PX 144: Introduction to Astronomy: Major concepts

Introduction

One of the difficulties with a partly rather descriptive subject as that covered by the "Introduction to Astronomy" module is that it is sometimes very difficult for you to see what material has just been presented for your general physical knowledge, and what material is assessed. It has been pointed out to me that I should make this clearer in the lectures. In future years I will do so, but given that it is too late in the lecture now, I feel that it is only fair for me to try and compensate for this admitted shortcoming of the lectures by trying to summarise the major concepts of the module here to help you with revising the module.

General rules of thumb

The following general rules of thumb apply perhaps to all modules you will ever attend:

- If a certain subject has been covered in the homework, it is deemed important by the lecturer and thus is material that will be assessed.
- If a certain subject has been covered more than once in the homework, it is even more important.
- If a certain subject comes up in the lectures more than once, or in more than one context, then it is important.
- Think where you learn *physics* as opposed to just memorising facts. The emphasis will always be on the former.

Solving all homework questions as well as the example exams is the best preparation that you will have for the exam. Solutions to all homework questions will be made available in due time, and long enough before the exam to allow you to check whether you understand the concepts.

Further training is also available by solving the questions following each chapter in Zeilik & Gregory. These are fairly easy to solve and provide for plenty of training.

Finally, I have distributed a cribsheet of the most important formulae. You are expected to know these formulae for the exam, however, do not memorise any numerical constants (such as h, σ_{SB}, $M_\odot$ and so on), as these will be given. You *are* expected to know orders of magnitude, though.

Major Assessable Items Covered By The Course

Elliptical Motion

- Kepler's Laws
- Kepler's 2nd law as a consequence of angular momentum conservation
- Derivation of Kepler's 3rd law for circular motion
- Velocity profile for circular motion
- major properties of ellipses: eccentricity, aphelion, perihelion, semi-major accis

Solar System

- Names of the planets
- Typical sizes of terrestrial and jovian planets.
- Major surface features and their origin (craters, evidence for plate tectonics, volcanism,...). be able to give a brief summary of the properties of each of the major planets (i.e., ask yourself whether you could compare, say, Venus with Mars, at a level that is understandable to your parents)
- Size scale of the solar system (AU!)
- Hydrostatic equilibrium (not the derivation, but the final equation for $P(h)$)

Stars

- Definition of parallax, small angle approximation
- Definition of the parsec, how many light years are in a parsec?
- luminosity, flux, $F = L/4\pi d^2$
- definition of magnitude, absolute magnitude, distance modulus
- order of magnitude values for solar luminosity, radius, mass, temperature
- principle of mass determination, Doppler effect
- luminosity and temperature range for stars
- spectral types, spectral sequence (OBAFGKM)
- Hertzsprung-Russell Diagram, location of Sun, main sequence, dwarfs, (super)giants, white dwarfs
- Stefan-Boltzmann law, Wien's law
- principal structure of a star
- energy generation through fusion (without numbers)
- major stages of stellar evolution (rough numbers for timescales only)
- general properties of white dwarfs, neutron stars, black holes (mass range, size scale, magnetic fields,... cf. summary slide of that section).

Galaxies

- Galaxy classification ("tuning fork diagram")
- major properties of ellipticals, spirals and irregular galaxies
- principle of mass determination, rotation curves
- major explanations for dark matter: MACHOS, WIMPS
- Distance determination: distance modulus, parallax (incl. typical range for today's measurements)
- Major standard candles: Cepheids as pulsating objects, Supernovae (origin, typical luminosity)

Cosmology

- Hubble relationship (formula and explanation)
- expansion, isotropy, homogeneity
- 3K radiation as relic of hot big bang
- major features observable in 3K radiation
- Ω and Λ (only brief explanation what is meant by them)