Science

Nature Notebook
Nature Walks & Scouting
Physics Lessons
Physics Labs

Alveary

About the Course

This course includes the following topic(s): Physics Lessons, Physics Labs, Nature Notebook: Grades 9-12, Nature Walks & Scouting: Grades 9-12

About Nature Notebook: Grades 9-12
Outdoor work is established or continued as a lifelong habit. Optional resources are provided in science lessons and on the Alveary bookshelf.

About Nature Walks & Scouting: Grades 9-12
Outdoor work is established or continued as a lifelong habit. Optional resources are provided in science lessons and on the Alveary bookshelf.

About Physics Lessons
Physics students gain a solid, hands-on foundation in this living lecture series from Math without Borders. This course guides students through the process of challenging their established perceptions by building up new observations. The course provides extensive experience with technology and mathematical modeling for a stand-alone high school physics course or as a foundation for a future, calculus-based physics course.

About Physics Labs
Labs are an essential part of science in which students engage with the Things they are reading about and practice the scientific method. Labs for this course are integrated into the lessons to facilitate adequate time for more involved activities and to better coordinate with the lessons.

Placement & Combining Tips

Nature Notebook: Grades 9-12
Learners may be combined and follow their own interests.

Nature Walks & Scouting: Grades 9-12
Learners may follow their own interests or follow the plan of their local scouting troop or natural history club.

Physics Lessons
Recommended for students in 11th or 12th Grade, depending on math placement. Students should have completed Algebra II/Trigonometry and preferably be taking at least Precalculus concurrently with this course.

Scheduling

GRADE	SCHEDULE INFO.	BOOKS
9-12	Nature Notebook: Grades 9-12 1+ time/week 20 min+	
9-12	Nature Walks & Scouting: Grades 9-12 1 time/week 30 min+	
11-12	Physics Lessons 5 times/week 45 min	Home Study Companion: Physics Schaum's Outlines: College Physics
11-12	Physics Labs 1 time/week 60 min	

Sample Weekly View

Day 1	Day 2	Day 3	Day 4	Day 5
Science: Physics				
Physics Lessons Nature Walks & Scouting: Grades 9-12	Physics Lessons	Physics Lessons	Physics Lessons Nature Notebook: Grades 9-12	Physics Lessons Physics Labs

Planning & Prep

Permission to print for non-commercial use. See Alveary group use policy to use lessons in a group context.

LINKS: Click text or scan the QR code in the top corner of the lesson plan pages to view online resources associated with the lessons.

Responsibility for previewing all links rests with the teacher. All links were checked at the time of publication; however, websites change frequently and may contain objectionable content. Please report broken links by contacting us through our website.

Physics Lessons
☐ Carve out time to continue or establish the regular habit of spending time in nature, including the use of a nature journal, as appropriate.

☐ Obtain materials from the supply lists.

☐ Note that time stamps have been included for each video in your lesson plans, so that the lesson time can be better managed. Lectures that are a bit too long for a single lesson have been broken into parts.

☐ From the HSC Physics Unit 01 folder, review the PDFs Assessment, Installation, Course Overview, and License Agreement. We also recommend printing the Overview PDFs for each unit, as these provide an outline for the course. Keep these in your binder or folder.

☐ Shortcut/download Geogebra from the Quick Links.

☐ Download Tracker from the Quick Links.

☐ If your smartphone does not allow you to control shutter speed, download a camera app, such as ProShot.

☐ If you need a media player for this course, Mr. Chandler recommends the VLC media player. You may use whatever calculator you prefer.

☐ If you would like to use the same calculator as Mr. Chandler, download Free42 from the Quick Links. You may use whatever calculator you prefer.

☐ If you would like to use the same spreadsheet as Mr. Chandler, download Libre Office from the Quick Links. You may use whatever spreadsheet you prefer.

☐ Plan for discussion and engagement. Teachers who do not feel that they can discuss the subject of this course with students should plan to either preread the material or complete the course alongside their students. Expertise is not necessary, but discussion is as important in math and science as in history and literature.

