

Activity Template

A published activity on *TeachEngineering* might look like this example →

After the table of contents, notice the “information box” on the first page (→); it provides teachers with key information to quickly review the activity to see if it meets their needs, before they look at the rest of the activity write-up.

From this point on, this template describes the **required** and optional components for all activities published in the TE digital library collection.

Visit <http://TeachEngineering.org> to see examples of activity content and how they render on the website.



TEACHEngineering Resources for K-12

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TE Activity: Measuring Lava Flow

Contributed by: UCLA Science and Engineering of the Environment of Los Angeles (SBE-LA) GK-12 Program

Summary
Students learn how volume, viscosity and slope are factors that affect the surface area that lava covers. Using clear transparency grids and liquid soap, students conduct experiments, make measurements and collect data. They also brainstorm possible solutions to lava flow problems as if they were geochemical engineers, and come to understand how the properties of lava are applicable to other liquids.

Engineering Connection
Discovery 1: Relating science content to engineering
Many types of engineers must understand the properties of liquids, including how they behave differently depending on their volume, viscosity and slope. This applies directly to geoenvironmental engineers who devise ways to divert the flow of lava if it becomes a hazard to people and communities. It also applies to engineers who design factory equipment that bottles liquids, everything from motor oil and glue to orange juice and milk, and chemical engineers who create plastics, fuel and ceramics.

Contents

1. Pre-Req Knowledge
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Grade Level: 5 (7-9) **Group Size:** 5
Time Required: 50 minutes **Activity Dependency:** How Far Does a Lava Flow Go? Lesson

Expendable Cost Per Group (€): US\$ 1

Keywords: flow, fluid, lava, liquid, magma, movement, slope, surface area, viscosity, volcano, volume

Reviews: Read Reviews | [Be the First to Write a Review](#)

Related Curriculum (€):
subject areas: Physical Science
lessons: How Far Does a Lava Flow Go?

Educational Standards (€):
California Math
California Science
National Science Education Standards Science

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. Users can browse TE for curricula by subject area.]

Associated Unit _____

[To what unit does this belong? Leave blank if does not apply.]

Associated Lesson _____

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

Activity Title _____ [Provide a catchy activity title]

Header Example: Insert Image 1 here, right justified to wrap
[(optional) Use Header if you want an image or other text to appear at the top of the document.]

Image 1

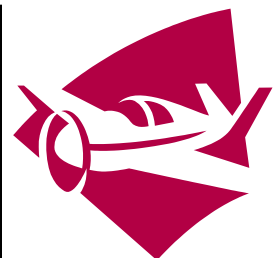
ADA Description: Simple drawing of a propeller plane.

Caption (optional): none

Image file: cub_airplanes_lesson03_activity2_image1.jpg

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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 the title(s) in the order you would like them to appear on the website.]

Time Required ___ minutes, hours, days or weeks *Example:* 50 minutes

[To help in teacher planning, provide an estimate of time to complete the activity. Cannot be a time range, however you may include an optional text note for a brief explanation. We often find that lessons take 15-20 minutes, and associated activities take longer, often one or more 50-minute class periods.]

Group Size ___

[(optional) Are students working alone, in pairs, groups of three, etc.? This must be 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.”), write it in the Procedure section.

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

[(optional) 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 than \$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.]

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 clarifying how the scientific and mathematical concepts being studied in this activity pertain to real-world engineering. Do not recap the activity. It often works to associate activity concepts to particular fields of engineering. For example, if the activity is about tension and compression, you might say that mechanical engineers use these principles when they design structures such as bridges and roller coasters. Must be one paragraph of plain text, which means no images or formatting.]

Engineering Category = #_

[(required for activities; optional for units and lessons) 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 actually 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, marshmallow, mechanics, tension, pasta, skyscraper, structure

[Provide 4-10 keywords. They should be words the layperson and a K-12 teacher would know and **might use to search** for the activity. List in A → Z order, lower-case unless proper nouns. Usually, make nouns singular. Avoid highly-technical or lingo words. It is likely you have used these words in the summary. For example, keywords might be concepts (tension, photosynthesis) or real-world examples (skyscraper, artificial leg), or even key materials (marshmallows, pasta) 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 standards that students would learn as a result of completing this lesson or activity. Of the 2-4 standards, at least one must be from the International Technology and Engineering Educators Association (ITEEA), as described below. You are encouraged to also align your curriculum with your local state standards. The standards you choose should be treated like learning objectives, and it should be clear in the curriculum where students will learn them. If you need to identify more than four standards, make sure that they are specifically taught in the lesson or activity.]

