Astronomy 110 Review – Fall 2009

The exam will have around 60 multiple-choice questions and 5 short answer questions. **You need the same grademaster as last time, Form 27640.**

The new material includes the following topics from class and Ch. 4, 5, 6, 9 &10 (7^{th} and 8^{th} editions). Ch 4: all (but we had the Doppler effect on the last test). The four fundamental forces and elementary particles are discussed in Ch. 4, but we covered more in class.) How to write the symbols for different isotopes, as we discussed in class. Ch. 5: all. Ch. 6-5 through 6-7. Ch. 9: all except 9-4 (8^{th} ed.) or 9-2 (7^{th} ed.) and the details of classification of meteorites). Ch. 10: through section 10-8 except for the details of magnetic fields and surface features (found in 10-4 through 10-6). Note: the material on the details of nuclear reactions in 10-8 and how to make a solar model will be postponed to the next test along with section 10-9.

Do not consider this a list of definitions to memorize. Understand the meaning, use, and importance of all these topics and ideas as well as memorizing any necessary definitions. The list is fairly complete, but it is not guaranteed to be 100% inclusive.

The Four Forces.

Gravity, the electromagnetic force, the strong nuclear force, the weak nuclear force. What do they do? How strong are they (relative to each other)? Over what range do they act?

Elementary Particles: protons, neutrons, and electrons. What are their properties?

Why is the electromagnetic force usually observed only over short distances?

Black Body Radiation. In the formulae below, you need to know the general relationships, not the details. For example, you need to know that power per area depends on temperature, not that it is related to the fourth power of temperature (but it wouldn't hurt!).

The Stefan-BoltzmannLaw:

$$\left(\frac{Power}{Area} \propto T^4 \right)$$

($\propto$ means "proportional to").

Wien's Law ($\lambda_{peak} \propto \frac{1}{T}$) - an inverse proportionality.

Surface area $= 4\pi r^2$

Luminosity = (power per area) × (surface area) = (total energy/second from a star).

Kirchoff's Laws

What are the conditions for continuous, emission, & absorption spectra?

Protons, electrons, and neutrons

Atoms, ions, and isotopes – (their structure and how to name them and write their symbols)

Energy levels or electron orbits.

Absorption and emission of photons from atoms (caused by electrons moving between orbits).

How does this relate to energy? Hint: what determines the energy of an emitted or absorbed photon?

How is an ion formed?

Pressure, temperature, and density (what do they have to do with each other?)

Formation of the solar system from a rotating cloud and disk

What is the solar system primarily made of? The Earth?

How do the planets form? What happens after the planets form?
What happens to all the H and He in the inner solar system?
9 planets (or former planets!) and their names (My Very Excellent Mother Just Showed Us Nine Planets)
Why is there a division into 3 distinct parts of the solar system?
Inner planet: rocky & small (What didn't they form with?)
Outer planets: gaseous & big. Why do they attract H and He?
Pluto, comets, & KBOs (Kuiper belt objects)
What is the importance of rotation in the collapsing cloud?
Counterclockwise orbital motion in one plane (more or less). Why?
Counterclockwise rotation of planets. Why? (same reason as above)
How big are the moons?
Small objects – where do they fit in? Comets (Oort cloud and Kuiper belt), meteors & asteroids; meteor showers

Finding planets around other stars. What do you find? How do you find them?

Moon
Its formation. How? When?
Features on the surface. Formation of craters and maria. – When?
Radioactive age dating.

Earth
Age of the Earth and Moon (determined how?)
What are the chances and effects of collisions with asteroids?

Heat transfer mechanisms; what are they & which occur in the Sun? Where?
Convection
Conduction
Radiation

Sun and nuclear reactions
Layers of the sun and their relative temperatures (Interior: core, radiative zone, convective zone. Atmosphere: photosphere, chromosphere, transition region and corona).
Hydrostatic equilibrium.
Temperature of the core and the photosphere.
What makes the Sun shine - and what doesn't?
Basic types of nuclear reactions (how do we write the names of the elements?)
Fission – Why not in the Sun?
Fusion – Which reaction powers the Sun?
$E=mc^2$ (mass to energy - what's that mean?)
Why is the Sun stable? Hydrostatic equilibrium.

Note: the following topics will be postponed until the next test.
The *details* of the proton-proton cycle (hydrogen $\longrightarrow$ helium)
How do you overcome the repulsion of two positive nuclei?

Where do the neutrons come from?
Antimatter. What happens when it comes in contact with matter?
Where does the energy come from?

How (roughly) to model the solar interior
Solar Oscillations
Neutrinos and their importance for understanding the Sun
The solar neutrino problem and its solution

Possibly useful review questions (I did not include any computational questions) (also, understand the "Key Ideas" and "Key Words"). Numbers in [ ] will be postponed until the next test.

8th edition.
What did you think? Ch. 4: all. Ch. 5: 1,2,4. Ch. 9: all. Ch. 10: all.
Ch 4: 1,2,4,5,6,7,8,9,10,11,12,13,14.
Ch. 5: 1,2,4,5,9.
Ch. 6: 4,15,16,17,20,23.
Ch. 9: 1,2,4,5,7, 11,13,15,17,19,20.
Ch. 10: 2,4,8,9,10,[11,12],13,14,[15].

7th edition.
What did you think? Ch. 4: 1,2,3. Ch. 5: 1,2,3,6. Ch. 9: all. Ch. 10: all.
Ch 4: 1,2,3,4,5,6,7,8,9,10,18.
Ch. 5: 2,4,5,9.
Ch. 6: 2,13,14,15,18,21.
Ch. 9: 1,2,4,5,6,8,9,11,14,17,18.
Ch. 10: 2,4,8,9,10,[11,12],13,14,[15].

Here are most of the questions I gave for homework in previous classes. You will not have to do numerical calculations on the test.

1) You can consider stars to be blackbodies. A star with temperature T=10000K emits the greatest intensity of light at a wavelength of approximately 300 nm (290 nm, actually), in the ultraviolet. Is a star with T=5000K bluer or redder? At what wavelength does it emit the greatest intensity? You will need Wien's law for this problem. It is given on page 98 (89) . You need to show some sort of reasoning; don't just to write down a number for an answer. You don't need to use the constants that appear in the equations. Just think about ratios and proportions. You can read about the Kelvin temperature scale on page App-7 (433). Page numbers are for the 6^{th} (5^{th}) edition. [numbers not required for test]
2) Consider two stars of the same size. One is twice as hot as the other is. Which one is brighter? By how many times? You need the Stefan-Boltzmann law. [numbers not required for the test]
3) The formula which tells you the surface area of a sphere of radius r, is surface area=$4\pi r^2$. Stars are spheres (close enough, anyway). If you have two stars of the same surface temperature, but one has 100 times the radius of the other, which is brighter? [numbers not required for the test]
4) What kind of spectrum does a hot solid, liquid or dense gas produce? Describe what this spectrum looks like. What would you see if you looked at the spectrum of such an object through a much less dense, cooler gas?
5) Explain (briefly) how an emission or absorption line spectrum is related to the structure of the atom. Why are the spectra of different elements different from each other?
8) How different would the solar system be if it had formed from a cloud of gas that was not rotating as it collapsed?

For next test.

9) Why are very high temperatures necessary for nuclear fusion to occur?
10) The temperature of the solar corona can reach several million K. Why does nuclear fusion not occur there?
11) Why do neutrinos tell us what is happening near the center of the Sun now, while the photons that we see tell us what was happening a long time ago?