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| **Lesson Template**  Dear Author,  Welcome to TeachEngineering! The purpose of this cover sheet is to provide important resources and a checklist that will help you craft an **associated lesson** that will be published on TeachEngineering.org.  TeachEngineering lessons provide background knowledge that allow students and teachers to work through corresponding hands-on activity (or activities). No standalone lessons are permitted in the collection nor are standalone lessons accepted for publication. Each submitted **lesson must be accompanied by at least one unique associated activity** that gives students the opportunity to apply their knowledge from the lesson in a hands-on way and cement comprehension. Note: you cannot submit a lesson for an activity that is already published on TeachEngineering. Remember, we strive to provide teachers with activities that can be done “on a shoestring budget” so please keep in mind the nature of the materials you are using, and ask yourself if they are readily available within a classroom or are *reasonably affordable* for a teacher who would like to perform your lessons and its associated hands-on activity!   * Does your lesson provide a tangible learning experience as in the description above?  **(check here)** * Each lesson (and associated activity) must be classroom tested before it can be published on TeachEngineering. Has your curriculum been classroom tested?  **(check here)** * Highlighted components below are **required**. Have you fully filled out those components**?  (check here)** * Have you included at least two original images or figures at the bottom of this template, including at least one image of this activity being performed in the classroom? If you included figures, have you cited where they should be placed within your curriculum?  **(check here)**   To assist you with planning your lesson, explanations and example text, which you can replace with your text, are presented for each section. After you fill in each section, use the **”click or tap here to enter text”** prompt to submit updated information.  If you have any questions, please feel free to contact us.  Warm regards,  zen signature  Zain Alexander Iqbal  Digital Media and Technical Editor | TeachEngineering  University of Colorado Boulder  [zain.iqbal@colorado.edu](mailto:zain.iqbal@colorado.edu) **Part 1: Lesson Overview** | | | |
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| **Lesson Title** | **Click or tap here to enter your Lesson Title.** | | |
| **Focus Grade Target** | **Click to select a grade**. | **Grade Level Range:** | **Click to select a grade.**  to  **Click to select a grade.**  *If this lesson works for a range of grades, provide them here. Example: 8th grade is the “target” but it can work for 7th and 9th graders. Limit to no more than 3 grade levels.* |
| **Subject Area(s)**  Check all subject areas that apply to this lesson.  [Subject area definitions](https://www.teachengineering.org/subjectareas) | Algebra  Biology  Chemistry  Computer Science  Data Analysis and Probability  Earth/Space  Geometry  Life Science  Measurement  Numbers and Operations  Physical Science  Physics  Problem Solving  Reasoning and Proof  Science & Technology | | |
| **Time Required:** | **Click or tap here to enter the Time Required.** Estimate the time required to complete the lesson in minutes; you may add a brief explanation for longer activities, such as “three 50-minute class periods”. | | |
| **Keywords** | **Click or tap here to enter Keywords.** Add 4-10 words here in alphabetical order that a layperson or teacher may use to search. | | |

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| **Instructional Summary – 200 words** |

Summarize what your lesson is all about in one paragraph using the present tense. [See an example.](https://www.teachengineering.org/lessons/view/cub_energy2_lesson04#summary)

**Click or tap here to write your Instructional Summary.**

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| **Engineering Connection – 60 to 100 words** |

Describe how the scientific and mathematical concepts being studied in this lesson pertain to real-world engineering. (Do not recap the instructional summary.) Explain for the teacher how everyday engineering ties to what is being done in the lesson or activity. [See an example.](https://www.teachengineering.org/lessons/view/cub_energy2_lesson04#engineeringconnection)

**Click or tap here to write an Engineering Connection.**

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| **Engineering Category** |

Select one of the categories below that demonstrates this lesson’s [depth of engineering content](http://content.teachengineering.org/content/documents/TE_EngrCategories_v7.pdf).

**Click here to choose a category.**

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| **Classroom Testing Information** |

Briefly describe the K-12 classroom or informal learning center testing conducted with this curriculum. Please include the date, school, location, grade level, and number of students.

**Click or tap here to enter Classroom Testing Information.**

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| **Educational Standards** |

In priority order, list up to four educational STEM standards that students would learn as a result of completing this lesson. If students need a prerequisite skill to complete the lesson, then list what is required.

