



Explore Engineering

Recommended Age: 8 and up

Explore all kinds of engineering including hydraulic engineering, structural engineering, and electrical engineering with these fun activity kits. With the activities in this kit, kids can build structures, machines, circuits, and more.



Steam Kits were supported in whole or in part by the U.S. Institute of Museum and Library Services under the provisions of the Library Services and Technology Act, administered in California by the State Librarian.



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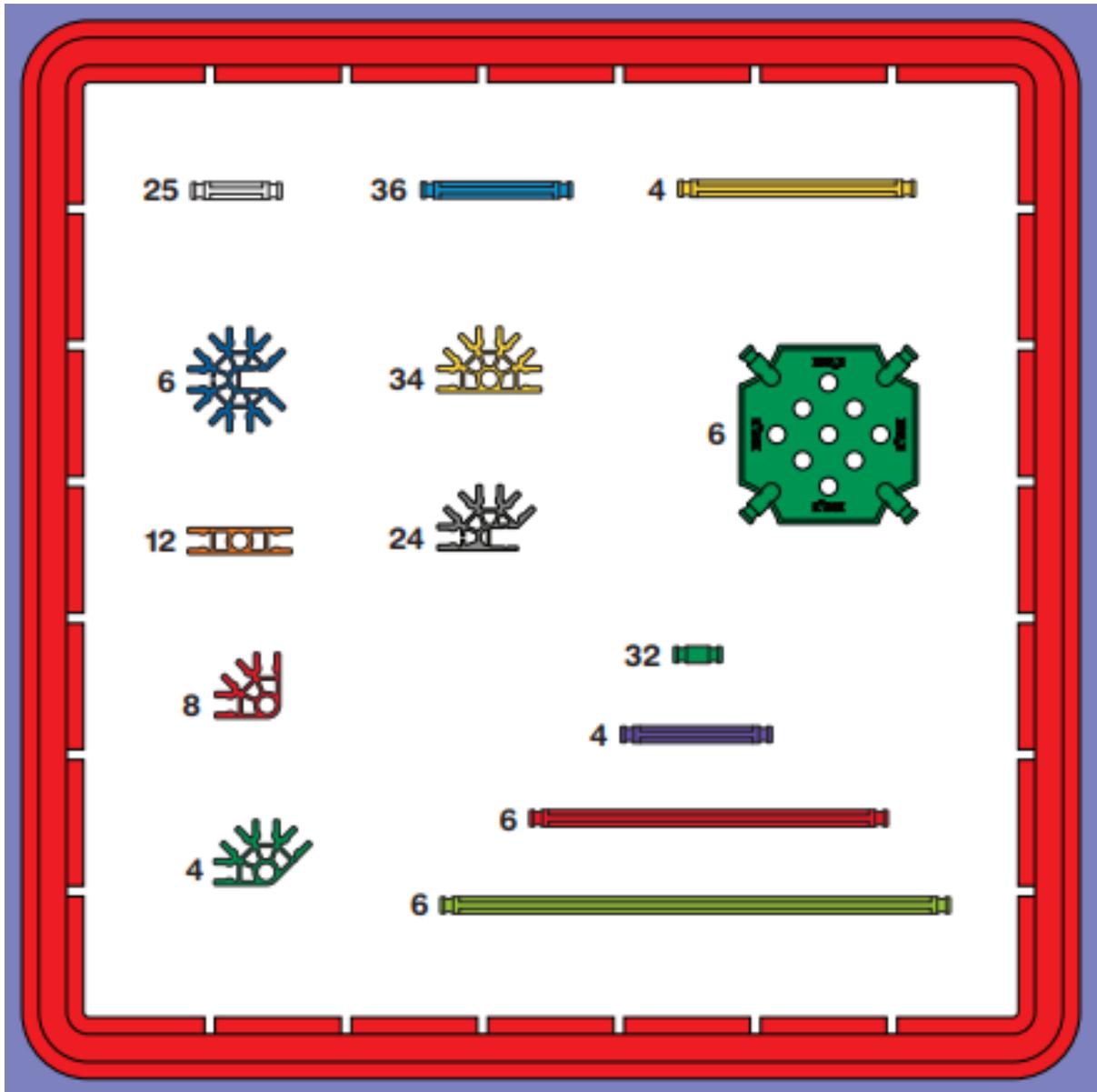
Contents List

