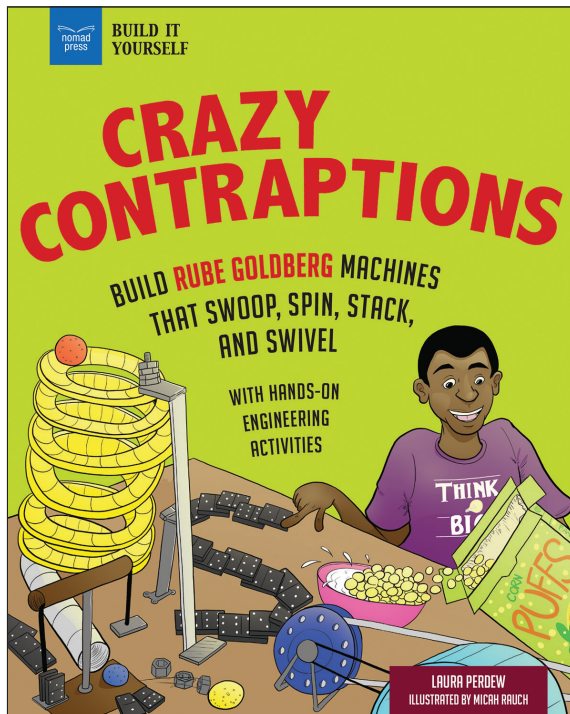




Crazy Contraptions: Build Rube Goldberg Machines that Swoop, Spin, Stack, and Swivel with Hands-On Engineering Activities

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Age: 9–12
Grade: 4–6
Softcover: 9781619308268, \$17.95
Hardcover: 9781619308237, \$22.95
eBook: all formats available, \$12.99
Specs: 8 x 10, 128 pages, color interior
Focus: Engineering and Technology
GRL: Z

Why use a simple hand motion to wipe your mouth when you can build a machine to do it for you?

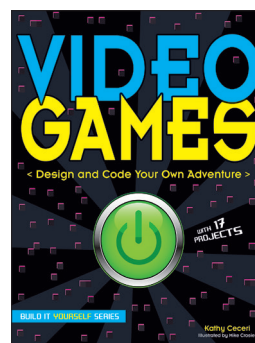
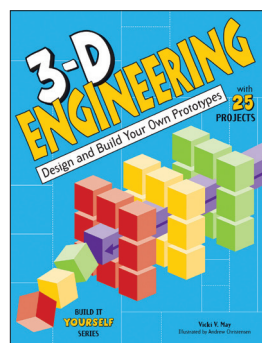
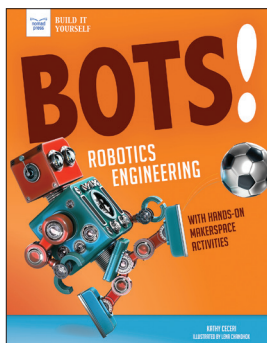
Toppling dominoes, rolling marbles, racing balloon cars, springing catapults, and whizzing zip-lines are all elements used to build Rube Goldberg machines in *Crazy Contraptions: Build Rube Goldberg Machines that Swoop, Spin, Stack, and Swivel with Hands-On Engineering Activities*. The book introduces kids ages 9-12 (and beyond!) to the wacky machines designed by Goldberg. Young engineers are invited to invent, design, create, and play as they make their own Rube Goldberg machines!

Crazy Contraptions includes hands-on STEAM activities, critical thinking exercises, fun facts, links to online primary sources and other supplemental material.

Learn more about *Crazy Contraptions* at nomadpress.net/nomadpress-books/crazy-contraptions-build-rube-goldberg-machines-that-swoop-spin-stack-and-swivel/



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ESSENTIAL QUESTIONS TO ASK

KEY VOCABULARY

angle, axis, catapult, chain reaction, engineer, kinetic energy, pivot, simple machine

BEFORE READING

1 Establish Background Knowledge

- What are some innovators or inventors you admire? What do you admire them for?
- Why might someone choose to invent a machine that performs a small, easy task?
- Have you ever designed a chain reaction contraption?

