STEM 8: RESCUE & REHABILITATION
INSTRUCTIONS

SEA RESCUE LIGHT

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An emergency light allows rescuers to find the pilot and crew quickly if an aircraft crashes into the sea. In this activity you make an electrical cell that uses salt water as an electrolyte solution to power a LED.

WHAT YOU'LL NEED

- Common salt
- Plastic drinking cup or beaker
- Strips of different metals: copper, zinc, tin, aluminium
- Magnesium ribbon
- Two crocodile clips
- Two leads
- Sandpaper
- Voltmeter (or multimeter)
- LED

ELECTRICAL CELL

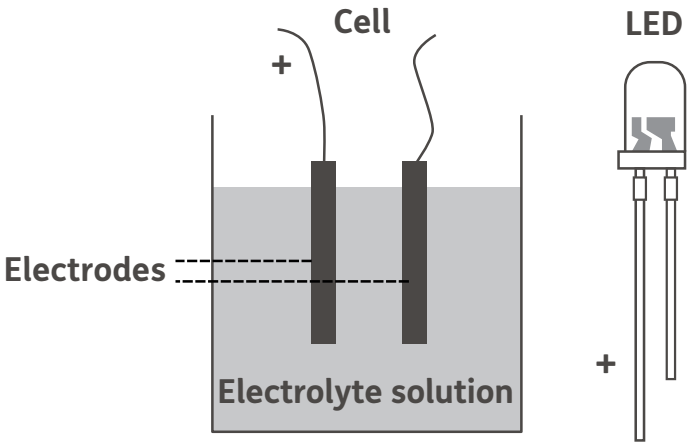
A cell is a device that is used to provide a voltage. It is made up of two metal electrodes and an electrolyte solution. Cells can be connected together to make a battery.

ELECTROLYTE SOLUTION

An electrolyte is a chemical compound that conducts electricity when melted or dissolved into a solution. You will be using sodium chloride (common salt) as an electrolyte.

LED

LED stands for Light Emitting Diode. A diode is a device that only allows current to flow in one direction. When it is connected to a cell or battery with a high enough voltage, an LED will emit light.



WHAT YOU NEED TO DO

1. Make a salt solution by adding 5g of salt to a cup or beaker almost full of water. Stir gently.
2. Check that the metals you will be using as electrodes are clean. If they appear tarnished, rub the surface with some sandpaper. Take care not to cut yourself on any jagged edges.
3. Starting with copper and zinc, bend the strips at least 2cm from one end, so that they hook over the edge of the cup or beaker at opposite sides. Most of the metal should be submerged. Attach crocodile clips and leads to the dry end of the metal strips.

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4. Attach crocodile clips and leads to the dry end of the metal strips.

5. Connect the other end of the leads to a voltmeter. If you are using a multimeter, use the voltmeter setting and plug your leads into the black C (common) and red V (voltage) terminals. The positive electrode of your cell is the one which is connected to the positive terminal of the voltmeter. If you get a negative reading, swap the crocodile clips on the electrodes to get a positive reading. If you get no reading, make sure that your electrodes are not touching each other.
6. Copy the table below. Try different electrode pairs and record the voltmeter reading for each. Which electrode pair gives the largest voltage?

Electrode pair	Voltmeter reading/V
Zinc, Copper	

7. Replace the voltmeter with a red LED. The LED will only allow current to flow in one direction. Its positive end (the one with the longer leg) should be connected to the positive terminal of your cell. If you are not sure that you have connected the LED the right way round, try the LED both ways around.
8. If the voltage is not high enough to light the LED you can join forces with another group and connect your cells in series to make a battery. You will need to connect the positive electrode on your cell to the negative electrode on their cell. For example if you are using copper-zinc electrodes, connect the copper electrode in one cell, to the zinc electrode in the second cell. Measure the voltage across your battery
9. Connect your battery to the red LED. Remember, the positive terminal of the LED is the longer leg. If it the LED still doesn't light up add another group's cell to increase the voltage and try again. How many cells are needed to make a red LED emergency light?
10. LEDs of different colour require different voltages to light them. If you have access to different coloured LEDs, can you devise an experiment to find out what these voltages are?
11. Sketch a design for an emergency light that, when dropped into seawater, will float, and automatically fill a chamber with electrolyte and turn on an LED.