Science

Nature Notebook
Nature Walks & Scouting
Introduction to Engineering Lessons
Introduction to Engineering Labs

Alveary

Alveary

Alt. Science Options

Science: Introduction to Engineering

GRADE(S): 9-12

About the Course

This course includes the following topic(s): Introduction to Engineering Lessons, Introduction to Engineering 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 Introduction to Engineering Lessons
An elective in Physical Science, Introduction to Engineering develops thinking skills and practical experience that are applicable to any field of design/innovation, while incorporating historical context, modern developments, current events, and citizenship. This is a VERY hands-on course that requires independent interest in any form of design/innovation, including various fields of engineering and the skilled trades. The course provides guidance and flexibility for teachers and learners to adjust the course for personal needs and preferences.

About Introduction to Engineering Labs
Note that labs are an essential part of science in which students engage with the Things they are reading about and practice the scientific method.

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.

Introduction to Engineering Lessons
The completion of Algebra 1 and Geometry are recommended for this course, as the experience will contribute to the learner's understanding, but they are not required.

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+	
9-12	Introduction to Engineering Lessons 5 times/week 45 min	The Things We Make The Boy Who Harnessed the Wind The Boy Who Harnessed the Wind, Young Reader's Edition The Way Things Work: Newly Revised Edition: The Ultimate Guide to How Things Work By Design: Ethics, Theology, and the Practice of Engineering
9-12	Introduction to Engineering Labs 1 time/week 60 min	

Sample Weekly View

Day 1	Day 2	Day 3	Day 4	Day 5
Science: Introduction to Engineering				
Introduction to Engineering Lessons Nature Walks & Scouting: Grades 9-12	Introduction to Engineering Lessons	Introduction to Engineering Lessons	Introduction to Engineering Lessons Nature Notebook: Grades 9-12	Introduction to Engineering Lessons Introduction to Engineering 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.

Introduction to Engineering Lessons
☐ There are 2 sensitive terms used in Ch.2 of The Things We Make as part of a larger discussion on design bias. Teachers should review Lesson 1 before the start of the term.

☐ 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.

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

☐ Bookmark or print Quick Links, as needed.

Term Prep & Teacher Tips

Introduction to Engineering Lessons
☐ Gather household items, typically easy for students to scavenge or teachers to obtain locally:
• items with which to tinker by student choice; Basements, closets, thrift shops, and scrap exchanges are great places to find objects for tinkering
• materials for projects by student choice; if you would like to have materials for the suggested Week 1 activity, obtain the optional supplies below
• optional: 2-3 boxes uncooked spaghetti (Term 1 Week 1)
• optional: all-purpose glue (Term 1 Week 1)
• optional: uncooked spaghetti (Term 1 Week 1)
• optional: S hook (Term 1 Week 1)
• optional: plastic bucket (Term 1 Week 1)
• optional: water or sand (Term 1 Week 1)
• optional: uncooked spaghetti (Term 1 Week 1)
• optional: kitchen scale(Term 1 Week 1)
• optional: bathroom scale (Term 1 Week 1)
• optional: 6-12" piece of wooden board (Term 1 Week 1)

Books & Resources

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

Science: Introduction to Engineering

Introduction to Engineering Lessons


The Things We Make


The Boy Who Harnessed the Wind


The Boy Who Harnessed the Wind, Young Reader's Edition


The Way Things Work: Newly Revised Edition: The Ultimate Guide to How Things Work


By Design: Ethics, Theology, and the Practice of Engineering

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

(No Subject Supplies Assigned)

Quick Links

Click THIS text or scan the QR code for links.

Science: Introduction to Engineering

Introduction to Engineering Lessons

∞ Science News Explores

Science: Introduction to Engineering

How To Approach

Introduce

• If starting a new book or a new topic in the book, then look at the title or a picture and take a moment to consider previous ideas and experiences.

• If continuing a previous reading, recap what was read previously. Often, the title of the book's section can help to draw out the main idea.

Read

• Read or do, as instructed in the lessons, making note of or flagging unfamiliar terms, interesting ideas, important dates, inspiring quotes, etc.

• Use supportive strategies and educational tools to reduce frustration and better engage the mind, as appropriate. These could include, but are not limited to, the use of eBooks, pictures, audio, read-aloud, buddy reading, colored reading strips, etc.