☐ Labs/activities are presented in a fully integrated state in which the instructor's recommendations to complete certain activities or practice problems after a specified lesson are incorporated. To use them in this way, it is helpful for the lab to be scheduled after the 5th lesson. If your lab time is earlier in the week and you will find it difficult to be flexible, plan to delay the start of the lesson schedule so that lab day occurs after the 5th lesson. For example, if your lab time is on Tuesday, you might begin lesson 1 on Wednesday of the first week of school rather than on Monday. Those wanting to use the labs/activities on a more flexible schedule can do so, but should be ready and able to adjust lesson connections.

☐ Select a science book from the Alveary bookshelf for personal reading time, as appropriate.

Physics Labs

☐ Preview science labs and purchase materials as indicated on the supply list. Print or shortcut any links, as desired.

Term Prep & Teacher Tips

Physics Lessons
☐ Gather household items, typically easy for students to scavenge or teachers to obtain locally:
- the instructor will suggest found items throughout the course
- any cell phone with a camera

Books & Resources

For book rationales and purchase options, click the Book List link or scan the QR code below.
∞ View Book List Details

Science: Physics

Physics Lessons


Home Study Companion: Physics


Schaum's Outlines: College Physics

Supplies

For supply list details and basic supplies helpful to have on hand, click the links or scan the QR code below.
∞ View Basic Supplies
∞ View Supply List Details

Science: Physics


Cell Phone Tripod

Household Items - Science: Physics

Pocket Lab

Quick Links

Science: Physics

Click THIS text or scan the QR code for links.

Physics Lessons

- ∞ Lab Notebook Examples
- ∞ John Muir Laws • Nature Journaling Resources
- ∞ Alveary Bookshelf
- ∞ Seek app from iNaturalist
- ∞ SkyView Lite for iOS
- ∞ SkyView Lite for Android
- ∞ GeoGebra

- Tracker
- Free42
- Libre Office

Science: Physics

How To Approach

Introduce

• Learners begin each lesson with their existing knowledge. If continuing or revisiting a topic, then recap.

• Take note of the chapter or video title, and consider how the day's topic connects back to prior topic(s).

• Look back at the book or lecture notes as needed. The outline of the book and even of the chapter is helpful in drawing out and connecting ideas. Learners practice making these connections as they proceed through the course.

View

• View or do, as instructed in the lessons. This course is mostly a living lecture series, but there are many opportunities to practice.

• The supplemental text is mainly there to do practice problems. It is not necessary to do all of the practice problems - try a variety, learn from them, and move on when the learner is confident.

• The supplemental text can supply a concise review of the material when learners need it, but don't want to rewatch the videos again, or if they do not understand a word or concept. It is not a replacement for the videos, however.

• As they view the lectures, learners record ideas in a notebook or binder using outlines, diagrams, graphic organizers, or other methods (or combination of methods) that suit them. These recordings can be a helpful mechanism for remembering or a mini-narration to support understanding.

Narrate

• Process the ideas of the lesson by explaining a concept, describing an object, retelling events, etc. Consider what the point of the lesson is before deciding what to do with it.

• Learners may use words, pictures, models, graphics, etc, to process and convey ideas in their own way.

Discuss

• Consider together any thoughts, confusion, or concerns about the lesson.

• Note that learners may need to spend more than the allotted time engaging with or even repeating a lesson before moving on or as reinforcement at a later time. Adjust the pace as needed to feed the learner.

• Notice if there are any dates to keep for the Book of Centuries or quotes for the Commonplace Book.

Connect

- Follow any extra links or pursue the Science and Society topics further, depending on learner needs and interest.

Science: Physics

How To Approach Labs

Introduce

• This course uses more open-ended 'projects' for lab, but every activity still has the same flow, which follows the scientific method.

