Review Questions for Examination #2

Describe the characteristics of the emission and absorption spectra of solids, liquids, and gases. How does the appearance of the spectrum depend upon the physical properties (size, temperature, composition, *etc.*) of the emitting or absorbing object.

What would you expect the spectrum of moonlight to look like? Mars? Please explain your answers.

Why is the sky blue? Why does a rising or setting Sun (or any other object) look red or orange?

Light interacting with matter can undergo refraction, reflection, scattering, absorption, and dispersion. Describe each of these phenomena, giving an example of each from everyday experience.

Which phenomena exhibited by light indicate a particle-like nature? A wavelike nature? In what important respects does the observed motion of light differ from that of other waves and particles?

Briefly explain what is meant by the inverse-square law and by the Doppler effect as applied to light. How do these phenomena depend upon the physical (temperature, mass, etc.) and spatial (location, motion, etc.) properties of the source of light and the observer?

Newton's version of Kepler's Third Law differs from Kepler's version. What is this difference and why is it so important? (*i.e.* What is it good for?) Why didn't Kepler notice that his version wasn't quite right? Where do we apply this Law when studying stars?

What is the Law of Gravity? Upon what does the gravitational force of one object upon another depend? What characteristic of gravity gives rise to Kepler's Second Law (The Law of Areas)?

Explain how we might determine for a planet its (a) mass, (b) radius, (c) mean density, (d) albedo, and (e) rotation period. Summarize the basic differences in these quantities between the Jovian and Terrestrial planets. What are the other differences between them?

The Random-Capture hypothesis presumes that space is full of unattached planets and the Sun has captured nine of these bodies, plus other stuff, to make the present-day solar system. Which of the orbital and physical properties of the planets are inconsistent with this idea? (Why don't we believe that the solar system resulted from a close interaction between the Sun and another star either?)

Explain the nebular/protoplanetary hypothesis. How does it explain the basic differences between the Jovian and Terrestrial planets? (What is a "refractory" material? A "volatile" material?)

What is the greenhouse effect? What causes it and what effect does it have upon the inner planets?

Explain why the planets are observed to show brightness variations and regular episodes of retrograde motion. Explain how these phenomena are related. (What are the synodic and sidereal periods of a planet? How are they related?)

What is meant by planetary "differentiation"? How is this related to the internal structure of the Earth? What is necessary for it to occur?

Give a brief description of the solar system accompanied by a sketch. The latter should show the relative placement of the planets and other constituents as well as indicating their directions of rotation. Provide both "top" and "side" views. Indicate where one is most likely to find asteroids and sketch a typical comet orbit.

Explain how one uses the phenomenon of radioactive decay to determine the age of a rock. What is meant by this "age" anyway? What is the Earth's age? What about the Moon, asteroids and Mars?

What is the zodiacal light? Where and when would you look for it? What causes it?

Neither Pluto nor Mercury has an appreciable atmosphere, yet both Neptune and Venus have rather thick ones. Why? (Hint: Explanations for Mercury and Pluto are very different)

The Earth's atmosphere is mostly nitrogen and oxygen while those of its neighbors are largely carbon dioxide, which is rare in the terrestrial atmosphere. Why is this? (Hint: Where did the carbon dioxide go and where did the gaseous oxygen come from?)

What are the differences between meteors and comets in terms of their appearances, their orbits, and their physical properties? What clues do they provide for the early history of the solar system?

Describe the most basic ways of determining the distances to stars. What difficulties or shortcomings are associated with each method? What is the typical distance between stars in our neighborhood?

How do we determine the motions of stars through space? What are the necessary measurements? How is the Sun's motion determined? (What is this motion with respect to?)

Sketch a Hertzsprung-Russell diagram, labeling the axes. Indicate where on this diagram you would find the (a) most luminous hot stars, (b) the smallest hot stars, (c) the Sun, (d) the largest stars, and (e) the least massive stars, (f) objects just about to become "proper stars", (g) Jupiter.

Describe how stars are classified upon the basis of their colors and the appearance of their spectra. How is a star's classification related to its physical properties? (What is the sequence of types?)

How are stellar masses determined? What sorts of observations are necessary to accomplish this?

Stellar sizes (radii)can be measured or estimated in a number of ways. Describe at least two methods.

What does the spectrum of a star look like? What sort of information about a star can be obtained from an examination of this spectrum?

In what part of the electromagnetic spectrum does a typical star radiate the most energy. Why?

Briefly describe the various categories of binary stars. How common are they? Why are studies of these objects so critical to our understanding of stellar structure?

What is mean by a star's (a) proper motion, (b) radial velocity, (c) tangential velocity, (d) parallax, and (e) luminosity?

Stars are classified as "dwarves", "giants", etc., on the basis of their size. How do we know that red supergiants, for example, really are larger than red giants?

Although they really extremely common objects in our galaxy, why are so few (i.e. none) white dwarf stars visible to the unaided eye while one can easily see numerous examples of the much rarer giants?

What is the mechanism from which main-sequence stars derive their energy? What about pre-main sequence stars? Giants and supergiants? White dwarves?

What is the effect of the interstellar dust and gas upon the appearances of distant stars? How does this affect determinations of distance?

What are the most common kinds of stars? How do we know this? What are the most common kinds of main-sequence stars?