Physics 206 – Spring 2019
Unit R Exam Study Guide

- Failures of classical theories/experiments that led to Special Relativity
- The Postulates of Special Relativity
    1. The laws of physics are Lorentz invariant
    2. The speed of light is the same in all reference frames
- The light cone and causal structure
    1. Timelike region / vectors
    2. Lightlike region / vectors
    3. Spacelike region / vectors
- Lorentz transformations (both forms)
- Know the difference between:
    1. Coordinate time
    2. Proper time (path length)
    3. Spacetime interval (shortest distance)
- Length contraction
- Time dilation
- Paradoxes and resolutions (pole in the barn and twin paradox)
- Know how to work with two-observer spacetime diagrams (calibration hyperbolae, measurements as seen from different frames, *etc...*)
- Know how to represent Lorentz transformations on ST diagrams (hyperbolic rotation)
- Relativistic velocity addition formula (derivation and applications)
- Four position, velocity, and momentum definitions
- Conservation of four momentum
- Mass as a Lorentz invariant quantity (length of four momentum vector)
- Conservation of four momentum on an (E, t) diagram
- Index notation basics
- the Minkowski metric ($ds^2 = g_{\mu\nu}dx^\mu dx^\nu = dt^2 - dx^2 - dy^2 - dz^2$) and its Lorentz invariance