2 Skill Introduction

- What do you do when you come to a word or phrase you do not know?
- How do photographs and videos help someone learn about a topic?

CCC: CCSS.ELA-Literacy.L.7.4b Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., belligerent, bellicose, rebel).

DURING READING

1 Check for Understanding

- What was Rube Goldberg's contribution to engineering?
- In what ways do simple machines work together as compound machines and improve people's lives?
- Why is play considered to be an essential part of learning?
- How is the experience of watching a contraption different from creating a contraption?
- Have you ever participated in the Rube Goldberg challenge at school?

CCC: CCSS.ELA-Literacy.L.7.5c Distinguish among the connotations (associations) of words with similar denotations (definitions) (e.g., refined, respectful, polite, diplomatic, condescending).



Take a look at this Rube Goldberg machine. How many steps can you count?
<https://interestingengineering.com/video/we-could-watch-this-wall-mounted-rube-goldberg-machine-all-day-long>



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ESSENTIAL QUESTIONS TO ASK

AFTER READING

1 Summary and Expansion

- a What roles do force, work, and energy play in Rube Goldberg contraptions?
- b How do inclined planes help people do work and build Rube Goldberg contraptions?
- c What role do levers play in today's world? Can you spot some examples of levers in your home?
- d How might history have been different without wheels? How would your town, neighborhood, and home be different?
- e What are some inventions made possible by pulleys?
- f How have screws been used throughout history to make work easier?
- g Why do you think people are fascinated by Rube Goldberg contraptions?
- h Do you prefer collaborative or competitive activities? Which category do Rube Goldberg contraptions fall into?
- i How many different simple machines can you spot around you right now?

CCC: 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).

CCC: CCSS.ELA-Literacy.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

CCC: CCSS.ELA-Literacy.SL.7.1c Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.

CCC: CCSS.ELA-Literacy.WHST.6-8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

COMMON CORE CONNECTIONS

Grade: 7 Language CCSS.ELA-Literacy.L.7.3,4,4a,4b,4c,4c,5,5b,5c,6

Grade: 6-8 Science & Technical Subjects CCSS.ELA-Literacy.RST.6-8.1,2,3,4,5,6,7,8,9,10

Grade: 7 Speaking & Listening CCSS.ELA-Literacy.SL.7.1,1c,1d,2,3,4,5,6

Grade: 6-8 Writing HST CCSS.ELA-Literacy.WHST.6-8.1,2,4,6,7,8,9,10



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COMMON CORE CONNECTIONS

Grade: 7 Language

CCSS.ELA-Literacy.L.7.3,4,4a,4b,4c,4c,5,5b,5c,6

3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.

4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 7 reading and content, choosing flexibly from a range of strategies.

4a Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.

4b Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., belligerent, bellicose, rebel).

4c Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning or its part of speech.

5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

5b Use the relationship between particular words (e.g., synonym/antonym, analogy) to better understand each of the words.

5c Distinguish among the connotations (associations) of words with similar denotations (definitions) (e.g., refined, respectful, polite, diplomatic, condescending).

6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Grade: 6-8 Science & Technical Subjects

CCSS.ELA-Literacy.RST.6-8.1,2,3,4,5,6,7,8,9,10

1 Cite specific textual evidence to support analysis of science and technical texts.

2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

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.

5 Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

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).

8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

10 By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.



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COMMON CORE CONNECTIONS

Grade: 7 Speaking & Listening

CCSS.ELA-Literacy.SL.7.1,1c,1d,2,3,4,5,6

- 1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.
- 1c Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.
- 1d Acknowledge new information expressed by others and, when warranted, modify their own views.
- 2 Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.
- 3 Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.
- 4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
- 5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.
- 6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 7 Language standards 1 and 3 here for specific expectations.)

