CLASSROOM OVERVIEW GEARS TINKER SET

Getting Started

At TeacherGeek, we strive to make our activities as simple as possible for you to implement, while giving you the flexibility to cater the activity to your class. All of our documents are available on our website, TeacherGeek.com, in both PDF and Microsoft Word so that you can customize them and make them your own!

Activities & Documents

All documents available at
teachergeek.com/gears

Recommended Group Size: 2-3 students

Set Up Guide – Start here to build your tinker set. Once it's built, move on to a lab or challenge!

Optional (Grades 3-4) Fraction Lab – Students use gears as a manipulative to learn about fractions. Covers all 3rd grade fraction standards.

Optional (Grades 6-8) Ratio & Proportion Lab – Students use gears to explore ratios and proportions.

Optional (Grades 1-3) Obstacle Course Challenge – Students design a moving, spinning obstacle course!

Optional (Grades 1-5) Kinetic Sculpture Challenge –Students use gears to make interactive art or dioramas.

Optional (Grades 3-8) Amusement Park Challenge – Students design as many amusement park rides as possible.

Optional (Grades 5+) Mechanical Advantage – Students *feel* mechanical advantage and have the option of calculating it. This is a great resource to use concurrently with a challenge.

Optional Market-It Sheet – Students turn their design into a retail product with the 4 Ps of Marketing.

Optional Engineering Notebooks (Simple or Standard version) – Students document and reflect on their use of the engineering design process.

Standards

The parts of the standard we address are bold, the rest isn't.

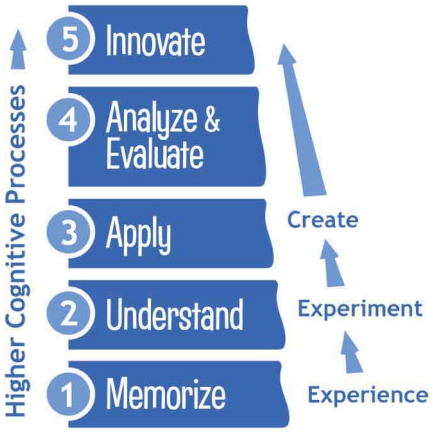
Fraction Lab
CCSS Math..... p. 2
CCSS ELA..... p. 3

Ratio & Proportion Lab
CCSS Math..... p. 4
CCSS ELA..... p. 5

Kinetic Sculpture Challenge
NGSS ..... p. 6-7
CCSS ELA..... p. 8

Obstacle Course Challenge
NGSS..... p. 9-10
CCSS ELA .....p. 11

Amusement Park Challenge
NGSS..... p. 12-14
CCSS ELA ..... p. 15-16



TeacherGeek is designed to bring your students to higher cognitive domains while addressing standards.

FRACTION LAB STANDARDS: CCSS

Math Standards (Grade 3)

Develop understanding of fractions as numbers.

CCSS.Math.Content.3.NF.A.1
Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.

CCSS.Math.Content.3.NF.A.2
Understand a fraction as a number on the number line; represent fractions on a number line diagram.

CCSS.Math.Content.3.NF.A.2.a
Represent a fraction 1/b on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line.

CCSS.Math.Content.3.NF.A.2.b
Represent a fraction a/b on a number line diagram by marking off a lengths 1/b from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line.

CCSS.Math.Content.3.NF.A.3
Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

CCSS.Math.Content.3.NF.A.3.a
Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.

CCSS.Math.Content.3.NF.A.3.b
Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model.

CCSS.Math.Content.3.NF.A.3.c
Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; **locate 4/4 and 1 at the same point of a number line diagram.**

CCSS.Math.Content.3.NF.A.3.d
Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

FRACTION LAB STANDARDS: CCSS

ELA Standards (Grades 3-5)

Craft and Structure:

CCSS.ELA-Literacy.RI.3.4
Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 3 topic or subject area*.

CCSS.ELA-Literacy.RI.3.5
Use text features and search tools **(e.g., key words,** sidebars, hyperlinks) **to locate information relevant to a given topic efficiently.**

CCSS.ELA-Literacy.RI.4.4
Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.

CCSS.ELA-Literacy.RI.5.4
Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.

Integration of Knowledge and Ideas:

CCSS.ELA-Literacy.RI.3.7
Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

CCSS.ELA-Literacy.RI.4.7
Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, **diagrams,** time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

RATIO & PROP STANDARDS: CCSS

Math Standards (Grade 6)

Compute fluently with multi-digit numbers and find common factors and multiples.

