

# Maker Space Syllabus

Tuesdays, 9:00 - 10:30

Instructor: Laura Erlig

Have you ever wondered how to create art with moving parts, using nothing but cardboard, a few skewers, and some craft supplies? A "maker" approach to STEM puts an emphasis on hands-on exploration and encourages students to think creatively. Flexible maker-inspired activities can build student enthusiasm and confidence with science and engineering. This class will have a variety of inspiring examples, and students can make them or their own creations using recycled materials. Students can do a lot with cardboard, a bin of recycled materials, rubber bands, and tape!

**Week One:** Cardboard Automatons - **Automaton**, a machine that makes parts appear and disappear, move up and down, spin in circles, or all of these together. You will learn about **forces** creating a reaction. The instructions will show you how to build a moving caterpillar, but you can use your imagination to build any other animal or object you want! Students will brainstorm ideas of what they are interested in making. **Homework: come up with a list of supplies needed to make your idea and research it.**

**Week Two:** Rubber-band powered cars - When you stretch a rubber band it stores potential energy. Specifically it stores **elastic potential energy**—the type of energy stored when a material is deformed (as opposed to gravitational potential energy, the type you get when you raise an object off the ground). When you release it all, that stored energy has to go somewhere. If you launch a rubber band across the room, the potential energy is converted to kinetic energy, the energy of motion. The instructions will allow you to build a rubber band car, but you can test different thickness of rubber bands to see how this affects the movement of the car. Students will share their lists and we will see if we have the supplies. **Homework: gather materials that you need for your project and have a plan.**

**Week Three:** Paper roller coaster- Roller coasters are all about physics! Unlike other vehicles like cars and trains, roller coasters do not have an engine that propels them along the track. Instead, they rely on **gravitational potential energy**. Students will discuss their plan and others will provide feedback.

**Week Four:** Wall marble run- **Gravitational Potential Energy** - Potential energy is the energy an object stores due to its height off the ground and its mass. When you release the marble, gravity starts to pull it down the track. Its potential energy is converted to kinetic energy, the energy of motion. The marble also loses a small amount of energy due to friction, or when it collides with the walls of the track. This energy does not disappear, however—it is converted into other forms like heat and sound. The *total* amount of energy in the system remains the same. This is called **conservation of energy**.

**Week Five:** Mini Trebuchet - You probably know what a catapult is. In the Middle Ages armies would use them to hurl stones at castle walls. But did you know about an even bigger type of medieval siege weapon called a trebuchet? A trebuchet relies on **gravitational potential energy**—the type of energy you get by raising something up off the ground. A trebuchet has a lever arm with a large, heavy counterweight on one end and a smaller projectile on the other end. When the counterweight is raised up, it has lots of gravitational potential energy. Then the counterweight is allowed to fall, rotating the lever arm and **converting that potential into kinetic energy** in the projectile, which is flung through the air.

**Week Six:** Make your Own Harmonica - Blowing air through your harmonica causes the rubber band to vibrate. The vibrating rubber band bumps against the air particles and as such, generates a **sound wave**. The vibration happens at a specific rate and generates a sound of the same frequency. The frequency is commonly measured in Hertz (Hz), where one Hertz equals one vibration per second. Humans typically hear sounds with a frequency between 20 and 20,000 Hz. **Homework: make sure you have what you need for your individual project.**

**Week Seven:** Create your own idea or non-mechanical robot hand- Students will either work on their own project or focus on making a non-mechanical robot hand. The science of developing robotic hands, along with other artificial limbs and organs, is called prosthetics. Students may explore this with creative designs. Present their designs and projects and written evaluation of the class and their learning.

Rubric:

20% Attendance and being prepared

40% Participation, keeping organized, and cleaning up

40% Completing projects and explaining how they work