**KEY Lesson 1: Circuits Explorations**

**Activity 1: Circuits in Series**

**Build Project 1 – Electric Light and Switch**

1. This is an example of a SERIES (series or parallel) circuit.
2. When the circuit is open, the light is OFF (on or off).
3. What is the voltage supplied in this circuit? 3 V (1.5V per battery x 2 batteries)

**Build Project 2 – DC Motor and Switch**

1. Describe the energy transformation that is occurring when the circuit is closed.

CHEMICAL → ELECTRICAL → MECHANICAL + SOUND + THERMAL

**Build Project 5 – Lamp and Fan in Series**

1. This is an example of a SERIES (series or parallel) circuit. Explain why? The electrons have only one path to flow. Part of the voltage goes to the lamp and the rest to the motor.
2. Compare the brightness of the bulb in this circuit with the fan on the motor and with the fan off the motor. Bulb is off with the fan off the motor; bulb is dimly lit with the fan on the motor
3. With this in mind, the voltage from the batteries will get divided between them. Which load will use more voltage? MOTOR
4. Without the fan, the motor spins faster and requires more voltage. That means there is LESS (more or less) available to the light.
5. Can you get the fan to launch? NO Why or why not? The fan is not spinning fast enough to overcome gravity
6. What would happen if you removed the snap that connected the lamp with the switch on? Neither would work Why? There is only one path for the electrons and it is incomplete without the snap connection.

Batteries can be connected in series. **Build Project 2 – DC Motor and Switch**. Add another battery set in series. Use the S2 (press switch). Shut off the switch and compare the flight of the “helicopter” with the height achieved with one battery set.

1. The total voltage of both battery sets = 6 V (1.5 V per battery X 4 batteries) volts.
2. Describe the height difference of the fan with one battery set and two battery sets. With the 2nd battery set and higher voltage, the fan flies much higher.

**ACTIVITY 2: Circuits in Parallel**

**Build Project 6 – Fan and Lamp in Parallel**

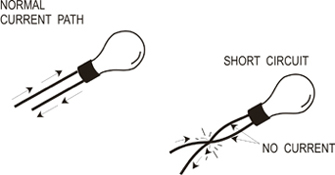
* 1. This is an example of a PARALLEL (series or parallel) circuit.
  2. Compare the brightness of the bulb in this circuit with the fan on the motor and with the fan off the motor. Describe your results. They are the same brightness
  3. The voltage from the batteries in this circuit is 3 volts. What is the voltage applied to each device? 3V
  4. In this circuit, will the fan launch? YES NOTE: Be sure to use fresh batteries to launch the fan and make sure the motor is in the proper direction for lift off.
  5. Remove one of the snaps (wires) connecting the lamp. Describe what happens to the motor when the lamp is disconnected. It remains on.

**Build Project 19 – Space War**

U3 Space Wars IC is an integrated circuit. An integrated circuit is a device made of interconnected electronic components, such as transistors, capacitors and resistors. They are etched or imprinted onto a tiny slice of a semiconducting material, such as silicon or germanium. An integrated circuit, which can be smaller than a fingernail, can hold millions of circuits. They complete a specific job such as produce or amplify a sound.

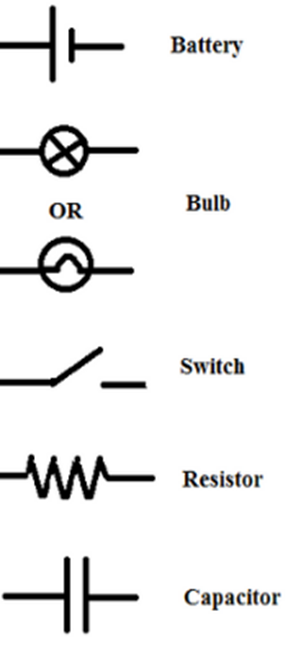
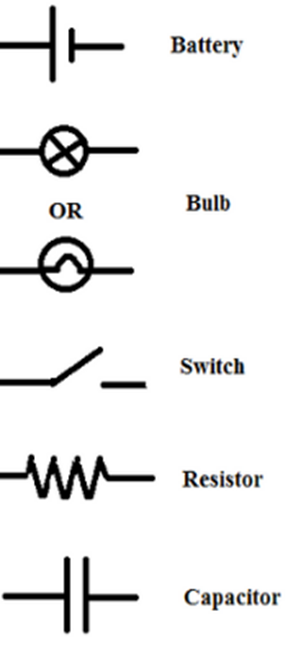
* 1. Does the circuit produce sound when the slide switch is turned on? YES
  2. Turn off the slide switch and push the press switch. Is the sound the same? NO
  3. Turn on the slide switch and the press switch. Describe the sounds. They each make their own unique sounds at the same time.
  4. The switches are wired in a PARALLEL (series or parallel) circuit.

Every circuit will include a power source (battery), resistor and wire connectors. If wires from a different part of the circuit touch or connect, a **short circuit** will occur. This creates a no-resistance path across the batteries and will damage your components and/or quickly drain the battery.



**ACTIVITY 3: Design Challenge**

1. Using two bulbs (L1 and L2), a switch (S1 or S2), snap connectors and a battery set, make a circuit in both series and parallel.
2. Using the symbols below, draw the schematics for each.



**Series Circuit**

**Parallel Circuit**

