PH1530: Breakdown of Classical Physics

Learning Outcomes:

After this course you are expected to:

- Be able to describe the photoelectric effect and why classical physics could not explain the experimental observations.
- Know Einstein's interpretation of the photoelectric effect and explain how it predicts the experimental observations.
- Define the terms work function and stopping potential and know how to calculate them.
- Know how the energy of a photon is related to its wavelength.
- Explain what is meant by Compton scattering.
- Explain why gaseous atoms have discrete line spectra.
- Know how to determine the energy levels of an element from the wavelength of lines in its line spectrum.
- Define the Lyman, Paschen, Bracket and Pfund series of hydrogen.
- Explain the terms blackbody radiation, ultraviolet catastrophe.
- Draw the shape of the spectrum of blackbody radiation and know how it varies with temperature.
- Know how to apply the Stefan-Boltzmann law and the Wein Displacement law.
- Explain how Planck solved the problem of the ultraviolet catastrophe.
- Explain why heat capacity could not be explain by classical physics and know Einstein's interpretation.
- Know the principle of complementarity.
- Know the de Broglie relation for matter waves.
- Calculate the maxima or minima of a diffraction pattern with electrons or other particles.

Reading:

References to latest (11^{th}) edition of Young & Freedman, *University Physics* (2004)

- Sections 38.2, 38.3, 38.7, 38.8
- Sections 39.1

Previous edition of Young and Freedman, *University Physics with Modern Physics*.

- Section 40-2 Photoelectric effect
- Section 40-3 Line spectra
- Section 40-4 Nuclear atom
- Section 40-8 Continuous spectra
- Section 40-9 Wave-particle duality.