For each standard, include the source, year, grade band, standard nomenclature (e.g., number(s)/letter(s)), and standard summary. Example: North Carolina, science, 2004, 1.01 (grades 8-8): Identify and create questions and hypotheses that can be answered through scientific investigations. ID# S1028531

Provide at least ONE from each of the following:

**Click or tap here to enter text.**

List [Next Generation Science Standards](https://www.nextgenscience.org/overview-dci) (NGSS)

**Click or tap here to enter text.**

List [Common Core Math Standards](http://www.corestandards.org/Math/) (optional)

**Click or tap here to enter text.**

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| **Prerequisite Student Knowledge** |

List any skills or knowledge a student must already have in order to be successful in this lesson, such as knowledge of a certain concept or topic, specific math skills, etc. Example: “A familiarity with compass directions” or “A basic understanding of gravity and friction” or “The ability to calculate median, mean, and mode.”

**Click or tap here to enter text.**

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| **Learning Objectives** |

Using bullet points and statement form, identify up to four main goals or student outcomes of the lesson. Learning objectives often come from the educational standards you chose above. Use **active** verbs such as “explain”, “calculate” or “summarize” and avoid passive verbs such as “understand”, “know”, or “realize”. For example:

After this lesson, students should be able to:

* Describe the flow of electrical energy through a simple circuit.
* Discuss the effects of gravity and friction in the context of their roller coaster designs.
* Solve problems involving pressure, density and Pascal's law.

[See an example.](https://www.teachengineering.org/lessons/view/cub_energy2_lesson04#objectives)

**Click or tap here to enter your Learning Objectives.**

# **Part 2: Lesson Instructional Plan**

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| **Academic Vocabulary** | **Definitions (you may source definitions from Wikipedia or Wiktionary)** |
| *orbit* | *The gravitationally curved trajectory of an object.* |
| *particle* | *A small localized object to which can be ascribed several physical or chemical properties such as volume, density, or mass.* |

[See an example.](https://www.teachengineering.org/activities/view/cub_energy2_lesson04_activity2#vocab)

Click or tap here to insert a table and add text.

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| **Introduction and Motivation – at least 250 words (or 1/2/ page)** |

# Write a (minimum) half page introduction, as if you were speaking directly to the students, that helps grab the students’ attention and provides an engineering context. Address the learning objectives, include vocabulary, reference worksheets and attachments, presentations, and include teacher prompts and instructions. Provide an engineering context. This could be a demo, an example or real-world context. Ask questions to engage students. [See an example.](https://www.teachengineering.org/lessons/view/cub_energy2_lesson04#intro)

# **Click or tap here to enter your Introduction and Motivation brief.**

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| **Lesson Outline** |

Summarize pertinent information a teacher would need to teach this lesson. Use the following format below.[See an example.](https://www.teachengineering.org/lessons/view/cub_energy2_lesson04#background)

Lesson Background/Teacher Concepts - Summarize pertinent information a teacher would need to teach this lesson:

**Click or tap here to enter Lesson Background text.**

Associated Activity (or Activities) - TeachEngineering requires an original activity with each lesson. Provide a description of your activity here:

**Click or tap here to explain the Before the Activity procedure.**

Lesson Conclusion - Write this section as if you’re speaking directly to students. Help bring it all together!

**Click or tap here to write your conclusion.**

(For images, see **Part 5: Photos and Images** below on how to properly reference and cite images in your submission.)

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| **Worksheets and Attachments** |

List the names of any documents you will use as part of this lesson such as **presentations, handouts, assessments**, etc. Please also provide **answer keys** for all handouts/assessments. **Upload these documents separately along with this template.**

Clearly label each lesson and include the lesson name in the file (for example, all-about-bridges-homework-assignment.docx. TeachEngineering accepts most files in an **editable format** including Microsoft Word (.docx) Microsoft Excel (.xlsx) Microsoft PowerPoint (.pptx), JPEG files (.jpg) and Portable Network Graphics (.png) and others. If you have any questions, please contact your editors at TeachEngineering.

