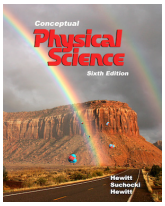
About This Course
Conceptual Physical Science —Astronomy



Thank you for signing up for Conceptual Physical Science—Astronomy. This article is much like a "users guide" to your Conceptual Academy course. It's full of many details, which we hope will answer most of your questions.

1. About Conceptual Physical Science—Astronomy
Astronomy is the study of outer space and the bodies that occupy this space, such as planets, stars, and galaxies. To truly understand astronomy requires a background in physics, including nuclear physics and Einstein's theory of relativity. This course provides that very background by taking advantage of the "non-astronomy" chapters of the Conceptual Physical Science textbook. Primarily, this involved a signficant rearrangement of the table of contents. For example, this course starts with Chapter 26 (The Solar System) before jumping to Chapter 2 (Newton's Laws). In this way, the student is able to apply the concepts of physics in a context of astronomy. You'll find this course is divided into 6 *units*, which are sub-divided into *lessons*. Each lesson is designed to take about one week to complete with the assumption that the student has other courses and extracurricular activities. For this course there are 26 lessons. Each lesson, however, is relatively short compared to our other courses making CPS—Astronomy easy to complete within a single semester or over a summer session. Having completed this course, the student will be in a good position to enroll in one of our more in-depth courses, such Conceptual Physics or Conceptual Chemistry.

2. Laboratories
Science and experiments go together hand-in-glove. For this CPS—Astronomy course, ample laboratory activities are included right within the weekly lessons. You need not purchase any mail-order lab kit. Instead, the materials for these activities, such as white glue, coins, and popsicle sticks, are readily available within your household or a discount store. You'll find these lab activities to be substantial and meaningful allowing the student to apply the concepts of physics and astronomy, which is an essential part of the learning cycle. These lab activities are collated from a the following sources:

1) You'll find the "Think and Do" activities described within the textbook end-of-chapter material. These activities tend to be short and sweet, as well as numerous.

2) We offer "PhET Labs" that make use of computer simulations created through the PhET program sponsored by the University of Colorado. The PhET simulations themselves are embedded within a lesson's From Your Instructor (FYI) page. For many of these simulations you'll also find within the Doc Share a write-up worksheet that guides the student through a simulation-based activity.

3) Select lab experiments are included from the Conceptual Physics *Beyond the Laboratory Manual* created by professor Stephanie Blake of Ozarks Technical College, MO. This creative manual features many engaging and mind-opening hands-on experiments utilizing only readily available materials. For each activity, after following through a prescribed set of instructions (guided learning), the student is then pushed to create their own experimental procedure on a related subject (inquiry learning).

4) We have selected relevant labs from our official *Conceptual Physical Science Lab Manual* and made them available to you through the FYI pages of this course. Like the other activities, these too require materials that should be readily available. For example, to measure a star's ascension, you need only a straw, protractor, pencil, and a weighted string.

3. Learning Philosophy

We are strong proponents of "interleaving", which means a student undertakes a series of shorter study sessions on different subjects rather than one long study session on a single subject. For example, the student might spend an hour studying physical science, followed by a history lesson. Interestingly, as the student is then studying history, the physical science lesson remains brewing at a deeper level—and vice versa with history as the student turns back to physical science.

We are also advocates of "Step 1/Step 2" learning. Step 1 is where the student is being introduced to material, such as through the textbook and video tutorials. Step 1 is an input process. You'll note the mouth is closed. "Step 2" is an output process where the student tries to articulate (output) that which they think they learned from Step 1. Of these two steps, Step 2 is arguably the more difficult. Students tend to avoid Step 2 or neglect its importance. Learning, however, is only deep and durable when BOTH Step 1 and Step 2 have been employed. See our "How to Study Effectively" document to learn more.

4. A Typical Student Day

What should a student's typical day look like? We find it generally best for the student to begin with a Step 1 activity, such as reading the textbook or watching a video tutorial. After completing each textbook chapter section or video, the student is encouraged to ask themselves a most powerful learning question: "What did I just learn?" and then to answer this very question aloud or in writing. In doing so, the student is interleaving a Step 2 activity within a Step 1 activity, which is awesome.

After working with the textbook and videos (and then maybe some history), the student should put effort into the "Practice Page" worksheets available from the Doc share.

The "Next-Time Questions", also available in select Doc Shares, make for a good family activity. Some one posts an NTQ (without the answer). It becomes a subject for discussion until the answer is revealed the next day.