- **Book: *Basher Science: Engineering* by Tom Jackson**
- **Book: *Solve This! Wild and Wacky Challenges for the Genius Engineer in You* by Joan Marie Galat**
- **K'nex Introduction to Structures: Bridges:**
 - **Guide**
 - **See attached Bill of Materials for complete parts list**
- **Hydraulics Engineering Kit:**
 - **See the attached Bill of Materials for complete parts list**
- **Discovering STEM Newton's Laws:**
 - **Guide**
 - **See attached Bill of Materials for complete parts list**
- **Snap Circuits:**
 - **SC-300 Snap Circuits Block Layout**
 - **Instruction Manual Experiments 1-101**
 - **Instruction Manual Experiments 102-305**
 - **See TWO attached Parts Lists for complete parts list**
- **Keva Contraptions:**
 - **50 wood planks**
 - **2 Keva balls**
 - **Guide book**

Please note: The total replacement cost for this kit is \$237.89

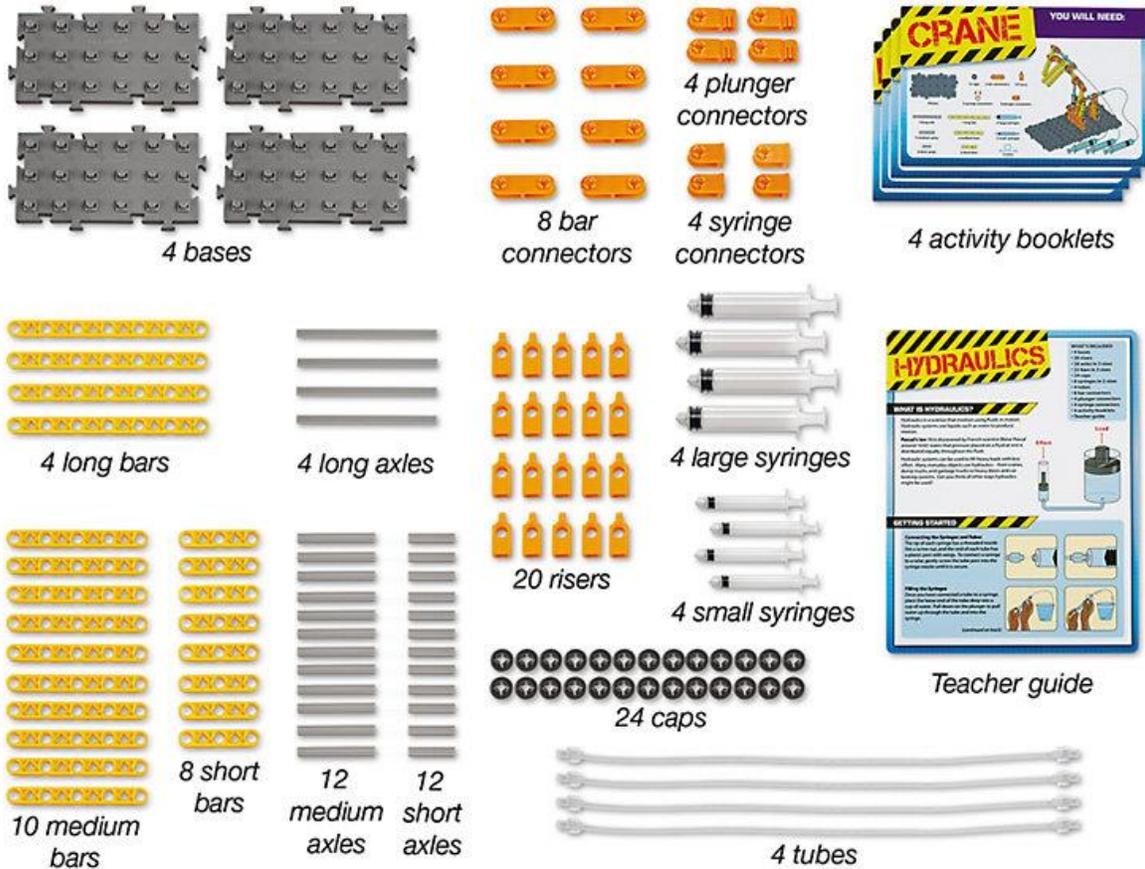
K'NEX Introduction to Structures: Bridges

Bill of Materials

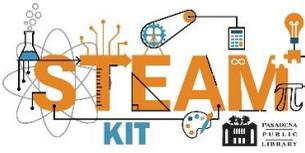


Hydraulics Engineering Kit

Bill of Materials



Kit includes everything you see here.



