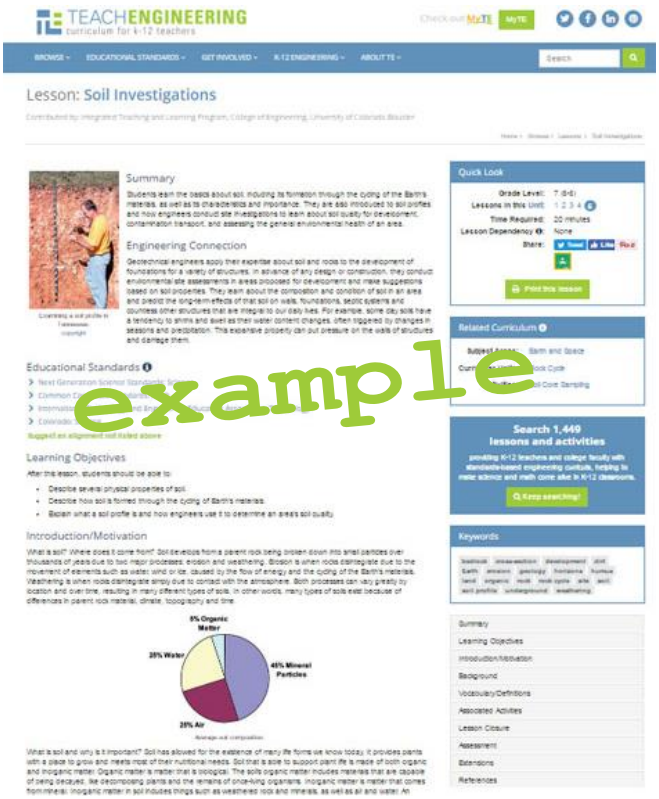
Lesson Template Description

A published lesson on TeachEngineering might look like this example ➔

Notice the boxed information on the right side of the first page; it provides teachers with key information so they can quickly review the lesson to see if it meets their needs, before they look at the rest of it.

This template describes the **required** and optional components for all lessons published in the TE digital library collection. The suggested subheadings may be removed completely or changed to something more suitable for your activity.

Visit www.TeachEngineering.org > Browse > Lessons to peruse examples of lesson content and how they render on the website.



Subject Area(s) [Choose from: algebra, biology, chemistry, computer science, data analysis & probability, earth & space, geometry, life science, measurement, number & operations, physical science, physics, problem solving, reasoning & proof, science & technology. TeachEngineering users can browse the collection for curricula by subject area.]

Associated Unit _____
[To what TeachEngineering unit does this belong? Leave blank if does not apply.]

Lesson Title _____ [Provide a catchy lesson title. Since 1,400+ documents are available in the collection, provide a descriptive and/or catchy title to differentiate your work.]

Header *Example*: Insert Image 1 here, align right, wrap text
[(optional) Use Header if you want an image to appear at the top of the document. We recommend a header photograph. Each time you want to insert an image, use a box like this to provide info.]

Image 1

Image file: cub_airplanes_lesson01_image1.jpg

ADA Description: A photograph shows a uniformed female pilot in a plane cockpit surrounded by a control panel of dials and indicators.
(Write as if describing the image to a blind person; do not repeat caption content.)

Source/Rights: © 2004 Microsoft Corporation, One Microsoft Way, Redmond, WA 98052-6399 USA. All rights reserved.

(optional) Caption: Engineers design navigation systems for all types of transportation.

For more info, see **Requirements & Tips for Using Images** on the Submit Curriculum page.

Grade Level __ (__-__)

[What grade(s) is (are) targeted in this lesson? "It is targeted for grade _, but could work for grades __ to __." *Example*: 8 (7-9) or 8 (8-8) for just eighth grade, or 8 (5-9) if it also works for lower-grade students.]

Lesson # __ of __

[(optional) Leave blank for standalone lessons that are not part of a unit. Indicate lesson numbers to make sure a unit's many lessons are listed in the order you want. This is flexible, though, so if a unit has three lessons that may be taught in any order, leave the lesson number blank and brief note to explain.]

Lesson Dependency

[(optional) Does this lesson depend on another TeachEngineering lesson or activity? If so, list those titles in the order you would like them to appear.]

