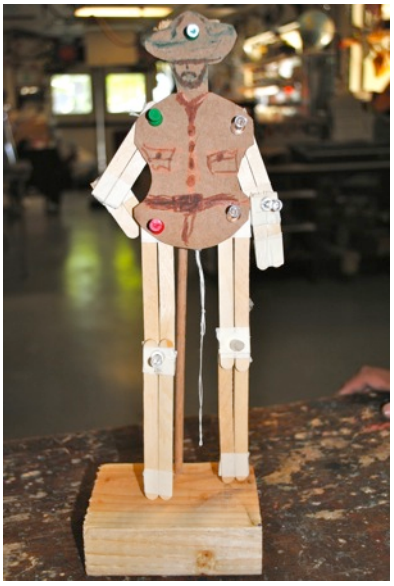
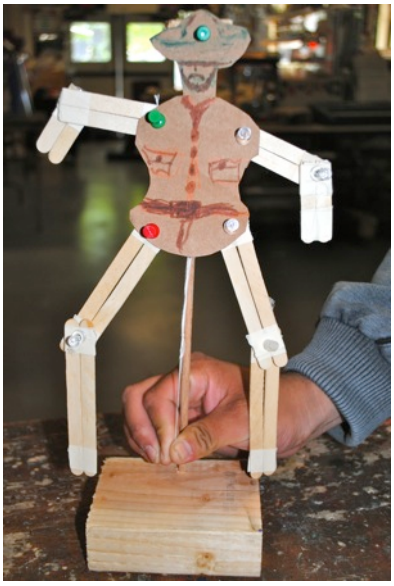
Lever Cowboy

Category: Physics: Force & Motion,
Biology: Animal Systems
Type: Make & Take



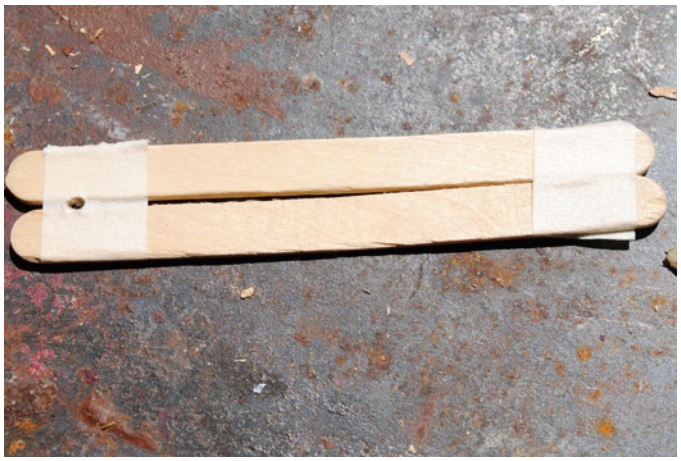


Rough Parts List:

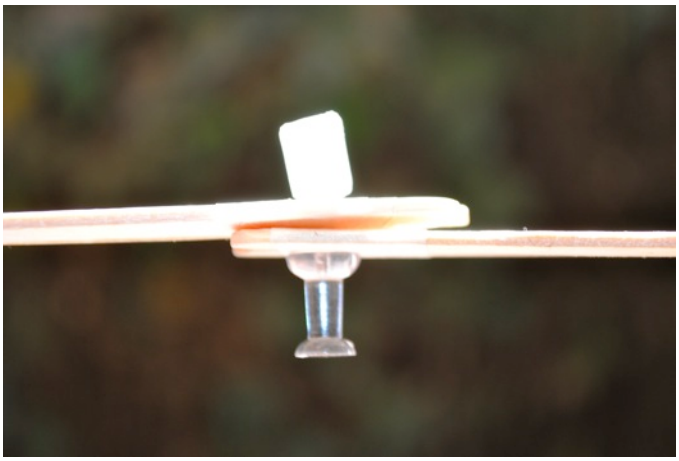
12	Craft sticks
1	Baseboard
1	Small block of wood
9	Pushpins
	glue stick
12"	Dowel, ¼"
1	Bead
	String
	Cardboard
	Masking Tape

Video: **http://youtu.be/TOtRIhWxdjk**

How To:

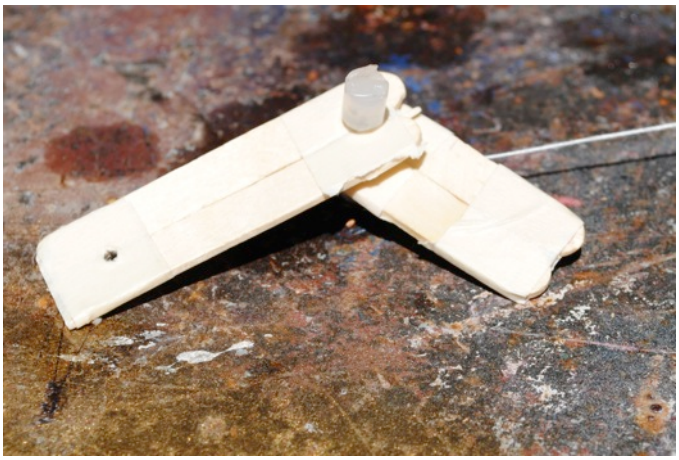


Tape 2 craft sticks together. Make 4 of these. Drill a small hole with a nail bit in the center of the tape and between the sticks.