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

• If learners do not understand a word or concept, do not worry. Try reading over the passage again, studying a picture or diagram, connecting the idea to something from real life, or practicing chapter exercises. The lab/field work further supports major concepts from the text.

Narrate

• Process the ideas of the lesson by retelling, defining a concept, explaining the links in a chain of thought, etc. Do this orally or silently to yourself.

• Use words, pictures, outlines, etc.

• If a particular idea cannot be narrated, then read or examine the text again.

Discuss

• Consider with the teacher any thoughts, confusion, or concerns about the passage.

• If understanding is still uncertain, try rereading the passage or do some personal research on the topic.

Connect

• Follow any extra links, examine any sidebars in the text, or pursue additional reading, depending on student interest.

Science: Introduction to Engineering

How To Approach Labs

Introduce

• Regardless of how many days are required to complete a particular activity, every Science Lab has the same flow, which follows the scientific method.

• Relevant concept(s) are introduced in the text.

• Your notebook entry begins with the introductory/prelab narration, including relevant information that you have read or previously experienced, what you plan to do in the lab, and any hypothesis or anticipated result.

Lab Procedure

• Perform the procedure according to the instruction, recording in your notebook what you do as it happens. This can be a challenge, but is an extremely important skill.

• Record all data and observations in the lab notebook.

Analysis & Conclusions

• After all data is collected, analyze the results by considering how the data reflects the introduced concepts and whether the hypothesis is supported by the data.

• If the data and observations do not support the hypothesis, reflect on why and what further testing would be interesting or helpful.

Science: Introduction to Engineering

Click THIS text or scan the QR code for links.

Term 1

WEEK 1 ⬚ **45m Introduction to Engineering Lessons - Lesson 1**

How Engineering Works

Materials: The Things We Make

PREP: Read Teacher Tip

→ INTRO
From medieval cathedrals to modern soda cans, this book will help you grasp "the engineering method" and notice it working all around you. Note that during a discussion regarding bias in the design process (Ch.2), the author uses two terms that may be unfamiliar to you:
porn - short for pornography; inappropriate, sexually-oriented media that treats people as material objects rather than whole persons.
cisgender - a modern term used to describe people whose biological sex and sociological gender are aligned, as opposed to transgender.

→ READ, NARRATE, & DISCUSS
Introduction

→ PREPARE
Since an important aspect of engineering is tinkering and developing your intuition, spend some time looking for an item you'd like to work with on your Tinker Lab days. This could be a broken clock, coffee maker, soap dispenser, etc. Anything found in a closet or a thrift store that you can take apart and figure out without worrying your teacher is the perfect thing!

★ TEACHER TIP
There are two sensitive terms used in Ch.2, which some students may not be familiar with. The author only mentions them in a larger discussion about the impact of design bias. Nothing beyond the basic definitions provided in today's introduction is needed, but you may want to preview pp.30, 42 if you would like to understand the context or consider any additional discussion you would like to introduce.

• PLAN WEEKLY
⬚ take a nature walk
⬚ science free read

WEEK 1 ⬚ **45m Introduction to Engineering Lessons - Lesson 2**

Tinker Lab

Materials: by student choice & notebook

→ INTRO
You have two days each week to tinker with found objects that you have permission to take apart, figure out, and attempt to put back together (or improve). Basements, closets, thrift shops, and scrap exchanges are great places to find objects for tinkering. When you finish with one object, simply find another!

→ TINKER
Take apart, figure out, and attempt to put back together (or improve). Record your observations.

WEEK 1 ⬚ **45m Introduction to Engineering Lessons - Lesson 3**

Tinker Lab

Materials: by student choice & notebook

→ TINKER
Take apart, figure out, and attempt to put back together (or improve). Record your observations.

WEEK 1 ⬚ **45m Introduction to Engineering Lessons - Lesson 4**

Engineering Literature

Materials: The Boy Who Harnessed the Wind

→ READ, NARRATE, & DISCUSS

Science: Introduction to Engineering

Click THIS text or scan the QR code for links.

Term 1

about 20 pages or 1 chapter per week

WEEK 1 ⬚ **45m Introduction to Engineering Lessons - Lesson 5**

Flex Day

Materials: Selected engineering literature, tinker/project supplies, or internet access

→ NOTE

Use this flex day to finish the week's reading or continue any hands-on activities. Or, you might read and narrate a current event (link below and in your Quick Links) or research an interesting engineering question that came to mind during a nature walk or drive around town, such as 'How do frogs jump so far?' or 'Why does that tall building look like it's tilting?' A fun TEDEd video is provided for inspiration.

