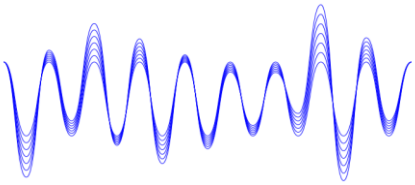
Discovering STEM Program

Exploring Sound: Snap Circuits



Description: Using snap circuit materials, students will use the picture images or the circuit diagram to construct a circuit that will play a familiar tune. Students will then alter the circuit to change the volume of the tune. Students will then install a special chip that will allow them to clap or tap to make the tune play. All circuits demonstrate the transfer of energy using several different types of energy transformations.

Grades: 3-8

Estimated Time: Approximately 20 minutes

Recommended Group Size: 1 - 2 students per group (kit supports 15 groups)

Key Questions: How does adding a resistor change the volume of the song? What are different ways in which you have experienced turning on lights (light switch, motion detector, clapping, etc.)? What types of energy do you recognize in this circuit?

Content Expectations Addressed (NGSS):

CCC (cross cutting concepts):

2. Cause and Effect, 5. Energy and Matter in Systems, 6. Structure and Function, 7. Stability and Change of Systems

Meets the Science and Engineering Practices

Specific NGSS Standards met:

3-5-ETS1-1 Define a simple design problem reflecting a need or want that includes specific criteria for success and constraints on materials, time, or cost.

Student will need to construct a closed circuit that plays the tune. Students will then change the volume of the tune by changing components of the circuit.

3-5-ETS1-2 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.

> Challenge students to show you several volume levels. Ask students when they would need each of the volume levels.

4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, **electric currents**.

> Chemical energy stored in the batteries is transformed into electrical energy. The electrical energy transfers the chemical energy from the battery to the Music Chip. The music chip changes the electrical signal slightly, so that when it passed through a coil in a magnet, the speaker moves; resulting in sound energy.
>
> Students will also interact with the WC which is a whistler chip. If you clap or tap on the chip, it will trigger the circuit (another form of a switch).

4-PS3-4 Apply scientific ideas to design, test and refine a device that converts energy from one form to another.

> Chemical energy stored in the batteries is transformed into electrical energy, which when flows through the circuit and is transformed through electromagnet interactions into kinetic energy inside the speaker that results in sound energy.

Teacher Background:

The Music IC is an integrated circuit that converts the direct current from the battery into a signal that can produce appropriate electromagnetic interactions to form a sound by the movement of a speaker. A resistor between the integrated circuit and the speaker will control the volume. The bigger the resistor, the quieter the music.

The WC is a Whistler Chip. When connected to the circuit, you must first let the song play. Once it stops, you can trigger the circuit again by clapping above or tapping on the WC.

Energy stored in the form of chemical energy from the batteries is transformed into electrical energy. The electrical energy is then transformed into a signal that drives a speaker. Speakers make sound by moving (kinetic energy) the result is the movement of the air in the form of waves. Because the waves are in the frequency range of our ears, we hear a sound.

Materials: 3 ring binder, Sound circuit pictures, 3 Sound circuit diagrams (with key), 3 Snap circuit boards, Bin of 8 AA batteries (2 for each board and 2 backup batteries), 3 bags of Snap circuit components.

Each Snap circuit bag includes: 1 Snap battery holders, 1 Snap Switch (S1), 1 Snap speaker, 1 Snap Music (U1) board, 1 Snap Whistler Chip (WC), 1 100Ω resistor (R1), 1 1K (1000Ω) resistor (R2), Snap connectors (1 - 6 snap, 1 - 5 snap, 2 - 3 snap, 3 - 2 snap).

Set-Up:

A. Each station will need:
- Sound circuit set-up instructions
- Snap circuit board
- Bag of Snap circuit components containing:
  - Snap battery holder with 2 AA batteries
  - S1 Snap Switch (make sure switch is in "Off" position)
  - 1 Snap Music IC (U1)
  - 1 Red Snap Speaker
  - 1 100Ω resistor (R1)
  - 1 1K (1000Ω) resistor (R2)
  - 1 Whistler Chip (WC)
  - 1 - 6 snap connector, 1 - 5 snap connector, 2 - 3 snap connectors, 3 - 2 snap connectors.

B. **Cautions**:

a. Small pieces are a choking hazard.

b. Circuits must contain at least 1 element. (Using a snap connector to link the + and – terminals of the battery holder directly together without any other elements in the circuit can result in overheating/melting.)

Procedure:

1. Encourage students to have their circuits checked before turning the switch to "on."
2. Students use the sound circuit picture and/or symbolic sound circuit diagram to construct the original circuit. Once students have circuit checked, they can move the switch to the "on" position and a familiar song should play.
3. Have students place the switch back in the "off" position.
4. Students will then replace the 3 snap connector that links Music U1 to the speaker with a resistor. After having their circuit checked, they will again move the switch to the "on" position and a familiar tune should play. Students will explore this idea with different resistors. (The larger the resistor, the quieter the music plays.)
5. Talk to students about energy transformations in the circuit and what role the resistor plays in that transfer. (See teacher section).
6. When ready, students can return their circuit to the original sound circuit and make sure the switch is in the "off" position. Students will then add the Whistler Chip (WC).
7. Once the Whistler Chip (WC) is added to the circuit and the circuit is checked, students can switch the circuit back "on." The song will play. To get the song to play again, students can clap above or tap the surface of the Whistler Chip.

Resources: Snap Circuits