Time Required __ minutes *Example:* 20 minutes

[(optional) To help in teacher planning, provide an estimate of the time to complete the lesson, in minutes. Cannot be a time range. Often, lessons take 15-20 minutes and activities take longer, for example a few 50-minute class periods or more. May add a brief explanation to more fully explain the time requirements, such as "three 50-minute class periods."]

Summary

[Provide a brief paragraph summarizing the lesson and topics students learn about. Must be one paragraph of plain text, which means no images or formatting. Write in present tense, not future.]

Engineering Connection

[Provide 60-100 words or ~3 sentences describing how the scientific and mathematical concepts being studied in this lesson pertain to real-world engineering. (Do not recap the lesson summary.) Explain for the teacher how everyday engineering ties to what is being done in the lesson or activity. For example: Engineers must fully understand the concepts of heat transfer via conduction when they design kitchen appliances. Or associate concepts to particular fields of engineering, for example, if the concepts of tension and compression are covered, say that civil and mechanical engineers use these principles when they design structures such as bridges and roller coasters. Identify how or where students are doing engineering, for example: Students play the role of engineers as they design and build biomedical prototype devices. Or: Like engineers, students apply the concepts of heat transfer via conduction in the Assessment section when making plans for home insulation. Provide no more than one paragraph of plain text, which means no images or formatting.]

Engineering Category =

[Indicate which of the following best describes this lesson's amount or depth of engineering content:

1. relating science and/or math concept(s) to engineering
2. engineering analysis or partial design
3. engineering design process

Anecdotally, category 1 is primarily science/math with some engineering, category 2 items are primarily engineering with some science/math, and category 3 presents full engineering design. For more complete descriptions of each category, see the *TE Engineering Categories Description* document (pdf) on the Submit Curriculum page. In rare instances, activities also contribute to the whole, in terms of their level of engineering design content, so that the lesson or unit has a different category than the activities below it. For example, a unit might be category 3 because its lessons and activities contain all of the steps in the engineering design process even though none of those individual lessons and activities is categorized as providing the complete engineering design process.]

Keywords

Example: compression, force, laws of motion, mechanics, tension, tensile, skyscraper, structure

[Provide 4-10 keywords. They should be words a layperson and K-12 teacher would know and **might use to search** for the lesson. List in A-to-Z order, lower-case unless proper nouns. Usually, make nouns singular. Avoid highly technical words or lingo. It is likely you have used these words in the summary. For example, good keywords are often concepts (tension, photosynthesis) or real-world examples (skyscraper, artificial leg) from the write-up. Even though TE provides full text search capability, often these become the few keywords that are seen by other websites that search the collection.]

Educational Standards

[List 2-4 educational STEM standards that students would learn as a result of completing this lesson or activity. TE requires a minimum of 1 state standard and 1 ITEEA standard, and strongly recommends 1 NGSS and/or CSCC standard(s), aiming for the suggested limit of 2-4 standards with the goal to identify only the best matched alignments. If you need to identify more than four standards, make sure that they are explicitly taught in the lesson or activity. Treat the standards you choose like learning objectives, and make it clear where in the curriculum write-up students will learn them.

Be accurate in listing educational standards. For example, if students need a skill to complete an activity, but the activity assumes they already have that skill, then the activity does not teach the skill. For instance, a standard might say, "students use protractors to measure angles." An activity in which students use protractors to measure the angle of a shadow while making a sun dial would not teach this standard unless it contained specific language designed to introduce students to the use of protractors in the activity. If it does not contain that language, then it assumes students already have previously used protractors. In this case, students would be practicing the skill—but not learning it. (Note: In this case, you might mention the skill under the *Pre-Requisite Knowledge* section.)

To create a list of the educational standards met, find them on the TeachEngineering website, or refer to the many online state and national standards resources:

- Browse/Search all educational standards on the TeachEngineering website
- browse NGSS or browse CCSS or browse ITEEA on the TeachEngineering website
- http://www.achievementstandards.org/resources/ASNJurisdiction (D2L's Achievement Standards Network viewer)
- http://www.nextgenscience.org/search-standards (NGSS)
- https://www.iteea.org/File.aspx?id=67767&v=b26b7852 (ITEEA) (Note grade-specific benchmarks under 8 and 11 for the engineering design process, and 14-20 for engineering applications.)

