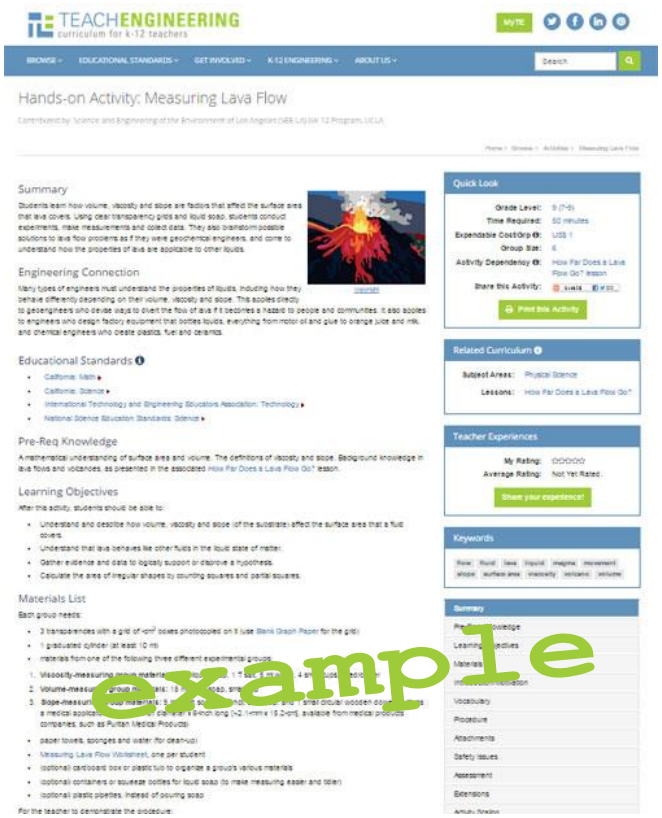
Activity Template Description

A published activity 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 activity 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 activities published in the TE digital library collection. The suggested sub-headings may be removed completely or changed to something more suitable for your activity.

Visit http://TeachEngineering.org > Browse > Activities to peruse examples of activity 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.]

Associated Lesson _____
[To what TeachEngineering lesson does this activity belong? Leave blank if it is a standalone activity.]

Activity Title_____ [Provide a catchy activity title. Since 1,300+ docs 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 or other text to appear at the top of the document. We recommend a header image. Each time you want to insert an image, use a box like this to provide info.]

Image 1

Image file: cub_windturbines_lesson03_activity2_image1.jpg

ADA Description: Photo shows a tall three-bladed wind turbine in a field of them.
(Write as if describing the image to a blind person; do not repeat any caption content.)

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

(optional) Caption: None

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

Grade Level __ (__-__)

[What grade(s) is (are) targeted in this activity? "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.]

Activity Dependency

[(optional) Does this activity 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:* 50 minutes

[To help teacher planning, provide an estimate of the time to complete the activity, 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: "spread over 14 days with a 90-minute session each day."]

Group Size ___

[Are students working alone, in pairs, groups of three, etc.? Provide one number, not a range. If working alone, group size is 1. If a class activity, group size is 28. Unable to accommodate a text note with this component, so if an explanation of group size is required (such as, "This is a demonstration for the entire class") or you want to suggest a range (such as, "Divide the class into teams of three or four students each."), say it in the Procedure section.

Expendable Cost per Group US $___ *Example:* US$.50

[What material costs are associated with this activity that cannot be re-used in another activity? (For example, do not include the cost of a microscope, scissors, paper or other items available in a typical classroom.) We strive to meet the "engineering on a shoestring" approach of no more that $20 per activity (= group size x cost per group). Must be an amount in U.S. dollars, not a range, however you may include an optional text note for a brief explanation. If activity requires substantial *non-expendable* items that are not typically found in classrooms, add a note about this, for example: The activity also uses non-expendable LEGO MINDSTORMS NXT robots, sensors and software; see the Materials List for details.]

Summary

[Provide a brief paragraph summarizing the activity 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 activity pertain to real-world engineering. (Do not recap the activity 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 appliances that people use to cook in kitchens. 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 three engineering categories best describes this activity'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 most cases, units and lessons will either not have a category or use the category of the most relevant lessons and activities below them. In rare instances, activities work as a 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, gumdrops, mechanics, tension, pasta, 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 activity. 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 can be concepts (tension, photosynthesis), real-world examples (skyscraper, artificial leg) or key materials (gumdrops, pasta) from the write-up. Even though TE provides full text search capability, often these become the few keywords 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 in the curriculum write-up where 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 on the TeachEngineering website
- http://www.achievementstandards.org/resources/ASNJurisdiction (D2L's Achievement Standards Network viewer)
- http://www.nextgenscience.org/next-generation-science-standards (NGSS)
- http://www.iteaconnect.org/TAA/PDFs/Benchmarks.pdf (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 do students need to know to be successful in this activity (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 activity, 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 activity. Learning objectives often come from the educational standards you identified.

Learning objectives should be 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 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 activity end whether students have fulfilled the learning objectives. To measure activity success, each assessment (see the Assessment section, below) should directly assess one or more of the learning objectives or educational standards.]

