



# Physical Science Syllabus

## 2019-2020

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<http://growingcos.org> [under construction]



### ◆ Overview ◆

Welcome to 9th grade Physical Science! We will investigate a range of science topics including the origins, development and structure of the Universe, atomic structure, basic chemistry and force, motion and energy. Solving complex and initially confusing science problems will require you to explore and research these topics in depth. In the process you will learn science knowledge through the practices of physical science--you will become a better problem solver and collaborator, that is, a better scientist..

### ◆ Becoming a Scientist ◆

While all scientists are unique, of course, it's well known that scientists typically have well-developed problem-solving skills and habits of mind. Scientists work as a community to solve theoretical problems. Solving these types of problems requires two very different types of capacities: Critical thinking and Creative thinking. For example, theory-improvement demands the critical thinking involved in carefully- collected evidence, solid logical reasoning that refers to reliable scientific knowledge. This type of thinking is essential in making sure the theories are trustworthy, however this analytical thinking is not enough.

The creative and imaginative side of science is equally important. Creative thinking is very different from critical thinking. When in this creative mode, one not only smells the rose, one also wonders at the thorns, the cracks on the stem, that bee crawling around the flower. Engaged in this type of thinking one asks, "Why...?" and "How does...?" questions. This type of thinking invents possible explanations to unexplainable phenomenon. And as the explanations are tested for limitations and weaknesses, it proposes solutions to these newly discovered problems. In summary, to create and improve scientific theories that help us understand our natural world, within their community, scientists alternate between these creative and critical ways of thinking to create and improve explanatory theories that provide an understanding of the natural world. This science class aims at presenting students with many opportunities and the needed support to grow in our classroom community as creative and critical problem solvers, as innovators of knowledge. (picture from: <https://www.buzzaboutbees.net/Which-Roses-Do-Bees-Like.html>)



As a final note, this type of creative and critical problem solving is important in every area of our life, whether we're acting in the role of a professional scientists, a friend, a student, a teacher, a parent, a carpenter, etc. These creative/critical practices are at the heart of the "Knowledge Age" and power the innovation required to solve the complex, unfolding problems of the modern world.

## ◆ Achievement ◆

### Is a focus on great grades incompatible with a focus on great learning?

It is considered common sense that grades, that is, an A, B, C, D or F, help us know how well we are doing and furthermore help motivate us to prioritize the hard work required to learn. It is therefore perhaps ironic that researchers have found three consistent negative effects associated with letter or number grades: Grades tend to...

1. ... *reduce students' interest in the learning itself.* (the focus of the motivation is on getting high grades)
2. ... *reduce students' preference for challenging tasks.* (self-esteem is more-easily based on successfully doing work then on making progress on understanding)
3. ... *reduce the quality of students' thinking, reducing learning to task completion.* (It's easier to just 'do' than to 'make sure you understand as you do')

Learning is complex and to maximize it we reflect often on how well we understand something or how well we can perform a skill. Recognizing that we don't understand something or can't do something very well can lead to setting new learning goals and growing positive habits. We also need feedback helping us know in what ways we are progressing and areas which need further effort. It is not the typical student to whom letter grades support this day to day reflection nor motivation to learn.

For these reasons, students are constantly encouraged to participate with the aim to understand, to try out new skills and ideas even when not confident of being correct. They are assured that it's more important to constantly work at the edge of their expertise, not only participating when confident at succeeding, of being right. Students will receive feedback as they participate in daily activities, helping them succeed and learn, encouraging them to push their limits. Content tests are also given, providing students the opportunity to test their knowledge of basic knowledge of the current area of study. Projects and longer term activities provide the opportunities to learn this knowledge as they apply it. In the process, they practice the critical and creative processes described in the previous section.

## ◆ Cooperation, Community and Personal Effort ◆

As a member of this learning community, students are ultimately responsible for their own learning. It is important to commit to engaging in the process. As a student, the following standards are expected of you:

1. **Give consistent effort.** Saving work "till the end" doesn't support learning, so please stay on top of it.
2. **Be in class, be on time.** Regular attendance is vital to your success. Class starts when the final bell rings. Coming late sets you behind and it is a disruption for the class. If you are absent, it is your responsibility to find out what learning/activities you have missed. Make up labs and tests after school.
3. **Come to class prepared.** Come with your lab book and pen/pencil. Come with thoughtful questions or related stories!
4. **Participate.** No one can do your thinking and learning for you. I only know what you know when you let me know what you know - so communicate! In addition, you are a leader in our classroom community: your questions and ideas make this science classroom unique and exceptional.
5. **Be safe.** For your own safety and that of others, you must read and follow lab instructions, ask questions when unsure, and use common sense. The lab safety contract remains valid.