There are the many end-of-chapter (EOC) questions within the textbook. These are an essential Step 2 activity for the student. Because of their great number, we recommend at least half of the odd-numbered questions be attempted. Notably, the student will find the answers to the odd-numbered questions at the back of the book. This is important for the student to be able to confirm their understanding. It's also important that the student try their best to answer the question BEFORE looking at the answer. Any good answer will "make sense" after reading it. But it's NOT the answer that matters. What counts is being able to come up with the answer on one's own. There's a world of a difference between reading an answer and creating that answer yourself.

Of course, any opportunity the student has to summarize (aloud) what they believe they have learned to classmates, friends, or family members, is a serious bonus to the learning process—on many levels.

In addition to the above activities, there are the labs and the unit exams.

5. Grades—Summative and Formative

In traditional academics, most students are more focused on their letter grade than the actual learning that letter grade is suppose to represent. When scholarships and admissions to competitive schools are at stake, this is understandable. Ideally, though, a higher letter grade reflects higher learning. But there are all sorts of exceptions. A student who has struggled for a "C" in a subject that is of sincere interest, is more likely to retain that knowledge over the long term, than a book savvy student who could care less but can still pull an "A".

We await the day when the standardized "Scholastic Aptitude Test" is replaced with a "Scholastic Attitude Test". In our experience as college professors, attitude is just as important as aptitude, if not more so.

It's not until grad school that many students begin to realize that the whole A|B|C|D|F grade system itself is to be taken with a huge grain of salt. What counts most is the learning. But more than mere "knowledge" the ideal goal is nurturing our innate curiosity. Then beyond curiosity, and much more valuable than a perfect SAT score, is helping the student grow into a responsible, well-adjusted, happy, loving, and productive individual who can support him or herself and a family with a career they actually enjoy.

The true value of a grade is not as a final end-all to a particular course of study. Let's call that a "*summative grade*". Rather, grades are more important as feedback that helps us

learn DURING that course of study. Let's call this a "*formative grade*". The value in a formative grade is in the guidance it provides while we still have time to make corrections—to let us know when we're on track and when we might still be holding onto misconceptions BEFORE the end of the semester.

We here at Conceptual Academy are not in a position to assign a final overall summative grade for each student. We feel this is more the prerogative of the teacher who has been working directly with the student throughout the course of study. We are, however, very much in a position to provide formative grades throughout. This comes in the form of the reading and video quizzes as tracked by the Conceptual Academy grade book, as well as the answers to the EOC at the back of the book, and the answers to the Practice Pages and NTQs available within the Doc Share, as well as the answer keys we provide for all unit exams and lab activities. Let's talk about these components one by one.

Reading and Video Quizzes

For context, you should understand how these quizzes are used at the college level. College students using Conceptual Academy are typically told they need to collect a certain number of CA quiz points by the end of the semester. How many points depends upon the needs of the course, where 400 is a typical number. For such a course, all students who acquire at least 400 points will earn a 100% on this assignment, which counts for about 15% of their total letter grade. In this scenario, students aren't penalized for wrong answers. They just need to keep taking quizzes until they earn these 400 points, and there are about 800 points possible! We call this a "carrot approach" such that Conceptual Academy is there to reward students for good study habits. Yes, they can click answers randomly. But that won't help them when it comes to their exams for which they are greatly penalized for their wrong answers (a "stick" approach).

So, in the college scenario, you've got one instructor with potentially 100+ students. For a home school self-study course where the student teacher ratio is closer to 1:1, then there's opportunity to take it to the next level, which means paying closer attention to the actual percentage of correctly answered questions as reported in the Conceptual Academy grade book.

For college students (where students may be tempted to click randomly), we find the percentage of quiz questions answered correctly hovers around 60%. For home schools, we see it hovering closer to 90%. Thus, if your student is hovering around 90% on these reading and video check questions, which are relatively easy, then your student is doing quite well. Please consider this along with what we expect of our college students in assigning any final summative letter grade. And for that letter grade, if you need to assign one, the reading and video quizzes should comprise only a minor component, such as 15%.

End-of-Chapter Questions

Most of the questions at the back of each chapter are presented in the short answer format. But which ones should your student answer? Here's a good rule of thumb:

Every other odd-numbered question is relatively ambitious. You'll note that the questions start out easy, then build in difficulty level. We feel the "Think and Explain" questions are of most value.

Now, "how" should your student answer these questions? Think of these questions as conversation starters. Ideally, the student has some one they can explain their thoughts to verbally. There's a discussion that leads to an agreement. Only then is the answer looked up in the back of the book. The student might rate themselves as to the quality of their initial answer on a scale of 1 through 5. At that point most students would just move onto the next question. We have a better alternative: Now that the student has been exposed to the "real answer", have them explain it again! (without looking at the answer). Then they rate again on a scale of 1 through 5. You'll see what's happening here is the student is articulating. As this is done, there are pathways within the brain that are literally being built. Durable learning is occurring! It requires effort. No one is exempt. It can be tiring. What to do when the student gets exhausted and feels like a sponge with all the water squeezed out of it?? Why not some physical activity or even history?