∞ Video Link: TEDEd (6:19)

∞ Website Link: Science News Explores

WEEK 1 ⬚ **60m Introduction to Engineering Labs - Lesson 1**

Materials: internet access

→ PROJECT

If there is a design problem in your home or community that you would like to tackle, use this time to research, design, and execute your solution.

If you'd like to sample different areas of engineering, begin with the structural engineering project linked, The Leaning Tower of Pasta. Or you might find your own idea by exploring the Science Buddies website. The filters on the left side of the page allow you to narrow your results. Once you have chosen a project, let your teacher know if you need any materials. Your project might take the whole year or you might finish it in just a few weeks. Whenever you finish your project, select another one! Record your work and your observations in your lab notebook.

∞ Website Link: The Leaning Tower of Pasta

∞ Website Link: Science Buddies

WEEK 2 ⬚ **45m Introduction to Engineering Lessons - Lesson 6**

How Engineering Works

Materials: The Things We Make

→ READ, NARRATE, & DISCUSS

Ch.1

WEEK 2 ⬚ **45m Introduction to Engineering Lessons - Lesson 7**

Tinker Lab

Materials: by student choice & notebook

→ TINKER

Take apart, figure out, and attempt to put back together (or improve). Record your observations.

• PLAN WEEKLY

⬚ take a nature walk

⬚ science free read

Science: Introduction to Engineering

Click THIS text or scan the QR code for links.

Term 1

WEEK 2 ⬚ **45m Introduction to Engineering Lessons - Lesson 8**
Tinker Lab

Materials: by student choice & notebook

→ TINKER
Take apart, figure out, and attempt to put back together (or improve). Record your observations.

WEEK 2 ⬚ **45m Introduction to Engineering Lessons - Lesson 9**
Engineering Literature

Materials: The Boy Who Harnessed the Wind

→ READ, NARRATE, & DISCUSS
about 20 pages or 1 chapter per week

WEEK 2 ⬚ **45m Introduction to Engineering Lessons - Lesson 10**
Flex Day

Materials: Selected engineering literature, tinker/project supplies, or internet access

→ NOTE
Use this flex day to finish the week's reading or continue any hands-on activities. Or, you might read and narrate a current event from Science News Explores (in your Quick Links) or research an interesting engineering question that came to mind during a nature walk or drive around town, such as 'How do frogs jump so far?' or 'Why does that tall building look like it's tilting?'

WEEK 2 ⬚ **60m Introduction to Engineering Labs - Lesson 2**

Materials: by student choice & notebook

→ PROJECT
Continue working on your project.

WEEK 3 ⬚ **45m Introduction to Engineering Lessons - Lesson 11**
How Engineering Works

Materials: The Things We Make

→ READ, NARRATE, & DISCUSS
Ch.2

- **PLAN WEEKLY**
  - ⬚ take a nature walk
  - ⬚ science free read

WEEK 3 ⬚ **45m Introduction to Engineering Lessons - Lesson 12**
Tinker Lab

Materials: by student choice & notebook

→ TINKER
Take apart, figure out, and attempt to put back together (or improve). Record your observations.

Science: Introduction to Engineering

Click THIS text or scan the QR code for links.

Term 1

WEEK 3 ⬚ **45m Introduction to Engineering Lessons - Lesson 13**

Tinker Lab

Materials: by student choice & notebook

→ TINKER
Take apart, figure out, and attempt to put back together (or improve). Record your observations.

WEEK 3 ⬚ **45m Introduction to Engineering Lessons - Lesson 14**

Engineering Literature

Materials: The Boy Who Harnessed the Wind

→ READ, NARRATE, & DISCUSS
about 20 pages or 1 chapter per week

WEEK 3 ⬚ **45m Introduction to Engineering Lessons - Lesson 15**

Flex Day

Materials: Selected engineering literature, tinker/project supplies, or internet access

→ NOTE
Use this flex day to finish the week's reading or continue any hands-on activities. Or, you might read and narrate a current event from Science News Explores (in your Quick Links) or research an interesting engineering question that came to mind during a nature walk or drive around town, such as 'How do frogs jump so far?' or 'Why does that tall building look like it's tilting?'

WEEK 3 ⬚ **60m Introduction to Engineering Labs - Lesson 3**

Materials: by student choice & notebook

→ PROJECT
Continue working on your project.