6. **Get help.** If you are having trouble with the material, tell the teacher, sooner rather than later. The teacher is available most days after school from 3:10 - 3:40: stop by or better yet make an appointment. Come to After School Science Study every Thursday from 3:10 - 4:30.

### ◆ Course Grades and Due Date Policy ◆

Learning comes from effort! Learning happens through engaging in the science activities alone and in collaboration with others in our classroom community, striving for ever-more expert participation. Therefore, your grade is based partly on evidence of participation where you are pushing your limits and more expertly applying the language and practices of our science class. This includes easily measurable things like test scores and percent of work satisfactorily completed. It also includes evidence of active participation such as asking questions or giving answers or guesses in whole class discussions or seeking or providing help within one's table groups. Participation can involve quietly listening to others during whole-class conversations. It can involve contributing questions or explanations, research or summaries in our knowledge-building conversations on line. Participation involves using one's lab book to think: recording ideas and questions that come to mind, recording important ideas and vocabulary words, recording data or other observations, processing the knowledge with underlining and more. In summary, letter/number grades are used sparingly but are given at the end of a quarter and are based on achievements shown on tests, percent of work completion, lab book use, major projects and the many forms of participation described above.

Two things to note: First, not all students learn science concepts at the same rate, therefore students are provided with unlimited after-school opportunities to relearn and retest if they did not do well on a test. It is encouraged that all students continue working until they show an "A" level of understanding on all tests. Second, simple participation—task completion—will be indicated in the online gradebook to help answer the question, "is the student participating". Looking at the Score column, an "X" indicates an assignment was successfully completed on time. An "L" indicates it was successfully completed, but late. An "E" indicates it was excused and an "I" means it was incomplete and still needs to be completed. If the line has a red color to it that means the assignment was marked as "Missing". If there is no score, that means the teacher has not yet entered a score for the assignment. Late assignments will be accepted for full credit until the dates listed below. Late assignments will not be accepted after those dates. Clarification and reminders about exactly which assignments must be turned in by the due date will be provided in class.

<u>Quarter 3</u>	<u>Quarter 4</u>
Due Date 7 = 2-14-20	Due Date 10 = 4-24-20
Due Date 8 = 3-6-20	Due Date 11 = 5-15-20
Due Date 9 = 3-26-20	Due Date 12 = 6-3-20

### ◆ Cell Phone/Device Use ◆

Cell phones and other devices have a significant negative impact on learning which we have explored during this year. The teacher has created a charging stations for all types of phones and offers it for students who would like to charge their phone during class. Our initial cell phone policy is as follows:

1. Ringers and notifications must be off or on silent at all times.
2. Cell phones must be put away at all times unless used as a tool to learn science.

## ◆ Science Topics Investigated, questions explored ◆

This year we are going to focus on sustainability—the ability to sustain our planet as a productive and healthy place to live. Engineering and physical science have something to add to this! The students have an ongoing project we call “Indoor Farming” where they take the lead in developing, managing and improving our 64 square foot growing space. Students are growing as leaders and entrepreneurs as this project is starting to take off!

### Semester 1:

**Unit 1: Astronomy** - Electromagnetic Spectrum, Early History and Expansion of the Universe, Solar System Formation, Processes that Take Place in Stars, Life Cycles of Stars

**Unit 2: Atomic Structure and Behavior** – Development of Atomic Theory, Composition of Atoms, Periodic Table, Chemical Bonding, Organic Compounds

### Semester 2:

**Unit 3: Chemical Reactions** - Conservation of Mass, Chemical Formulas and Equations, Energy Change During Chemical Reactions, Fission, Fusion, and Radioactive Decay

**Unit 4: Motion and Forces** – Newton’s Laws of Motion, Doppler Effect, Scientific Experimentation, Experimental Design

**Unit 5: Energy** – Power, Work, Energy Transfer, Electricity including Circuits, Current and Voltage, Magnetic Forces, Coulomb’s Law, and Evaluation of Various Energy Sources for Generating Electricity

### **Essential Questions:**

How do scientists build knowledge? What is science? How does a scientist answer questions about the natural universe? How do people invent new things, ideas and processes?