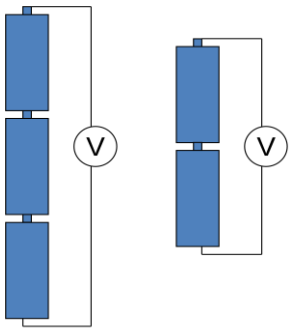
Section 5: Cells and Batteries

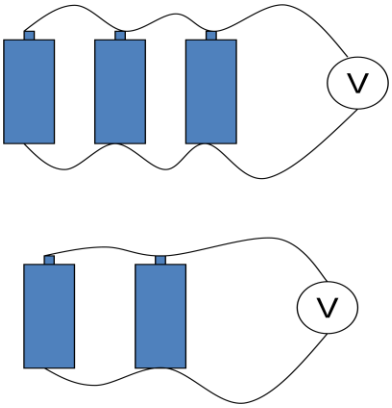
A combination of cells is called a **battery**. Cells are commonly combined so that they can generate a larger potential difference - the greater the number of cells, the stronger the battery and the more expensive the battery.

Cells in Series



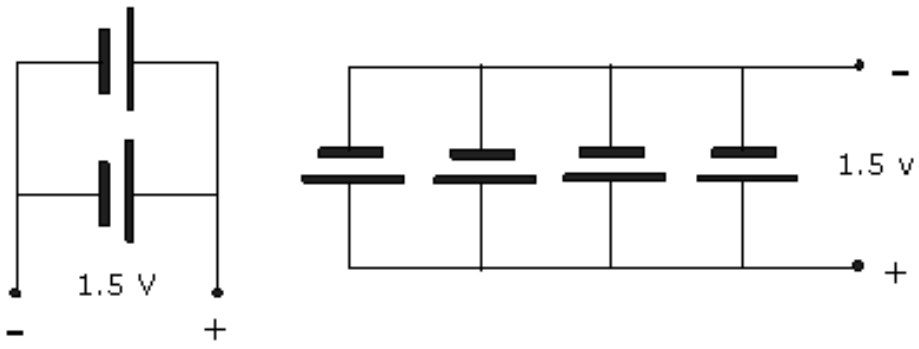
$V_T = V_1 + V_2 + \ldots$

Cells in Parallel



$V_T = V_1 = V_2 = \ldots$

cells connected in series add up



cells connected in parallel don't add up

Question: If cells in parallel maintain the same voltage as a single cell, what's the point in using such arrangements?

Answer: Cells connected in parallel last longer. Each cell in parallel is providing only a portion of the required current. For example, if a current of one ampere is being drawn from four cells in parallel, then each cell provides only 1/4 of an ampere. This means the 4 cells will last 4 times longer than one cell.

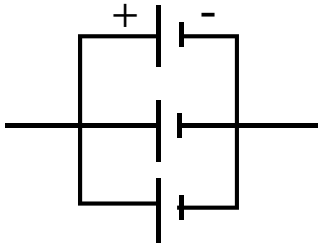
The advantage of connecting cells in series is obvious: the resulting battery has a higher voltage than a single cell. (The larger the voltage, the larger the current that can be provided - - more on this later – Ohm's Law)

Examples:

1. Find the voltage of each combination if the voltage of each cell is 1.5 V.

A)

B)



C)

D)

2. The battery required by a CD player can provide 10 C of charge when the chemical action in the battery expends 90 J of energy. How many dry cells would it take to operate the smoke detector?

3. How many electrons move through a circuit when 3.0×10^2 J of energy are expended by two 1.5 V cells connected in series?