[See an example.](https://www.teachengineering.org/activities/view/cub_energy2_lesson04_activity2#attachments)

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| **Assessment (Pre-Activity, Formative, and Summative)** |

Provide assessment tools/activities for teachers to assess the learning objectives. How do you know if the students “got it” during and after the lesson? Provide active and embedded ways (formative assessment) for the teacher to gauge what students are learning about the topic/content throughout the lesson, and a performance-based way to assess student understanding of the learning objectives at the end of the lesson (summative assessment).

Browse the TE collection for example assessment tools. [See an example.](https://www.teachengineering.org/activities/view/cub_energy2_lesson04_activity2#assessment)

Pre-Lesson Assessment

**Click or tap here to enter text.** Descriptive Title: Describe the assessment procedure so the teacher knows what to do. Include detailed sample items and/or list the name of the actual assessment that you will be attaching. .

Lesson Embedded (Formative) Assessment

**Click or tap here to enter text.** Descriptive Title: Describe the assessment procedure so the teacher knows what to do.

Post-Lesson (Summative) Assessment

**Click or tap here to enter text.** Descriptive Title: Describe the assessment procedure so the teacher knows what to do; if posing discussion questions, provide example answers. Include detailed sample items and/or list the name of the actual assessment that you will be attaching.

**Part 3: Supporting Activity Information**

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| **Lesson Extensions** |

**Click or tap here to enter text**. Provide suggestions of additional activities that explore the activity topic further, and suggestions for thought-provoking questions for students in the weeks ahead. [See an example.](https://www.teachengineering.org/activities/view/cub_energy2_lesson04_activity2#extensions)

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| **Multimedia Support or Technology Integration** |

**Click or tap here to enter text.** Provide ideas and sources for additional information that supports the lesson, such as online images, animations, videos, websites, etc. Also include suggested exceptional resources.

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| **Required Internet Materials (Redirect URL)** |

**Click or tap here to enter text.** If your lesson is dependent on a resource from a website, please include it here. Provide one URL to direct teachers to required internet materials; “Attention: This lesson requires the following resource: (insert URL here)”.

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| **References** |

List all references used to create the lesson, especially the background knowledge section.

Use this 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 below:

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, Jon R. “Title of Article.” Scholarly Journal Name. (1999) Vol. 3, No. 6, pp. 112-28. URL or DOI number.

**Click or tap here to enter text.**

# **Part 4: Contributor, Supporting Program, Acknowledgements, and Classroom Testing**

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| **Contributors** |

**Click or tap here to enter text.** List the names of any person who participated in the development of this lesson (teachers, mentor, lab director, education staff, etc.). List the primary author first.

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| **Supporting Program** |

**Click or tap here to enter text.** If this instruction was developed as part of a special program, list the name of the supporting program and/or organization.

Example: Research Experience for Teachers (RET), Center for Bio-mediated & Bio-inspired Geotechnics (CBBG), in partnership with Arizona State University, Georgia Institute of Technology, New Mexico State University, University of California-Davis, and the National Science Foundation.

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| **Acknowledgements** |

**Click or tap here to enter text.** This curriculum was developed under National Science Foundation RET grant number ABC-XXXXXXXX. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

# **Part 5: Photos and Images**

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| **Lesson Photos** |

**TeachEngineering requires a minimum of two original photos per lesson.** This helps teachers visualize the nature of the lesson. We don’t expect nor require expert photos—smartphone photos work fine! However, we would like to see how teachers and students engage in the lesson—and you may use photos from your associated activity. (There are five placeholders below for photos, but we encourage you to add as many as you like.)

You may supplement your images with additional content sourced from the internet as long as they are licensed for public use (see [Requirements and Tips for Using Images](https://www.teachengineering.org/content/documents/TEAboutImages_v8.pdf)). Note: if authors plan on submitting photos that include their students, the author is responsible for securing the appropriate permissions from parents, guardians, or administrators. TeachEngineering classifies photos into two categories:

**Images** are photos or illustrations that enhance the lesson’s visual appeal. Reference where you want the image to go in the lesson by simply saying **(Insert Image 1)** in the text above and attach the photo in a box below.

