HOW TO DO WELL

1. **Classify the information.** Distinguish between data, facts, hypotheses and theories. Sort by topic. Identify and concentrate on those ideas and concepts which are of most general relevance.

2. Concentrate on the **physical principles**. Physics is valid throughout the Universe, and at all times, so a few principles help explain most features of the universe. If you understand the principles, you understand a lot.

3. **Analyze**. Try to reduce the information presented to its most basic elements, and then consider the relationships between these elements. For example, on the topic of "telescopes" you might ask the following questions: What are the purposes of a telescope? What are the main parts of a telescope? What shape and function do they each have? How do telescopes differ? Similarly, for "terrestrial planets": What is the mass and size? What physical principles determine their size? How common are they? What do they look like? How are they discovered and observed? These types of questions are important, because they motivate and direct research and discoveries, and they are likely exam questions.

4. **Synthesize.** Use what you learn to create the large picture. Try questions such as: List the objects in the solar system in order of distance, size, mass, age, density.

5. **Compare.** What is the difference between a star and a planet? Mars and the Earth have in common?

6. **Evaluate.** Why do we build telescope in space? Are they better than those on the ground?

7. **Visualize.** Visualization is the main way in which we think about astronomy and many other sciences. Learn to develop pictures in your mind: 3 dimensional movies of the objects which we discuss, and how they move.

8. **Be precise.** When describing astronomical objects and phenomena you must be extremely precise, and you must use the right words. If you describe a person as tall, young, and quiet, memories will be triggered. But to say that a planet is bright and distant is not sufficient because, compared to people, planets are much more varied. You have to say how bright (some are a million times brighter than others), and how distant. Compared to objects in your daily experience, the universe is full of variety and surprises.

9. Make sure that you can explain the **meaning of the key concepts**, including those listed as *new terms* at the end of each chapter in most text books.

10. **Memorize** some basic numbers, such as the age of the universe and solar system, the number of stars in our Galaxy, or the number of eclipses per year, because they provide a rough scale for comparison with different types of objects and environments. Also memorize and understand the definitions of the key concepts.

11. **Avoid Gaps.** You should be able to understand, and hence explain to someone else, everything in the text book. If something is not crystal clear then you should ask someone straight away. You can not afford to wait until just before an exam, because you may need that concept during the next few lectures. You do not need to know everything in the book. Specific examples, such as the names of individual stars, or the number of satellites, are usually not important.

If you are having trouble with a particular topic, read about that topic in several different books.

12. Sit at the front of the class and **ask questions**. Take clear notes, because they are the best way to learn the material, since you are forced to concentrate carefully while listening and writing.

13. Do some of the **problems** at the end of each chapter. Some of them will be in the exams.

14. Go to the **discussion sections** and ask about the lecture, the material in the book and the problems at the end of each chapter.

15. **Assess yourself**. The best way to check if you understand something is to explain it to someone else. Ask yourself, do I understand this? If not, seek help at once.

16. Read ahead in the book, because you will then get more from the class.

EXAM REVISION. There are three keys to success: 1) Predict what will be on the exam; 2) use your time carefully; and 3) be active during the revision, not passive (e.g. reading).

Collect past homework and exam questions. Analyze these past questions: what is the concept at the heart of each question? Make sure you completely understand the concepts and answers. Determine both (a) the types of questions (memory, analysis, synthesis ...) and (b) topics in past exams. What are the second best answers to the multiple choice questions? Make sure you can distingush between the best and second best answers. Predict questions, and work out their answers. Classify the objects encountered in the course in as many ways as possible (by mass, size,...). How do we know or measure the various preoerties of objects. Do not read the book, except when this helps with the above. Reading is a passive activity. It will not help much with exams which require you to work out answers.