
- Black-body Radiation
- The Photoelectric Effect
- Electron Energy Levels
- Matter Waves
- Schrödinger's Equation
- Heisenberg Uncertainty Principle

8. Relativity
- Reference Frames and Galilean Relativity
- Einstein's Postulates
- Evidence for Special Relativity
- Minkowski Diagrams
- Relativistic Momentum and Energy

9. Nuclear Physics
- Review of Exponentials and Logarithms
- Models of the Atom
- Energy Levels, Emission and Absorption Spectra
- Fundamental Forces Introduction
- Radioactive Decay and Half-Life
- Mass Defect and Nuclear Binding Energy
- Nuclear Fission and Fusion
- Standard Model Particles
- Exchange Particles and the Higgs Boson
- Pair Production and Annihilation

10. Cosmology
- The Big Bang and Stellar Evolution
- Solar Systems and Schwarzschild Black Holes
- Galaxies and Astronomical Distances
- Stellar Characteristics and Evolution
- Redshift and Hubble's Law
- The Cosmological Principle
- Dark Matter and Dark Energy