

# Level 1 Foundations of Physics

## Modern Physics: Lecture Summaries.

Chapters covered from "University Physics" by Young/Freedman. Note that this document may be updated over the next few weeks. Please check DUO regularly.

**You are expected to have read the relevant sections before the lecture.**

### Part I: Lectures 1-7 are on Chapter 37 – Special Relativity.

#### Lecture 1:

37.1 Invariance of Physical Laws [p1223-1226]

#### Lecture 2:

37.2 Relativity of Simultaneity [p1227-1228]

37.3 Relativity of Time Intervals [p1228-1233]

#### Lecture 3:

37.4 Relativity of length [p1233-1237]

#### Lecture 4:

37.5 The Lorentz Transforms [p1237-1241]

#### *Self-reading:*

37.6 The Doppler Effect for Electromagnetic Waves [p1241-1243]

#### Lecture 5:

37.7 Relativistic Momentum [p1243-1246]

#### Lecture 6:

37.8 Relativistic Work and Energy [p1246-1249]

#### *Self-reading:*

37.9 Newtonian Mechanics and Relativity [p1249-1251]

#### Lecture 7:

Not in book: Vectors in relativity

### Part II: Lectures 8-12 are on Chapters 38 and 39 - Photons: Light Behaving as Particles and Particles Behaving as Waves

#### Lecture 8:

38.1 Light Absorbed as Photons: The Photoelectric Effect [p1261-1266]

38.2 Light Emitted as Photons: X-ray production [p1266-1269]

#### *Self-reading:*

38.3 Light Scattered as Photons: Compton Scattering and Pair Production [p1269-1273]

**Lecture 9:**

38.4 Wave-particle Duality, Probability and Uncertainty [p1273-1279]

**Lecture 10:**

39.1 Electron Waves [p1286-1292]

**Lecture 11:**

39.2 The Nuclear Atom and Atomic Spectra [p1292-1296]

39.3 The Bohr Model of the Atom [p1297-1307]

**Self-reading:**

39.4 The Laser [p1307-1309]

**Lecture 12:**

39.5 Continuous Spectra [p1310-1314]

39.6 The Uncertainty Principle [p1314-1317]

**Part III: Lectures 13-21 are on Chapters 40 and 41 - Quantum Mechanics and Atomic Structure****Lecture 13:**

40.1 Wavefunctions and the 1-dimensional Schrodinger Equation [p1328-1338]

**Lecture 14:**

40.1 (Continued) Wavefunctions and the 1-dimensional Schrodinger Equation [p1328-1338]

**Lecture 15:**

40.2 Particle in a Box [p1338-1343]

**Lecture 16:**

40.2 Particle in a Box (continued) [p1338-1343]

**Lecture 17:**

40.3 Potential Wells [p1343-1347]

**Lecture 18:**

40.4 Potential Barriers and Tunneling [p1437-1350]

40.5 The Harmonic Oscillator [p1358-1354]

**Lecture 19:**

41.1 Three Dimension [p1364-1366]

41.2 Particle in a 3-D Box [p1366-1371]

**Lecture 20:**

41.3 The Hydrogen Atom [p1372-1379]

**Lecture 21:**

41.4 The Zeeman Effect [p1379-1382]

41.5 Electron Spin [p1383-1387]

**Lecture 22:**

41.6 Many-Electron Atoms and the Exclusion Principle [p1387-1393]

**Self-reading:**

41.7 X-Ray Spectra [p1393-1396]

**PART IV: Lectures 22-24 are a quick summary of Chapters 42 (Molecules and Condensed Matter), Chapter 43 (Nuclear Physics) and Chapter 44 (Particle Physics and Cosmology). The main content of the chapters are for self-study.**

**Self-reading:**

42.1 Types of Molecular Bonds [p1405-1408]

42.2 Molecular Spectra [p1408-1412]

42.3 Structure of Solids [p1412-1415]

42.8 Superconductivity [p1430]

**Self-reading:**

Chapter 42 Molecules and Condensed Matter [p1405-1430]

**Lecture 23:**

43.1 Properties of nuclei [p1439-1444]

43.2 Nuclear binding and nuclear structure [p1444-1449]

**Self-reading:**

43.3 Nuclear stability and radioactivity [p1449-1456]

43.4 Activities and half-lives [p1456-1459]

**Self-reading:**

Remainder of Chapter 43 Nuclear Physics [p1459-1471]

**Lecture 24:**

Chapter 44 Summary of Particle Physics (Sections 44.1-44.5) [p1480-1516]

**Self-reading:**

Chapter 44 Particle Physics and Cosmology [p1480-1516]