Grade: 6-8 Writing HST

CCSS.ELA-Literacy.WHST.6-8.1,2,4,6,7,8,9,10

- 1 Write arguments focused on discipline-specific content.
- 2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- 4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- 6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
- 7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- 8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- 9 Draw evidence from informational texts to support analysis, reflection, and research.
- 10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.



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ACTIVITY!

COLLAPSING CARDS

For your first lever challenge, perform a simple task using one type of lever—a domino. Dominoes act as third class levers when you set them on end. The end on the table is the fulcrum. The domino itself is the arm, and when it falls, it applies force to the middle of next domino.

The Challenge Identified: Build a simple contraption made of dominoes to destroy a house of cards.

► **Brainstorm ideas and supplies:** Well, you'll need dominoes and playing cards. What happens if you don't have these supplies? What else could be used like a domino? Could you make your own cards cut out of cereal boxes?

► **Draw a plan:** This is a pretty simple challenge. Your drawing might look something like this one.

► **Build:** Set up your house of cards. Steady hands! Stand your dominoes on end in a line, making sure the last one is close enough to the card house to knock into it when it falls.

► **Test:** Ready? Knock over that first domino. Watch the chain reaction of one lever (a domino) falling into the other.

► **Evaluate:** Did the dominoes fall like you expected? Did your house of cards fall? What went well? If the cards didn't fall, you need more force. Try moving the last domino closer to the house. You might also add larger, heavier dominoes to the chain.

► **Redesign?** You may want to add more dominoes (LOTS more!). You could even experiment with making the line of dominoes snake across a table. You could also set up the chain reaction to make the falling dominoes move in two different directions. Or perhaps you could make your house of cards even bigger!

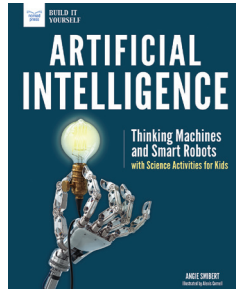
Contraption Hint: Several old cereal boxes, CD cases, books, or even wooden blocks make great dominoes if you don't have actual dominoes.



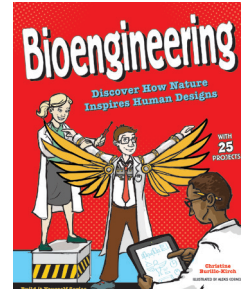
More Engineering Books!



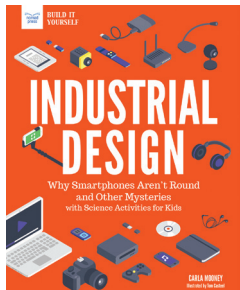
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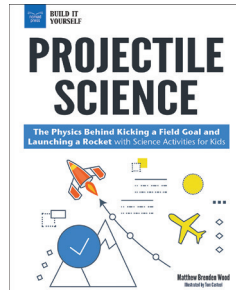
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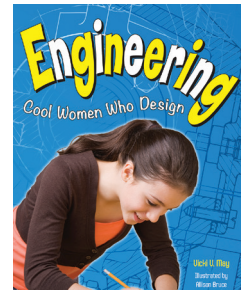
Author: Christine Burillo-Kirch



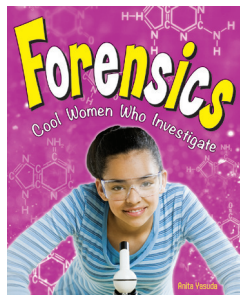
Author: Carla Mooney



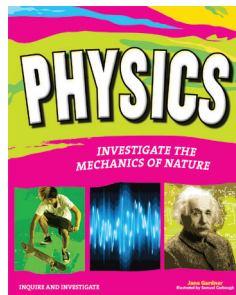
Author: Matthew Brenden Wood



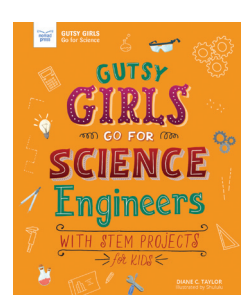
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