Choose **specific standards, not just the broader objectives of the standards**. Also, so that TE is able to precisely identify the standards you have chosen, for each, please include the source, year, standard number(s)/letter(s), grade band and text (if available, its unique ID# is optional, but helpful). Examples:

> North Carolina, science, 2004, 1.01 (grades 8-8): Identify and create questions and hypotheses that can be answered through scientific investigations. ID# S1028531
>
> ITEEA, 2000, Standard 8: Design, C (grades 3-5): The design process is a purposeful method of planning practical solutions to problems. ID# S114173C

Note for Massachusetts: The middle school science standards are written in the same format except that instead of a "strand" there is a number: 1 for Earth and Space Science, 2 for Life Science and 3 for the Physical Science strand. For example, 1.12 stands for the "Relate the extinction of species to a mismatch of adaptation and the environment" standard in the earth and space science strand.]

Pre-Requisite Knowledge

[(optional) What does the student need to know to be successful in this lesson (a previous lesson, depth of a certain topic, specific math skills)? *Examples:* A familiarity with north, south, east, west compass directions. A basic understanding of gravity and friction. Ability to calculate averages.]

Learning Objectives

After this lesson, students should be able to:

- Describe, list, relate, define**...**

[In statement form, identify **2-4 main** intended goal(s) or student outcome(s) of the lesson. Learning objectives often come from the educational standards you identified.

Learning objectives are well-crafted specific goals that can be assessed relatively easily. Use active verbs, such as "explain, list or calculate," and not passive verbs, such as "understand, realize or like." This approach is well described (with many example verbs) at a TeacherVision web page at: http://www.teachervision.fen.com/curriculum-planning/new-teacher/48345.html?detoured=1.

The most important thing is to be specific, so that it is clear at lesson end whether students have fulfilled the learning objectives. To measure lesson success, make sure each assessment (see the Assessment section, below), directly assesses one or more of the learning objectives or educational standards.]

Introduction / Motivation

[***Write this section as if you were directly talking to the students***. Suggest how the teacher might prepare the students for the lesson and activities. Provide an engineering context. How do you grab students' interest? This might be a demo, an example or real-world context. Ask questions to engage students. Create a storyline that flows with the objectives to make the lesson more challenging and exciting. Suggested half-page minimum. Address the learning objectives identified earlier. Incorporate vocabulary. Include teacher instructions and answers in parentheses, such as: (Write the equation on the classroom board.) or (Next, show the attached PowerPoint presentation.) or (Possible answers: xxx, yyy, zzz.)]

Lesson Background & Concepts for Teachers

[***This is usually written for the teacher***. Include a clear and complete explanation of the lesson subject covered, in layperson's terms. Summarize pertinent background to make the teacher's job easier; do not just copy information from other resources. It is okay to provide links/URLs to high-quality relevant information (or refer to them as listed in the References or Additional Multimedia Support sections). Provide teachers with a bit more information than needed to teach the lesson, so that s/he can answer student questions competently. Provide sub-headings or bullets, as necessary, to organize the material.]

Image Insert Image # or Figure # here, [Each time you insert an image, use a box like the one below to provide key info. Cut and paste the box as many times as you want to insert images in the document.]

Figure 1

Image file: cub_earthsci_lesson01_activity1_figure1.jpg

ADA Description: A photograph shows a huge concrete dam blocking a river in a canyon gorge, and water spraying below it. *(Write as if describing key elements of the image to a blind person; do not repeat caption content.)*

Source/Rights: © Bureau of Reclamation, U.S. Department of the Interior http://www.usbr.gov/lc/hooverdam/

Caption: Figure 1. The Hoover Dam in NV.

For more info, see **Requirements & Tips for Using Images** on the Submit Curriculum page.

Vocabulary / Definitions

[(optional) Define unusual or probably unknown words, including unclear keywords, for the target grade level, plus any engineering words that are used in the lesson. Use singular versions of words. Only capitalize terms if they are proper nouns. Write definitions in sentence format, even if phrases (begin with capital letter; end with a period). Put any abbreviations or acronyms in the definition space.]

Word	Definition

Associated Activities

[(Minimum of 1 required; optional only with permission from TE reviewers or editors.) List the names of each TeachEngineering activity associated with this lesson and a brief sentence or two describing each (a shortened Summary). On TE, the title hyperlinks to the activity write-up. *Example:*]

What a Drag! Students investigate the forces of flight using paper helicopters they design and construct.

Lesson Closure

[(optional) ***Write this section as if you were directly talking to the students.*** Help students bring it all together. Review what they are expected to have learned in the lesson introduction and assessment(s). Make sure the learning objectives are covered. Provide connections to student outcomes, subsequent lessons or activities, and the overall unit topic. Suggested quarter-page length.]