So, you should see that all the end-of-chapter questions are quite the resource for Step 2 learning. But how to grade their performance on these questions? The answer is: don't. Learning is still occurring. No grading please. But you might consider setting a goal for the number of questions worked upon. For example, 15 questions. Get through 15 questions and you'll have earned yourself a sticker, or better yet, a chocolate bar. Ultimately, the student should recognized that working on these EOC questions is great preparation for the unit exam. But beyond that, learning is its own reward. If all students could be brought to this understanding, we believe the bulk of problems in our nation's education system would melt away.

Practice Page Worksheets

These are pencil-pushing minds-on activities. In a way, they are similar to a lab experience, except it's all on paper. Our goal in creating these Practice Pages is to provide an enjoyable venue through which the student can *apply* what they think they understand. Please note: It's not like the student already understands something and then should be able to do the work sheet. It's the other way around! The understanding evolves only when the student is working on the worksheet.

This is similar to the end-of-chapter questions. The student may ask: How can I answer these questions if I don't first understand the material?? They have it backward. The real question is: How can you understand the material if you don't first work on these questions? The understanding itself arises from working on the questions. After Step 1? After reading the book and watching the videos? The student may feel they still don't really understand. That's correct. That's a wise student! An even wiser student knows that the understanding will grow like a seed from the soil only when watered by a stream of well-placed questions (Step 2). We call this "formative".

Unit Exams

Our unit exams can be considered a blend of both formative and summative grading, but with an emphasis on the formative. They are each presented in what at first seems like an unusual and complicated format, we call the "pyramid" format. But once you've been introduced to this format, you'll see it as a great learning opportunity. And fun too! You'll never want an exam presented in any other manner.

You'll find the pdf for each unit exam in the Doc Share on the last FYI page of each unit. Unlike the quizzes, and much like the Practice Pages, these are to be printed out. You'll find each exam begins with directions on how to run the exam in the pyramid format. Keep in mind that this format requires relatively tough questions. Your student is doing well upon earning around 60% on the first round! Make sure they understand this.

In assigning a final summative grade, performance on these unit exams should be weighted heavily. For college students, their exams typically account from 50% to 80% of their course grade (lecture component). This would include their final exam. We have not included a final exam in this course as we expect different students will be covering different material. But for a final exam, if you wish for such, it would be fair for you to collate 40 relevant questions from all the previous unit exams taken over the course. Use the very same questions. That's legit and we would argue preferable.

Lab Activities

Many colleges still follow a 3:1 credit system, whereby the student earns 3 credit hours for "lecture" and 1 credit hour for "laboratory". On some campuses the student earns a single grade for both lab/lecture. At other campuses, the grade for lecture and lab are recorded separately. So, one way or the other, the lab component counts for about 25% of the overall asessement. It is typical that a student's lab scores tend to lift their lecture scores, which are based primarily on the mid-term exams as described above.

For your Conceptual Academy course, we recommend the same kind of balance. Ideally, the hands-on lab activities are there to complement the more minds-on process of learning concepts. The two work together. Relative to a grade, consider granting your student 75% just for completing an activity. You might then nit-pick the remaining 25% on the quality of a student's writing or their answers to questions.

On a final note, the course concludes with a downloadable, high-resolution Certificate of Completion, pre-signed by us and awaiting the signature of the student's mentor.

6. Putting It All Together

In addition to the textbook, our library of video lessons (integrated with the textbook), the automated quizzes, the Practice Pages, Next-Time Questions, the unit exams, you will also find study advice from us authors on each FYI page, computer simulations, plus a

number of Easter egg surprises spiced here and there. And for responsive technical support, you need only write to Support@ConceptualAcademy.com.

We know you will find this self-study course to be unusually rich not only in content but in flavor. Our goals go beyond imparting knowledge. We aim to nurture a life-long curiosity about this amazing natural world in which we are blessed to live. We know this to be an important path to becoming good stewards. Further, the rules of nature are what we all have in common and as this world gets smaller, a focus on what we have in common becomes all the more important. Further still, understanding science for what it is, for what it can do, for what it can't do, for how it, for better or worse, has impacted our daily lives, is critically important for any student in this modern age.

Thank you for your support of Conceptual Academy. We are so please and honored to be working with you.

Good science to you!

The Conceptual Academy Team


Prof. Hewitt
Geology


Prof. Suchocki
Chemistry & Astro


Prof. Hewitt
Physics


Prof. Lyons
Earth Science


Prof. Yeh
Biology