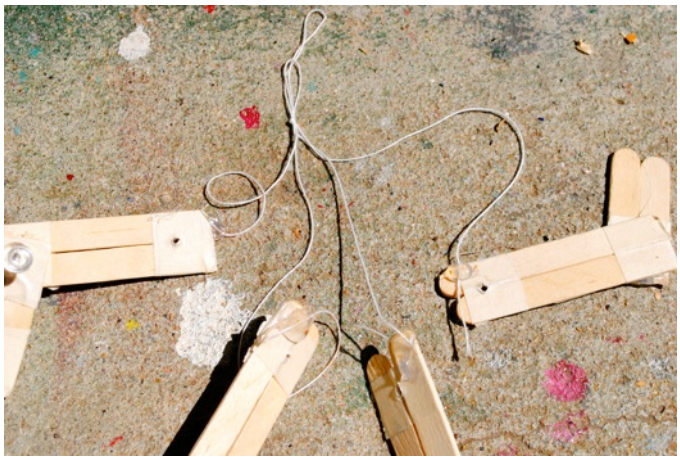


Attach 2 sets of sticks using a tack and a piece of glue stick.
Do this twice to make 2 legs.

Cut 4 sticks in half and tape 2 halves together, do this for all 4 sticks.

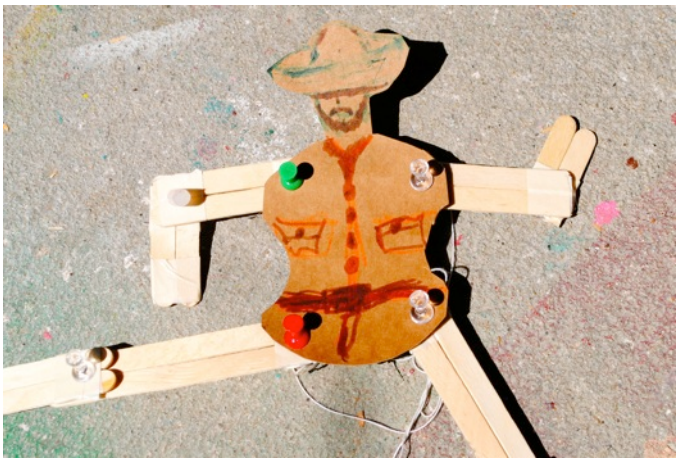


Attach 2 sets of short sticks using a tack and a piece of gluestick, do this twice.



Glue a long piece of string to the tip of each of the limbs, well above the hole.

Draw and cut out a body.



Connect the arms and legs to the body.

Place a bead near the bottom edge of the back side of the body and thread the strings through it.

Drill a holes in the baseboard and a small piece of wood.

Connect the two pieces with a dowel.

Attach your character to its stand.

Fine Points:

→ The holes in the arms and legs must be big enough so that they swing easily, not tight. If they are tight and don't move easily, make them bigger.
→ The strings must be held in a position lower than all the levers.
→ Each string should be glued to the corner and not the middle of a craft stick.

Concepts Involved:

- Levers are sticks or bars that turn around a single point.
- Levers can make work easier by increasing the force or the distance the force moves. Levers also change the direction of force; in this project, you pull down but the arms and legs go up.
- Real bone-muscle systems also work this way: each has a point it turns around called the joint. The bone is the bar, and the muscle pulls on the bone to make it move.

Focus Questions:

1. What would happen if you put the pushpin for each arm or leg exactly in the center of that arm or leg?
2. Can you think of another way to get the bear to move its arms or legs?

3. Which can you lift with more, your bicep (in front of your upper arm) or your tricep (in back of your upper arm?
4. When you lift something with your arm, using your bicep muscle, can you keep your tricep completely loose, or does it always tighten up?

Elaboration:

Sea cucumbers and slugs don't have bones. They're called invertebrates and all they can do is slide around. Animals with bones, like fish and humans, are called vertebrates. Bones help us move in many different ways.

Most bones have muscles pulling on them. Muscles are attached to bones by tendons. Muscles contract and pull on the tendons at each end of itself, which pull on other bones. Bones are held together by ligaments. A place where two or more bones come together is called a joint.

In this project, the pushpins are the joints and the strings are the tendons. Your pull is the muscle. Each arm and leg is a lever that moves when you pull on it. It is set up like most bone-muscle systems in your body so that the muscle (you) only have to pull a short distance to get a large movement out of the bone. Muscles are able to pull hard, but not for much of a distance. They never push, only pull.

When one muscle is pulling, the other muscles can be completely limp. You can try this by lifting up a chair and checking which muscle is tight. Sometimes you are tensing more muscles than you need to. But other times, you really do need several muscles to perform a certain motion.

Links to k-12 CA Content Standards:

Grades k-8 Standard Set Investigation and Experimentation

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

Grades k-12 Mathematical Reasoning:

1.0 Students make decisions about how to approach problems:
1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.
1.2 Determine when and how to break a problem into simpler parts.

2.0 Students use strategies, skills, and concepts in finding solutions:
2.1 Use estimation to verify the reasonableness of calculated results.
2.2 Apply strategies and results from simpler problems to more complex problems.
2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

3.0 Students move beyond a particular problem by generalizing to other situations:
3.1 Evaluate the reasonableness of the solution in the context of the original situation.
3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
3.3 Develop generalizations of the results obtained and apply them in other circumstances.

Grade 2 Standard Set 1. Physical Sciences:

The motion of objects can be observed and measured.

1.c Students know the way to change how something is moving is by giving it a push or a pull. The size of the change is related to the strength, or the amount of force, of the push or pull.

1.d Students know tools and machines are used to apply pushes and pulls (forces) to make things move.

Grade 3 Standard Set 1. Physical Sciences (Energy & Matter):

1.c Students know machines and living things convert stored energy to motion and heat.

Grade 8 Standard Set 2. Forces:

Unbalanced forces cause changes in velocity.

2.a Students know a force has both direction and magnitude.