Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class \_\_\_\_\_\_\_\_\_\_ ****

**LESSON 1: Circuits Exploration**

**Activity 1: Circuits in Series**

**Series Circuit -** There is a single path for electrons to flow when electrical components are connected one after another. The current is the same through each resistor.

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

1. This is an example of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (series or parallel) circuit.
2. When the circuit is open, the light is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (on or off).
3. What is the voltage supplied in this circuit? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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

\_\_\_­\_\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_­\_\_\_\_\_\_\_\_\_\_\_ → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_\_\_

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

1. This is an example of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (series or parallel) circuit. Explain why? \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Compare the brightness of the bulb in this circuit with the fan on the motor and with the fan off the motor. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. With this in mind, the voltage from the batteries will get divided between them. Which load will use more voltage? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Without the fan, the motor spins faster and requires more voltage. That means there is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (more or less) available to the light.
4. Can you get the fan to launch? \_\_\_\_\_\_\_\_ Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. What would happen if you removed the snap that connected the lamp with the switch on? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_­­­­­­\_\_\_ Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 = \_\_\_\_\_\_\_\_\_\_\_\_ volts.
2. Describe the height difference of the fan with one battery set and two battery sets. \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Activity 2: Circuits in Parallel**

**Parallel Circuit** – There is more than one continuous path for the electrons to flow. It is a closed circuit in which the current divides into two or more paths before recombining to complete the circuit. Each load connected in a separate path receives the full circuit voltage, and the total circuit current is equal to the sum of the individual branch currents.

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

* 1. This is an example of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (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. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. The voltage from the batteries in this circuit is \_\_\_\_ volts. What is the voltage applied to each device? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. In this circuit, will the fan launch? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	5. Remove one of the snaps (wires) connecting the lamp. Describe what happens to the motor when the lamp is disconnected. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**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 (S1) is turned on? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Turn off the slide switch (S1) and push the press switch (S2). Is the sound the same? \_\_\_\_\_\_\_\_\_\_\_\_
	3. Turn on the slide switch (S1) AND the press switch (S2). Describe the sounds. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. The switches are wired in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (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 2: 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.



**Parallel Circuit**

**Series Circuit**