Getting Started Guide

The Explore Engineering Kit is full of all kinds of things to build, connect, and try to learn about different types of structures and engineering. Each activity within the kit can be used separate from the others, but by trying all of them you'll get a good start learning about some of the things engineers deal with. Don't know where to start? Keep reading to learn where you can find suggested projects for the activities in this STEAM kit.

K'nex Introduction to Structures: Bridges

The K'nex Introduction to Structures: Bridges set has 207 parts, which allow you to build 13 different key bridge types and teaches STEAM concepts such as bridge types, compression, tension, load, force, stress, cantilever construction, and suspension technology.

Take a look through the K'nex guide to see how to build different types of bridges and look through the K'nex Teachers Guide for more information about the different kinds of bridges you can build with this set.

Keva Planks

KEVA planks are an exceptionally versatile tool for teaching STEM concepts to children of any age or skill level. Only one simple building block is used which allows for an infinite number of construction possibilities. Planks are assembled using various stacking techniques. Since gravity is the primary force acting on the blocks, compounding variables such as gluing skill or connector strength are eliminated. Construction progresses quickly so multiple trials or experiments can be conducted in the course of any challenge. Trial and error maximizes discovery.

Use the guide included in the kit to try building some contraptions, or experiment on your own. Since there are no glue or other connecting factors in play the possibilities are endless! You can also use some of the challenges outlined below to spark further building creativity. Some of the concepts children discover while building: balance, counterbalance, leverage, velocity/mass/force relationships, slope vs velocity, momentum, optimum proportions, 2D vs 3D design, linear vs parabolic shapes, symmetry, problem solving, innovation, quantitative math, geometric shapes.

Challenges:

- **Stacking Game**
Each player creates a square base with 5 block placed side by side. No other planks may touch the table or floor. Every player must place each plank according to the instructions of the leader. Leader will say flat, edge or upright for each plank to be added to the structure. Leader may use a die (1 and 2= upright, 3 and 4= edge, 5 and 6 = flat) or just randomly call out instructions.

Try these variations: tallest structure, widest structure, artistic structure, 5 blocks per structure, 10 blocks per structure, 20 blocks per structure, 2 blocks at a time,



left (off) handed building, last structure to fall, use 1 or 2 planks instead of 5 for the starting base.

How does your strategy change with each new parameter?

- **Bridge Challenge**

Build a bridge span as wide as possible with only four blocks touching the floor or table.

- **Motion**

Create a structure that will deliver a ping pong ball into a container that is 12 inches away from the drop point. Make the ball bounce into the container. Make the ball change directions on its way to the container.

- **2 Dimensional Designs**

Create a 2D representation of a real object- apple, butterfly, etc. Create a 2D design using patterns. Consider pattern repetition. Linear patterns, circular patterns, spirals.

How many different ways can you make a square? triangle? hexagon?

- **3D Sculptures**

Create a structure with a shape theme: triangles, squares, polygons. Shapes can be structural or decorative.

- **Spirals**

Make a structure using spirals. How many different types of spirals can you make? How can you affect the number of layers needed to make a complete revolution?

- **Impossible Structures**

Build a structure and remove some of the planks to create a sculpture that could not be built from the ground up.

Build a non uniform sculpture- Does not follow a pattern, non linear- free form (Island, stack of hay, tree etc.)

- **Games**

Sculptionary™- One person builds and others must guess the object.

Sculptura™- One person calls out a stacking orientation and all students must stack accordingly, i.e. flat, edge, upright straight, upright angled. Every sculpture will be different. Stress listening skill and NOT looking at others' work.