Materials List

[A list of materials that each group needs for the activity. Help teachers find unusual and non-expendable (reusable) supplies by suggesting source information, part numbers and estimated pricing, including URLs, as necessary. Please provide measurements in **metric units**, as **required** by our NSF-funded TE grant; it is okay to provide both metric and English units, for *example*, string, 2 m (6 ft).]

Each group needs: (suggested subheading)

-

For the entire class to share: (suggested subheading)

-

Introduction / Motivation

[***Write this section as if you were directly talking to the students***. Suggest how the teacher might prepare the students for the activity. Provide an engineering context. How do you grab students' interest? This could 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 activity more challenging and exciting. Suggested half-page length. 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.)]

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 activity. Only capitalize terms if they are proper nouns. Write definitions in sentence format, even if phrases (begin with capital letter; end with a period).]

Word	Definition

Procedure

[Clearly explain the step-by-step procedure to follow to conduct the hands-on activity. ***Make sure to include connections to engineering and address activity objectives***. To clarify the activity setup and procedure, place **images**, photographs and diagrams throughout this section and the activity write-up. Use figure numbers if the image is referenced in the text. Include metric units.]

Background [(suggested subheading, if needed) Clearly explain any essential background information the teacher may need to know to successfully complete this activity. Usually in paragraph format.]

Before the Activity (suggested subheading)

- *Example*: Gather materials and make copies of the worksheet.
- Describe any other pre-activity preparation here…
- Bullet format suggested.

With the Students (suggested subheading)

1. *Example*: Divide the class into groups of three or four students each.
2. Describe step-by-step procedures here…
3. Numbered list format suggested.

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

Figure 1

Image file: cub_biotech_lesson04_activity1_figure1.jpg

ADA Description: Photo shows a two-liter bottle with two straws sticking through the cap with balloons attached to the straw ends with rubber bands. The bottle bottom is cut off and replaced with another balloon stretched over the bottle base opening. *(Write as if describing key elements of the image to a blind person; do not repeat any caption content.)*

Source/Rights: Copyright © 2010 Teresa Ellis, ITL Program, University of Colorado Boulder.

Caption: Figure 1: An example lung/diaphragm model made by students.

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

Attachments

[(optional) List activity attachments, such as handouts, worksheets, worksheet answers, quizzes, data sheets, readings, graphics, visual aids, 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, Excel, PowerPoint) so teachers can modify; TE will make the PDF versions. In listing the attachment names, indicate the file format (see examples, below), to help teachers choose what to download/print.]

Examples:
Pair of Chutes Worksheet (docx)
Pair of Chutes Worksheet (pdf)
Pair of Chutes Worksheet Answers (docx)
Pair of Chutes Worksheet Answers (pdf)

Safety Issues

[(optional) What safety measures must be considered for this activity? *Examples:*]

- Use eye protection (goggles or safety glasses) during this activity.
- Use caution near the small flame from the sterno canned heat.

- Resulting chemical solutions are safe to dispose of down the sink drain.
- While the bacteria that occur naturally during the experiment are generally harmless, students should nevertheless wash their hands after handling the soil and vegetables.
- Bullet format suggested.

Troubleshooting Tips

[(optional) Think through likely common snags that might be encountered while conducting the activity. Suggest solutions, approaches to avoid pitfalls, etc. What should you consider if the activity does not work right the first time? What could you change? Providing hints to students at the appropriate time in the procedures?]

Investigating Questions

[(optional) Provide questions for the teacher to pose to students that require them to figure out the meaning of something. Students may come to somewhat different conclusions. The questions could serve as a brainstorming session or a quick activity wrap-up. Provide answers (or example answers) to aid the teacher.]

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 activity? Provide active and embedded ways for the teacher to gauge what 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-Activity Assessment (suggested subheading)
Descriptive Title: Describe the assessment procedure so the teacher knows what to do…

Activity Embedded Assessment (suggested subheading)
Descriptive Title: Describe the assessment procedure so the teacher knows what to do…

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

Activity Extensions

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

Activity Scaling

[(optional) Explain modifications or suggestions to activities that would make them more or less challenging for use at various grade levels, or within one grade for class groups who are more advanced or behind. For example: reducing or increasing the number of redesign steps, shorter time period to complete the activity, graphing the collected data, etc. *Example lead-ins*:]

- For lower grades,
- For younger students,
- For upper grades,
- For older students,
- For more advanced students,

Additional Multimedia Support

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

References

[(optional) List all references used to create the activity. Use 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 March 4, 2013. (Source of some vocabulary definitions, with some adaptation) http://www.dictionary.com

National Data Buoy Center. Last modified August 12, 2013. Center of Excellence in Marine Technology, NOAA. Accessed August 21, 2013. (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*. August 2013, pp. 32-40.

For journal articles:
Doe, Juan R. "Title of Article." *Scholarly Journal Name*. (1987) Vol. 3, No. 6, pp. 112-28.

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

Redirect URL
[(optional) Provide one URL to direct teachers to required internet materials; URL will be rendered in *TE* by a note in the boxed information at the top of the document, like this: **Attention:** This activity 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 activity. 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.]