• Learners begin with an introduction. How does the project relate to what they have learned so far, as well as any previous experience? What will they learn from the lab? This is how hypotheses are formed.

• Learners are not given a Procedure and must decide for themselves how to approach the lab. If they are unsure what to do, it can help to dialogue with someone as they work through the ideas.

• Once they have had a chance to think, learners compose a prelab narration to put these introductory ideas, hypotheses, and plans into their lab notebooks. These prelab narrations may seem short and even incomplete if learners are new to keeping a lab notebook, but that is okay.

• If learners have difficulty or are easily frustrated, then consider allowing a digital notebook for typing, a scribe, or the use of assistive technology, as appropriate.

• After they complete their prelab narration, learners should collect any materials, being sure to let teachers know if something is missing or to remind the teacher if something needs to be purchased at the store.

Lab Procedure

• Learners complete the activity.

• They should use their lab notebooks to record what they do and capture any data, which can be printed from the computer and taped into the notebook.

Analysis & Conclusions

• The last step in the lab is to analyze the data and observations and draw conclusions from them. Similar to the prelab narration, the concluding or postlab narration is a chance to think about and put into words. This time, learners are considering what they learned from the lab and what they could learn more about if they were to continue.

• Teachers should engage learners with this reflection by reviewing their lab notebooks with them, discussing the science used in the lab, and demonstrating curiosity about the lab themselves.

• Depending on the interest of the learner and the priorities of the teacher, the learner might be encouraged to spend more time on those ideas of what more they could learn or it might be time to move on. Either way, it is an important part of the scientific method to reflect on what we could or would do next - our practice should help to clarify our thinking and teach that there is always more to be learned.

Science: Physics

Click THIS text or scan the QR code for links.

Term 1

WEEK 1 ⬚ **45m Physics Lessons - Lesson 1**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ NOTE
These lesson plans are an organizational tool that can be used as much or as little as is helpful; the Home Study Companion is your course. Note that the times in parentheses indicate the length of the HSC videos mentioned.

→ VIEW/READ, NARRATE, & DISCUSS
- Familiarize yourself with the new software you will be using.
- Print Unit overviews to keep in a folder for reference.
- Look over the PDF files in the Unit 1 folder.
- Read the Unit 1 overview.
- If needed, review helpful math concepts in the 1-00 Math Break folder (14.39, 1.30, 7.32) and Unit conversions and practice problems in video 1-01 (27.48). Some students may not need any of this review, while others might spend a few days here.

WEEK 1 ⬚ **45m Physics Lessons - Lesson 2**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
- Refer to the Unit 1 overview to note what video 1-02 is about before watching the lesson (25.27).
- Then, begin the Physics Problem Sets for Unit 1 with time remaining.

WEEK 1 ⬚ **45m Physics Lessons - Lesson 3**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
- Refer to the Unit 1 overview to note what video 1-03 is about before watching the lesson (26.36).
- Then, continue Unit 1 Problem Set with the remaining time.

WEEK 1 ⬚ **45m Physics Lessons - Lesson 4**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ PRACTICE/READ, NARRATE, & DISCUSS
- Complete Physics Problem Set for Unit 1.
- Check out 1-05 Science and Society, as desired.

WEEK 1 ⬚ **45m Physics Lessons - Lesson 5**

Materials: Science Free Read, Math Without Borders Physics Home Study Companion, and computer access

PREP: Read Student/Teacher Tip

→ READ, NARRATE, & DISCUSS
- Read science free read, as desired, then move on to the lab.

• PLAN WEEKLY
⬚ nature walk - record observations
⬚ science free read

★ STUDENT/TEACHER TIP
Depending on the learner and the schedule, it may work best to read during the lesson time and begin the lab later or to devote time to the lab first and read at a later time or another day. Notice what works best and adjust accordingly.

Science: Physics

Click THIS text or scan the QR code for links.