Assessment

[***Provide assessment tools/activities for teachers to assess the learning objectives described earlier.*** How do you know if the students "got it" during and after the lesson? Provide active and embedded ways for the teacher to gauge what the students know about the topic at the beginning, and whether students *met the learning objectives* at the end. Browse the TE collection for example assessment tools and activities.]

Pre-Lesson Assessment (suggested subheading)
Descriptive Title: Describe the assessment procedure so the teacher knows what to do…

Post-Introduction Assessment (suggested subheading)
Descriptive Title: Describe the assessment procedure so the teacher knows what to do…

Lesson Summary Assessment (suggested subheading)
Descriptive Title: Describe the assessment procedure so the teacher knows what to do; if posing discussion questions, provide example answers.

Homework (suggested subheading)
Descriptive Title: Describe the assignment and answers so the teacher knows what to do…

Lesson Extension Activities

[(optional) Provide suggestions for additional activities that explore the lesson subject further, and suggestions for thought-provoking questions for the students in the weeks ahead.]

Additional Multimedia Support

[(optional) Provide ideas and sources for additional information that support the lesson, such as online images, animations, videos, websites, etc. Also include suggested exceptional background resources.]

References

[(optional) List all references used to create the lesson, especially the background knowledge section. Use a modified MLA format (see below). Provide in A-to-Z order according to authors' last names or website banner page name, whichever appears first in citation.]

For books:
Lastname, Firstname. *Book Title*. City, ST: Publisher Name, year.

For websites:
Author(s) [Lastname, Firstname]. BannerPageName. LastUpdated/Posted/RevisedDate. OwnerName, Organization. Accessed date. http://www.colorado.edu

Examples:
Dictionary.com. Lexico Publishing Group, LLC. Accessed September 15, 2016. (Source of some vocabulary definitions, with some adaptation) http://www.dictionary.com

National Data Buoy Center. Last modified May 10, 2015. Center of Excellence in Marine Technology, NOAA. Accessed September 15, 2016. (Source of much teacher background information; also excellent interactive map of buoy locations around the world) http://www.ndbc.noaa.gov/

For magazine articles:
Doe, Juanita Q. "Title of Article." *Magazine Name*. July 2014, pp. 32-40. URL if available.

For journal articles:
Doe, Juan R. "Title of Article." *Scholarly Journal Name*. (1999) Vol. 3, No. 6, pp. 112-28. URL

Attachments
[(optional) List lesson attachments, such as handouts, worksheets, worksheet answers, quizzes, data sheets, readings, graphics, visual aids, presentations, etc., in digital formats (for details, see *Introductory Notes about the Templates* on the Submit Curriculum page). On TE, they will be linked to files. Provide original format versions (Word, PowerPoint, Excel) so teachers can modify; TE will make the PDF versions. When listing the attachment names, indicate the file format (see examples, below), to help teachers choose what to download/print.]

Examples:
Flying Solo Worksheet (docx)
Flying Solo Worksheet (pdf)
Flying Solo Worksheet Answer Key (docx)
Flying Solo Worksheet Answer Key (pdf)

Other
[(optional) This component is available for information that doesn't seem to fit in anywhere else.]

Redirect URL
[(optional) To direct teachers to required internet materials, provide one URL, which will be rendered in by a note in the boxed information at the top of the document, like this: **Attention:** This lesson requires the following resource: http://theURLhere/. See an example.]

Contributors
[Who is the author(s)? List the name(s) of who contributed to developing, testing, reviewing and editing this lesson. List the primary creator first. Role and organization may be included, too.]

Example: Jay Shah, Malinda Schaefer Zarske, Janet Yowell

Supporting Program
[Briefly provide the name and organization of the source of this curricular content. This will appear at the top and bottom of the document.]

Example: STARS GK-12 Program, College of Engineering, University of South Florida

Acknowledgements
[(optional) Provide brief text to acknowledge significant funding or other support.]

Example: This curriculum was developed under National Science Foundation GK-12 grant no. DGE 0338326. However, these contents do not necessarily represent the policies of the NSF, and you should not assume endorsement by the federal government.

Classroom Testing Information

[Briefly describe the K-12 in-classroom testing conducted with this curriculum. Indicate the month, school, location, grade and number of students.]