KEVAtalk™- One person describes precise positioning and all try to build the same sculpture without seeing the master. Here, a "blind" is necessary. Start with no more than five blocks until players' communication skills improve.



Extraction™- players build a tall tower together. Take turns removing one planks at a time without making the tower fall. During the game, ask players to predict what will happen before the plank is removed. Discuss the forces acting on the blocks. How do the forces change during the game?

- **Minimalism**
Build a sculpture using only 10 planks. Build objects with only the most essential elements-i.e. Airplane with 3 planks.

After trying challenges or free build time, use some of the questions below to get kids talking about their build process.

- What did you learn or discover as you built?
- How is your final structure different from your original concept?
- What was the most difficult part?
- How are forces working in your structure? i.e. “ This block was leaning against this wall with a sideways force so I needed to reinforce the wall.”
- How could you make your structure more attractive or more interesting?
- What would you do differently the next time you try to build something like this?

Snap Circuits

Snap Circuits makes learning electronics easy and fun! Just follow the colorful pictures in the two included manuals to build exciting projects such as AM radios, burglar alarms, doorbells, and much more! You can even play electronic games with your friends. All parts are mounted on plastic modules and snap together with ease.

Included in this kit are two project manuals with detailed instructions for 300 electronics projects all built with Snap Circuits. These projects will give kids a basic understanding of circuitry and how electronics work.

Discovering STEM Newton’s Laws

Learn all about the ingenious Sir Isaac Newton’s laws of motion which are the basis of classical mechanics that still describe most everyday life situations. Observe the effects of kinetic and potential energy and see first-hand how energy is transformed from one form to the other. Build 8 working models such as a ballistic catapult, a gravity fan, a collision car, a moving cabin, a balloon powered plane and a dragster.

Use the booklet included in the kit to find easy to follow instructions for building these machines. The booklet also provides detailed explanations of the different scientific principles applied and incorporates innovative experimental activities for hands-on learning.

Hydraulics Engineering Kit



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Kids explore the mechanical power of liquid in motion—as they build their own hydraulic machines! The kit includes 4 step-by-step activity booklets and all the reusable building pieces kids need to create 4 different hydraulic machines—from a working drawbridge to a crane that really lifts objects. With this kit, kids can explore concepts like force, motion, distance, leverage, and gravity, as well as developing skills such as problem solving and perseverance.

Use the activity booklets included in the set to build four different hydraulic machines including a bridge, crane, lift, and rake. The teacher card included in the kit will give you basic information about hydraulics in general. Once you've explored the basics of hydraulics through these machines and information, try creating your own hydraulic machine.

Here are some questions to encourage critical thinking as you or your child build the machines:

1. Do you think the machine will work just as well without water? Why do you think so?
2. Why do you think a smaller syringe moves farther than a large syringe when they are connected?
3. How can you adjust your machine so that it moves farther or higher?



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Policies and Procedures

1. All STEAM Kits must be checked out from and returned to the Central Library Circulation Desk.
2. The children using these kits must be within the prescribed age range. Adult supervision is required.
3. Only one kit is permitted per card at a time.
4. All kits are checked out for two weeks and cannot be renewed. Overdue fees are 25 cents per day past the due date.
5. Holds may not be placed on STEAM Kits, which are available only on a first-come, first-served basis.
6. These kits are intended for home use. Use in a classroom or other group setting requires direct adult supervision.
7. Materials in the front pockets of folders are for your use. Everything in plastic sleeves should remain in plastic sleeves.
8. We reserve the right to inspect the kits in front of the patron before and/or after checkout.
9. The library cardholder is responsible for the contents of the kit. Each kit contains a detailed list of all items in the kit and the replacement costs. Any damage or loss may result in assessed fees.



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For Susan

Replacement Costs

- **Book: Basher Science: Engineering by Tom Jackson \$9.99**
- **Book: Solve This! Wild and Wacky Challenges for the Genius Engineer in You by Joan Marie Galat \$16.99**
- **Knex Introduction to Bridges \$39.99**
- **Hydraulic Engineering \$49.99**
- **Discovering STEM Newton's Laws \$35.99**
- **Snap Circuits \$64.99**
- **Keva Contraptions \$19.95**

Call Number

STEAM Explore