**Figures** may be photos or illustrations as well as diagrams or drawings that specifically reference a topic within the text. For example, in explaining the parts of a cell or how a suspension bridge works, a figure may reference that explanation. Figures may also be used to help explain how to build a tool or a machine. Reference where you want the image to go in the lesson by saying **(Insert Figure 1)** in your text above and attach the photo in a box below.

 How to format images and figures; see below for a finished example:

**Image 1:** Insert into Procedure under “Day 1”

**Image file**: lesson01-image1-prism.jpg

**ADA Description**: A glass prism sits on a black background; a light source shining through the prism is demonstrating refraction of white light into the visible light spectrum.

**Source/Rights**: 2009 D-Kuru, CC BY-SA 3.0, Wikipedia, [source link](https://en.wikipedia.org/wiki/Prism#/media/File:Light_dispersion_of_a_mercury-vapor_lamp_with_a_flint_glass_prism_IPNr%C2%B00125.jpg).

**Caption**: Why does white light diffract into the colors of a rainbow when it shines through a prism?

**Click the center of the box below to upload an image.**

**Image 1 / Figure 1:** *Enter the location of where you want the image or figure in the text by saying* (Insert Figure 1) *here*.

**File name:** *The photo must be included as an attachment and must have the exact same name as you type here.*

*Example: lesson05-image1-pilot.jpg*

**ADA Description:** *Write this text as if describing key elements of the image to a blind person.*

**Source/Rights:** *Include copyright or identifying information for any images used. Images pulled from the Internet should be either in the public domain or licensed for use through Creative Commons (CC-BY or CC-SA); you must still attribute them to the person or website from which they were pulled as well as provide a* ***direct link*** *to the image.*

**Caption:** *This text will appear directly below the Image. This should not be the same text as used for the ADA Description.*

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**Image 2 / Figure 2:** *Enter the location of where you want the image or figure in the text by saying* (Insert Figure 1) *here*.

**File name:** *Example: activity05-image1-pilot.jpg*

**ADA Description:**

**Source/Rights:**

**Caption:**

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**Image 3 / Figure 3:** *Enter the location of where you want the image or figure in the text by saying* (Insert Figure 1) *here*.

**File name:** *Example: activity05-image1-pilot.jpg*

**ADA Description:**

**Source/Rights:**

**Caption:**

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**Image 4 / Figure 4:** *Enter the location of where you want the image or figure in the text by saying* (Insert Figure 1) *here*.

**File name:** *Example: lesson05-image1-pilot.jpg*

**ADA Description:**

**Source/Rights:**

**Caption:**

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**Image 5 / Figure 5:** *Enter the location of where you want the image or figure in the text by saying* (Insert Figure 1) *here*.

**File name:** *Example: activity05-image1-pilot.jpg*

**ADA Description:**

**Source/Rights:**

**Caption:**

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| **Submission Checklist** |
| This material has been tested in a K-12 classroom or out-of-school setting.  **(check here)**  The submitted curriculum is my own original work. (Note: Submissions will be checked for originality via [TurnItIn](https://www.turnitin.com/).)  **(check here)**  All activity and lesson template files as well as their associated handouts, images, presentations or other files are ready to upload as a single ZIP file, organized into folders within the ZIP file to clarify which handouts go with which lessons and activities.  **(check here)**  Image files and attachments (such as student handouts) are included as separate files in the ZIP file. (Note: Make sure images are inserted both in the template to show where they belong as well as submitted as separate image files, as described in the [Requirements & Tips for Using Images](https://www.teachengineering.org/content/documents/TEAboutImages_v8.pdf) on the [Submit Curriculum](https://www.teachengineering.org/getinvolved/submitcurriculum) page.)  (check here)  Curricula meets all of the requirements of the [K-12 Content Review Rubric](https://www.teachengineering.org/content/documents/TE_K-12_reviewcriteriarubric_v4.pdf) on the [Submit Curriculum](https://www.teachengineering.org/getinvolved/submitcurriculum) page.  **(check here)**    Submitted curricula fits into one of the TE engineering categories as described in the [TE Engineering Categories Description](https://www.teachengineering.org/content/documents/TE_EngrCategories_v7.pdf) on the [Submit Curriculum](https://www.teachengineering.org/getinvolved/submitcurriculum) page.  **(check here)** |