

How to Study Astronomy

Introduction

Studying for Introductory Astronomy is not difficult, but it is a bit different from the studying you might be doing for a non-science course. These notes should help you use your time more wisely as you study astronomy. The key is to know what to study and how to study it.

What to Study

When we first begin studying a new subject, we see a vast sea of facts, and we may begin to sink. The key to staying afloat is to look for the main ideas and to let the facts fall into place. That may be obvious to you, but many people do not know how to do it. They sink.

First, how do you know a main idea when you see it? Just ask yourself, "What is the instructor (or textbook) talking about here?" Put it in your own words, but keep your answer to a single sentence. "Today we talked about..." "This section explains how..." Those are main ideas.

In a science course, the main ideas are usually theories, methods, or processes. Theories are specific, testable statements about how things happen. We might talk about the theory for the origin of comets, for instance. By a method, we will usually mean a way of getting information -- a method of measuring the velocities of comets for example. A process is a sequence of events leading to a certain result -- the process by which a comet forms a tail, for example. If you look for theories, methods, and processes and are able to discuss them, you have conquered the heart of the subject.

The main ideas must be supported by facts, and many students have trouble with all the facts in science courses. They even try to memorize the facts as if they were memorizing the kings of England. The key is to link the facts to the main ideas. The chemical composition of comets will be impossible to forget if you know the theory of their origin and the process by which they generate tails. If you know the main ideas, you won't have to spend hours memorizing meaningless, boring facts because the facts won't be meaningless or boring any more. You will remember them because they are necessary to support the main ideas.

In a science course, the most important facts are evidence, examples, and steps in a process. Look for statements that begin "We believe that..." "Because we see..." or "The same thing happens when...and when..." The first sentence here would warn us that evidence is coming, and the second should tell us that these are examples of evidence, a method, or a process. Steps in a process may be easy to recognize because they occur in sequence. "First this happens, then that, and finally that." Of course, things that are numbered are probably evidence, examples, or steps in a process.

Notes

Finding the main ideas and supporting facts will help you take notes. To use your notes well, you must look for the main ideas and supporting details. You can't write down

everything your instructor says, and it wouldn't do you much good if you could. You would never have time to review it all. Instead, you should be looking for the main ideas and the supporting facts. Your notes are not a textbook; they are a shorthand reminder of what you did in class.

In a science course a main idea can often appear in a diagram. A picture is worth a thousand words. If your instructor takes the trouble and time to draw it for you, it is probably important. Even if you recognize it from your text, sketch it in your notes and add the necessary labels. Then add the facts. Why is this diagram being discussed? What does it mean?

We have already mentioned some other items you will watch for in class: theories and their supporting evidence; methods and examples of their use; processes and the steps in each process. Watch especially for examples that illustrate these main ideas. When you hear "for example..." or "for instance..." or "this can happen when..." jot it down.

Of course you will want to record any sample problems done in class, but we will talk more about math later.

Finally, you should try to make your notes as clear as possible. You don't want to spend hours before a test trying to decode your notes. They are supposed to help you, not slow you down. You should read your notes over as soon after class as possible and add what explanations you will need later. A clue to incomplete notes is a diagram or formula with no comments.

The Textbook

The most common error made with a textbook is the failure to read it. Of course, you will read your book, but just reading is not enough. When you read a chapter, look for the main ideas and supporting facts.

You can find clues to the main ideas in the chapter by reading the section titles. Look at them and notice that they occur in a certain order. That order is a clue to what is important. Some books have main section titles and subtitles within a section. Don't ignore these clues; they are as good as free points on a quiz. Look through a chapter before you read it, and note the headings, read the figure captions, skim the tables. Get a preview of the chapter and its main ideas before you read it in detail.

You can also recognize main ideas by looking for a topic sentence in each major paragraph. The topic sentence is the one that tells what the paragraph is about. It is usually, but not always, the first sentence in the paragraph. If the author of the book went to the trouble of putting an idea into a separate paragraph with its own topic sentence, then it is worth noticing.

