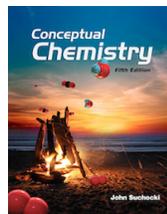


# About This Course

## Conceptual Chemistry — Prep Chemistry

2017 – 2018 Academic Year



Thank you for signing up for Conceptual Chemistry—the “Prep Chem” Version. 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 Prep Chem

This course is divided into 7 *units*, which are partitioned into a total of 31 *lessons*. The amount of material covered is sufficient for a full academic year of study. Each lesson is designed to take one to two weeks to complete with the assumption the student has other courses and extracurricular activities. If few or no other courses are being taken, then this course could potentially be completed over a single semester or the summer. You’ll find this course focuses on material relevant to basic chemistry and does not shy away from the more quantitative chapter sections of the textbook. Keep in mind that our “full version” chemistry course also doesn’t shy away from the quantitative and also works well as a “prep” for college level chemistry. This prep chem course, however, leaves out the last four “topical” chapters of the textbook providing the student more time to focus on the basics. This works well for students who have a natural interest in science and might consider taking general chemistry in college.

### 2. Laboratories

Science and experiments go together hand-in-glove. For this Conceptual Chemistry course you have two options: 1) light and free, 2) intensive and expensive.

1) For the “Light and Free” option it’s just a matter of performing just about all the “Hands-On Chemistry” and “Confirm the Chemistry” activities found in the textbook. These are easy to perform experiments using only household materials. For example, soak pennies in some salt water. This strips copper ions into solution. Place an iron nail in this solution and you will see the copper metal depositing on the nail within minutes. This activity is done in the context of electrochemistry as addressed in Chapter 11. These sorts of “home” activities were originally developed for a distance learning college level chemistry course where students were needing to perform experiments at home. They tend to be short and sweet. There are about 4 or 5 per chapter.

In the “Light and Free” category, you will find about half a dozen “simulations” already embedded into the course. For example, in Chapter 6, the student will encounter a

simulation that allows them to build molecular models and move them about in 3D space right on the computer screen.

Furthermore, this course also offers a few chemistry-related experiments borrowed from the popular “Beyond the Laboratory” physics manual developed by Stephanie Blake of Ozarks Tech College and edited by John Suchocki. For example, for Section 9.5, you’ll find an experiment that explores the atomic view of entropy. All the experiments in this popular “Beyond” manual use only materials readily available in the home or any discount store.

2) But for students seeking a much more dedicated laboratory experience, we have teamed up with the company eScience Labs, who offers three different Conceptual Academy customized chemistry kits we call: Helium, Neon, Argon. The Argon kit contains the most experiments and is the most expensive. This should be considered for cases where the student is clearly aiming for a career in a science-related field. A single Argon kit can also be nicely shared among several students who are taking the course together. In such a situation, we suggest each student takes a turn at being the “principal investigator”. Their role is to direct the others on how to actually run the lab while staying “hands-off”, which means this student has some work they need to do before everyone begins.

The Neon kit is a slimmed down (and more affordable) version of the Argon kit. For this life science chemistry course, it should be considered that the Argon kit includes labs on DNA—Forensics and Toxicology. For the Neon kit, the Toxicology lab has been omitted.

The Helium kit, in turn, is a slimmed down version of the Neon kit and designed to maximize impact while minimizing cost. (not having either the DNA nor the Toxicology labs). Still, any of these kits are relatively expensive. Of course, this is because each kit also includes equipment, which is shipped right to your home. If at all possible, we highly recommend you opt for one of these lab kits, which have been collated to match the Conceptual Chemistry curriculum. For more details, see our home school support site: <http://LearnScience.Academy>.

### **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 chemistry, followed by a history lesson. Interestingly, as the student is then studying history, the chemistry lesson remains brewing at a deeper level—and vice versa with history as the student turns back to the chemistry.

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**

So 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.

There are the many end-of-chapter (EOC) questions within the textbook, all of them partitioned by chapter section. 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. You should consider the following capstone learning activity: Once a student “completes” a chapter, have the student provide a verbal summary of the main ideas of the chapter. You can call this: “The Summary Challenge”. It’s not as easy as it might sound, but it’s a great way of identifying that which has been retained (or not). The process itself helps to make the learning durable. The student can then read the author’s own chapter summary, which you’ll find provided in the Doc Shares of the FYI pages. After reading the author’s summary, ask the student to give their verbal summary another try. It’s normal for students to stumble as they try their best to articulate what they think they learned.

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, which is closely related to good attitude. 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 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 summative 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 assessment. 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 the author 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, the unit exams, you will also find study advice from the author 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](mailto: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



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