

Study Guide for Physics 1180 Exam #3

Note: The exam will consist of both multiple-choice questions (about 35) and short problem solving questions (about 6). There is EXTRA CREDIT embedded within the exam.

Measurement

Be able to keep track of units and be able to use conversions. For example:
Given: Speed = 60 mile per hour, what is this speed in meters per second?
(You would be given that 1.6 km = 1 mile, and 1000 m = 1 km).

Elementary Particles

Know the basic structure and constituents of atoms: protons & neutrons in the nucleus, and electrons surrounding the nucleus.

Know the basic organization of the Periodic Table of Elements: increasing atomic number, Z ; elements in the same columns have similar chemical properties.

Know the terminology: Atomic number, Z ; atomic mass number, A ; be able to determine the number of protons and neutrons in a given nuclide.
Example: cesium-137 has how many protons and how many neutrons?

Know the different decay mechanisms: alpha, beta, and gamma decay; know how each decay affects the daughter nucleus
Example: in alpha decay, the atomic number decreases by 2 and the atomic mass number decreases by 4.

What is the “half-life” of an unstable nucleus? Be able to calculate the age of a radioactive sample given the half-life and the percentage of unstable nuclei remaining. (See Example 2 on p. 107 of Griffith’s text.)

What is binding energy? Be able to calculate the energy liberated in a nuclear reaction by calculating the Δmc^2 between the reactants and the products.

Distinguish between a fission reaction and a fusion reaction.

Know the terminology: baryons, mesons, leptons, neutrinos, quarks.

What are the four fundamental forces? (strong, weak, EM, and gravity)

Be able to apply conservation laws (charge, lepton #, baryons #, strangeness, etc.) to predict the outcome of a particle reaction.

Be able to interpret simple Feynman diagrams.

Be familiar with the quark model: quarks come in 6 “flavors”; quarks carry “color charge”; recognize that baryons are made of 3 quarks and mesons are made of a quark-antiquark pair; quark combinations making a particle have to be “color-neutral.”

Cosmology

Know that the universe is believed to have begun in a giant explosion called the *Big Bang* about 13.7 billion years ago. What is the *cosmological principle*?

What is the cosmological redshift? What is the evidence that the universe is expanding?

Be able to apply the Hubble law to determine the speed of a distant galaxy based on its distance from us or vice versa.

What is “blackbody radiation?” Be able to make qualitative determination of relative temperatures of objects based on their spectral distributions.

Be able to apply the Stefan-Boltzmann law to calculate the power radiated by an object that has a certain size and temperature.

Be able to apply Wien’s law to determine the peak wavelength of the spectral distribution of an object given its temperature or vice versa.

What is the current temperature of the universe? How do we know?

How did the heavy elements form?

What is *dark matter*? What is the evidence for its existence?

What is *dark energy*? Know that the universe is expanding and that its rate of expansion is not slowing down (as earlier believed, but is in fact increasing).