CCSS.Math.Content.6.NS.B.2
Fluently divide multi-digit numbers using the standard algorithm.

CCSS.Math.Content.6.NS.B.4
Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2).

Understand ratio concepts and use ratio reasoning to solve problems.

CCSS.Math.Content.6.RP.A.1
Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."

CCSS.Math.Content.6.RP.A.3
Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

CCSS.Math.Content.6.RP.A.3.a
Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. **Use tables to compare ratios.**

RATIO & PROP STANDARDS: CCSS

ELA Standards (Grades 6-8)

Craft and Structure:

CCSS.ELA-Literacy.RI.6.4
Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and **technical meanings.**

CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6*-*8 texts and* *topics*.

Integration of Knowledge and Ideas:

CCSS.ELA-Literacy.RI.6.7
Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, **diagram, model**, graph, **or table).**

Key Ideas and Details:

CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, **diagram, model**, graph, **or table).**

KINETIC SCULPTURE STANDARDS: NGSS (Grades K-2)

K-2-ETSI-I. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETSI-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2-ETSI-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Science and Engineering Practices

Asking Questions and Defining Problems

Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)

Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)

Developing and Using Models

Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)

Analyzing and Interpreting Data

Analyze data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3)

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1)

Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)

Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)

ETS1.B: Developing Possible Solutions

Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)

ETS1.C: Optimizing the Design Solution

Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)

Crosscutting Concepts

Structure and Function

The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2)

KINETIC SCULPTURE STANDARDS: NGSS (Grades 3-5)

3-5-ETSI-I. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETSI-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETSI-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Science and Engineering Practices

Asking Questions and Defining Problems

Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

Planning and Carrying Out Investigations

Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)

Constructing Explanations and Designing Solutions

Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

Disciplinary Core Ideas

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Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

ETS1.B: Developing Possible Solutions

Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)

At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)

Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

ETS1.C: Optimizing the Design Solution

Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)

Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

KINETIC SCULPTURE STANDARDS: CCSS

ELA Standards (Grades K-5)

Craft and Structure:

CCSS.ELA-Literacy.RI.K.4
With prompting and support, ask and answer questions about unknown words in a text.

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CCSS.ELA-Literacy.RI.1.5
Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons**) to locate key facts or information in a text.**

CCSS.ELA-Literacy.RI.2.4
Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.

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OBSTACLE COURSE STANDARDS: NGSS (Grades K-2)

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Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)

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AMUSEMENT PARK STANDARDS: NGSS (Grades 6-8)

MS-ETSI-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETSI-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETSI-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETSI-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Science and Engineering Practices

Asking Questions and Defining Problems

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Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.

CCSS.ELA-Literacy.RI.2.5
Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons**) to locate key facts or information in a text efficiently.**

CCSS.ELA-Literacy.RI.3.4
Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 3 topic or subject area*.

CCSS.ELA-Literacy.RI.3.5
Use text features and search tools **(e.g., key words,** sidebars, hyperlinks) **to locate information relevant to a given topic efficiently.**

CCSS.ELA-Literacy.RI.4.4
Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.

CCSS.ELA-Literacy.RI.5.4
Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.

Integration of Knowledge and Ideas:

CCSS.ELA-Literacy.RI.3.7
Use information gained from illustrations (e.g., maps, **photographs) and the words in a text to demonstrate understanding of the text** (e.g., where, when, why, and how key events occur).

CCSS.ELA-Literacy.RI.4.7
Interpret information presented visually, orally, or quantitatively **(e.g.,** in charts, graphs, **diagrams,** time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

AMUSEMENT PARK STANDARDS: NGSS (Continued)

ELA Standards (Grades 6-8)

Integration of Knowledge and Ideas:

CCSS.ELA-Literacy.RI.6.4
Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and **technical meanings.**

CCSS.ELA-Literacy.RI.6.7
Integrate information presented in different media or formats (e.g., visually, quantitatively**) as well as in words to develop a coherent understanding of a topic or issue.**

CCSS.ELA-Literacy.RI.7.4
Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and **technical meanings**; analyze the impact of a specific word choice on meaning and tone.

CCSS.ELA-Literacy.RI.8.4
Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and **technical meanings**; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.

CCSS.ELA-Literacy.RST.6-8.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

Key Ideas and Details:

CCSS.ELA-Literacy.RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7
Integrate quantitative or **technical information expressed in words in a text with a version of that information expressed visually (e.g.,** in a flowchart, **diagram, model**, graph, or table**).**