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.)

List the educational standards addressed in the activity from the state and national standards available at the online ASN viewer at <http://www.jesandco.org/asn/viewer/default.aspx>. These should be **specific standards, not just the broader objectives of the standards**. Please include the source, year, standard number(s) and text of each standard, and for ITEEA, provide the standard number, grade band, benchmark letter and text. *Examples:*

North Carolina, science, 2004, 1.01: Identify and create questions and hypotheses that can be answered through scientific investigations.

ITEEA, Standard 8, Grades 3-5, C. The design process is a purposeful method of planning practical solutions to problems.]

[Note: From the International Technology and Engineering Educators Association ([ITEEA](#)) standards, at least one of the [ITEEA grade specific benchmarks](#) must be identified as aligning with this curriculum to compensate for the fact that most states do not have engineering standards, while ITEEA does. (For example, look at the grade-specific benchmarks under ITEEA standards 8 and 11 for the engineering design process, and standards 14-20 for engineering applications.)]

[Special 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 activity (a previous lesson, 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 in STEM standards covered. Learning objectives often come from the educational standards you identified.]

Materials List

[A list of materials that each group needs for this activity, including estimated cost and where to acquire non-expendable/re-usable and/or unusual items. 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)

- xxx

For the entire class to share: (suggested subheading)

- xxx

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 the students' interest? This could be a demo, an example or real-world context. Ask questions of the students to engage them. Create a storyline that flows with the objectives to make the activity 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 on the classroom board) 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 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 set-up 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 and has a caption. Remember to use 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, [note position: left justified, centered or right justified]

Figure 1

ADA Description: Photo shows a two-liter bottle with two straws sticking through the cap with balloons held on the straw ends with rubber bands. The bottle bottom is cut off and replaced with another balloon stretched over the bottle opening

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

Image file: cub_biotech_lesson04_activity1_figure1.jpg

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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 hot-linked to files. In addition to PDF versions, provide original format versions (Word, Excel, PowerPoint) so teachers can modify. In listing the attachment names, include the file format (see example, below), to help teachers choose what to download/print. When naming files for attachments, use lower-case letters only(no caps). This includes file extensions: jpg, .doc, pdf, ppt, etc. Also, leave no spaces in the file names; use underscores instead.]

Examples:

[Pair of Chutes Worksheet \(pdf\)](#)

[Pair of Chutes Worksheet \(doc\)](#)

[Pair of Chutes Worksheet Answers \(pdf\)](#)

[Pair of Chutes Worksheet Answers \(doc\)](#)

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 be disposed 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.]

Assessment

[Provide assessment tools/activities for teachers to assess the learning objectives described earlier. How do you know if the students “got it” during the activity and after the activity? Provide active and embedded ways for the teacher to gauge what the students know about the topic at the beginning, and

whether the students *met the learning objectives at the end*. For examples of assessment tools and activities, browse the *TeachEngineering* collection.]

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...

Activity Extensions

[(optional) Provide suggestions of additional activities that explore the activity topic further, and suggestions for thought-provoking questions for the 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 to support the activity, such as online animations and images, video/DVDs or attached PowerPoint slide presentations, etc.]

References

[(optional) List all references used to create the activity. Also include suggested good resources. Use MLA format (see below). Provide in A → 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, 2010. (Source of some vocabulary definitions, with some adaptation) <http://www.dictionary.com>

Fish Management Office. Last updated January 15, 2010. Northwestern Division, US Army Corps of Engineer. Accessed March 4, 2010. (source of much teacher background information; good photos and diagrams) <http://www.nwd.usace.army.mil/ps/home.asp>

For magazine articles:

Doe, Juanita Q. "Title of an Article." Title of a Magazine. August 12, 1999: 23.

For journal articles:

Doe, Juan R. "Title of an Article." Title of a Scholarly Journal. 18 (1987): 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 internet resource: [URL here.](#)] See an [example](#).

Contributors

[(optional) 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

Copyright

[(optional) To include a brief copyright citation for the source of this curricular content, provide a copyright year and owner name. Check with your institution for the appropriate copyright text.]

Example: Copyright © 2010 by Regents of the University of Colorado. This digital library content was developed by the Integrated Teaching and Learning Program under National Science Foundation grant no. 0338326.

Supporting Program

[Briefly provide the name and organization of the source of this curricular content.]

Example: Integrated Teaching and Learning Program, College of Engineering, University of Colorado at Boulder

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