

International Baccalaureate
Standard Level Physics

PHYS 442 Fall 2015 Year One

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Extra Hours: Mondays 4-6 PM Room 119

Textbook: *IB Physics Course Companion* 2014, by David Homer

Course Outline:

I. Week One - September 14th-18th

A. Circular Motion

Angular Motion
Angular Velocity
Angular Acceleration

B. Gravitation

Universal Gravitation
Orbits
Kepler
Gravitational Potential
Escape Velocity

II. Week Two - September 21st - 25th

A. Electrostatics

Charge
Conductors, Insulators and Semiconductors
Coulomb's Law
Electric Field
Gauss's Law
Electric Potential

III. Week Three - September 28th - October 2nd

A. Electrodynamics

- Current
- Resistance
- Capacitance
- Circuits

IV. Week Four - October 5th - 9th

A. Magnetism

- Magnetic Field
- Magnetic Force

V. Week Five - October 12th - 16th

A. Induction

- Motion of a conductor through a magnetic field
- Magnetic flux
- Electromotive force
- Induced currents

B. Electromagnetic Waves

- Maxwell's equations
- Changing fields in free space
- Vector waves
- Light and electromagnetic radiation
- Speed of light

VI. Week Six - October 19th - 23rd

A. Rotational Dynamics

- Torque
- Moment of inertia
- Equations of rotational motion for uniform angular acceleration
- Newtons second law applied to angular motion
- Conservation of angular momentum

VII. Week Seven - October 26th - 30th

A. Thermodynamics

- Kinetic Theory
- Temperature
- Internal Energy
- The first law of thermodynamics
- The second law of thermodynamics
- Entropy

VIII. Week Eight - November 2nd - 6th

A. Thermodynamics

Cyclic processes and pV diagrams

Isovolumetric, isobaric, isothermal and adiabatic processes

Carnot cycle

Thermal efficiency

IX. Week Nine - November 9th - 13th

A. Radioactivity

Radioactive decay

Fundamental forces and their properties

Alpha particles, beta particles and gamma rays

Half-life

Absorption characteristics of decay particles

Isotopes

Background radiation

X. Week Ten - November 16th and 20th

A. Nuclear Reactions

The unified atomic mass unit

Mass defect and nuclear binding energy

Nuclear fission and nuclear fusion

XI. Week Eleven - November 23rd - 25th

A. Review

XII. Spring

A. Energy Sources

Specific energy and energy density of fuel sources

Sankey diagrams

Primary energy sources

Electricity as a secondary and versatile form of energy

Renewable and non-renewable energy sources

B. Thermal Energy Transfer

Conduction, convection and thermal radiation

Black-body radiation

Albedo and emissivity

The solar constant

The greenhouse effect

Energy balance in the Earth surfaceatmosphere system

C. Quantization

Discrete angular momentum
Discrete energy and discrete energy levels
Transitions between energy levels
Plank Spectrum
Plank Constant

D. Particle Physics

Quarks, leptons and their antiparticles
Hadrons, baryons and mesons
The conservation laws of charge, baryon number, lepton number and strangeness
The nature and range of the strong nuclear force, weak nuclear force and electromagnetic force
Exchange particles
Feynman diagrams
Confinement
The Higgs boson