Just as you find main ideas in topic sentences, you can summarize supporting facts in key words. A key word is a word or phrase that will remind you of an important point later when you review. You don't have to carry all of the facts in active memory because the key word will recall them from your subconscious. For example, you don't need to memorize all of the details of the evolution of the moon if you remember the key words

"bombardment" and "flooding." If you understand the main idea and remember the key words, you don't have to memorize all of the supporting facts.

Topic sentences and key words can help you underline a text. There should be only one main idea per paragraph and it is probably in a topic sentence. Underline it. If you think you've found two or three in a paragraph, look again and see if they are really different from each other and if they are really main ideas. Once you underline a main idea, underline the key word or words that will remind you of the supporting facts and examples. You could even use different colors for main ideas and key words. If you underline a chapter this way, you can review rapidly. If you underline as most people do, everything will be marked and you will have to reread the entire chapter.

As an example, the previous paragraph is underlined to mark the main idea and key words.

Studying for Tests

When you study for a test you should remember four words...recall, comprehend, apply, practice. These words will make your studying more efficient and more productive.

Recall means "remember", and you have to remember something just to get started. Concentrate on the main ideas and the supporting facts. Look for theories, methods, and processes.

Just recalling things is not enough. You have to comprehend the ideas. That is, you have to understand. For one thing, you must know what the terms mean, and in a science many ideas are expressed in a vocabulary that will be new to you. Be sure you understand the new terms. Another step toward understanding is looking for connections between the supporting facts and the main ideas. "Why is the shape of a moon related to its mass?" The logical connections between facts are usually more important than the facts themselves.

Now apply what you are studying by making comparisons and drawing contrasts. "Jupiter is like the earth because it...but it is different because it..." Try to think of new examples to illustrate the ideas you are studying. These are not just mental exercises. They will help you understand what you are studying by applying the ideas to real situations. If you have misunderstood a main idea, it will probably become obvious when you begin trying to apply it to a new situation.

Finally, practice. Learning a body of knowledge can't be done in a single night, just as you can't learn to play the guitar by reading a book once through. You have to practice. Do the problems; think through the ideas; argue with a friend; draw and label the diagrams; find an empty room and explain an important theory to a chair. Do not allow a day to pass without practicing. Have you heard this old joke? A man asks a New York cab driver, "How do you get to Carnegie Hall?" The cabbie answers, "Practice baby, practice."

Mathematics and Science

The math we will do in Introductory Astronomy is simple. Mostly we use a few simple formulae to make rough calculations. We do not manipulate equations or venture into calculus. Anyone who can get into college can do the math we discuss.

There is, however, a secret method for success in the mathematical problems we do, and we have already discussed it. Practice. Do the problems in the book and the examples we do in class. Change the numbers and try them again. If you do each one a few times, they will be old hat when you see them on a test.

The math in this course is quite simple, but it is important, if only because it symbolizes the importance of mathematics in the sciences. Science is a way of studying nature, a way of thinking about the world we live in, and mathematics is just quantitative thinking. Of course mathematics is important beyond science. People who can think quantitatively will be the best in whatever field they choose. Those who say, "I'm not good at math," are really saying, "I can only think qualitatively."

How to catch up.

You can't. If it is a week before the final exam, and you are in deep trouble in this or any other course, it is almost too late. Go see your instructor immediately. Most courses, including Introductory Astronomy, are cumulative. Make a good start, work steadily through the semester, and you won't have to catch up.

The Most Important Thing

Educators at a major university studied thousands of students and tried to discover what the single most important thing students could do to improve their grades. The answer was simple. Go to class. Students who go to class almost always do better than students who don't. Going to class is more important than reading the book, more important than doing the homework, even more important than studying for tests. Of course, students who come to astronomy class and then nap, or read a newspaper, or translate their Latin assignment are not really present. Even if you can't spare the time for anything else, come to class and pay attention.

The First and Last Step

When in doubt, ask. If you begin studying a topic and can't figure it out, ask about it in class, before class, after class, or any other time you can find your instructor. Asking about confusing points should be the very first step you take in your studying. Asking for help is also a good last step. If you are having trouble with a single idea or an entire course, ask your instructor for a few pointers. Instructors like questions.

I hope these notes will help you with Intro. Astronomy. Perhaps they will help you with other courses. In any case, please don't hesitate to ask questions in class or out.

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