Term 1

WEEK 1 ⬚ **60m Physics Lessons - Lesson 6**

Materials: Math Without Borders Physics Home Study Companion and computer access

→ LAB DAY
- If you need practice with measurements, do Project 1 in folder 1-04. Otherwise, watch the short video about Using Tracker in Project 2 (11.29), choose from among the given Projects, and get started.
- Be sure to write your introductory narration in your notebook and journal about your progress.
- When you finish, write your concluding narration.
- If you finish quickly, you can take a break for today or choose another Project to begin. If you don't finish today, you may do so another time. You do not need to do all of the Projects. You may continue them for fun in the afternoon or move on after doing one or two.

WEEK 2 ⬚ **45m Physics Lessons - Lesson 7**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
- Refer to the Unit 2 overview to note what video 2-01 is about before watching the lesson (32.05).

- **PLAN WEEKLY**
⬚ nature walk - record observations
⬚ science free read

WEEK 2 ⬚ **45m Physics Lessons - Lesson 8**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
- Refer to the Unit 2 overview to note what video 2-02a is about before watching the lesson (20.24).
- Then, watch 2-02b (16.52).

WEEK 2 ⬚ **45m Physics Lessons - Lesson 9**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
- Refer to the Unit 2 overview to note what video 2-03a is about before watching the lesson (15.40).
- Then, begin the Physics Problem Sets for Unit 2 with time remaining.

WEEK 2 ⬚ **45m Physics Lessons - Lesson 10**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
- Watch 2-04a (30.33).
- Then, continue the Problem Set for Unit 2.

WEEK 2 ⬚ **45m Physics Lessons - Lesson 11**

Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
- Watch 2-04b (25.10).

Science: Physics

Click THIS text or scan the QR code for links.

Term 1

• Then, continue the Problem Set for Unit 2.

WEEK 2

⬚ **60m Physics Lessons - Lesson 12**

▯ Materials: Math Without Borders Physics Home Study Companion and computer access

→ LAB DAY
• Choose from among the Projects in folders 2-05 and start using your lab notebook to write your introductory narration, record your progress, and write your concluding narration.
• If you finish quickly, you can take a break for today or choose another Project to begin. If you don't finish today, you may do so another time (you will have more time next week for the Unit 2 projects). You do not need to do all of the Projects. You can continue them for fun in the afternoon or move on after doing one or two of them.

WEEK 3

⬚ **45m Physics Lessons - Lesson 13**

▯ Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ PRACTICE
• Complete the Problem Set for Unit 2.

• PLAN WEEKLY
⬚ nature walk - record observations
⬚ science free read

WEEK 3

⬚ **45m Physics Lessons - Lesson 14**

▯ Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
• Refer to the Unit 3 overview to note what video 3-01a is about before watching the lesson (17.57).
• Use any remaining time to catch up on unfinished work or read from your science free read.

WEEK 3

⬚ **45m Physics Lessons - Lesson 15**

▯ Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
• Refer to the Unit 3 overview to note what video 3-02a is about before watching the lesson (27.00).

WEEK 3

⬚ **45m Physics Lessons - Lesson 16**

▯ Materials: Math Without Borders Physics Home Study Companion, computer access, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
• Refer to the Unit 3 overview to note what video 3-03a is about before watching the lesson (15.51).
• Then, begin the Problem Set for Unit 3.

WEEK 3

⬚ **45m Physics Lessons - Lesson 17**

▯ Materials: Math Without Borders Physics Home Study Companion, computer access, video link, and Schaum's College Physics

→ VIEW/READ, NARRATE, & DISCUSS
∞ Video Link: "Frames of Reference" (26.00)

Science: Physics

Click THIS text or scan the QR code for links.

Term 1

	• Then, move on to the lab.
WEEK 3	⬚ **60m Physics Lessons - Lesson 18** Materials: Math Without Borders Physics Home Study Companion and computer access **→ LAB DAY** • Continue or try another Project from Unit 2 or move on to those in Unit 3, using your lab notebook to write your introductory narration, record your progress, and write your concluding narration.