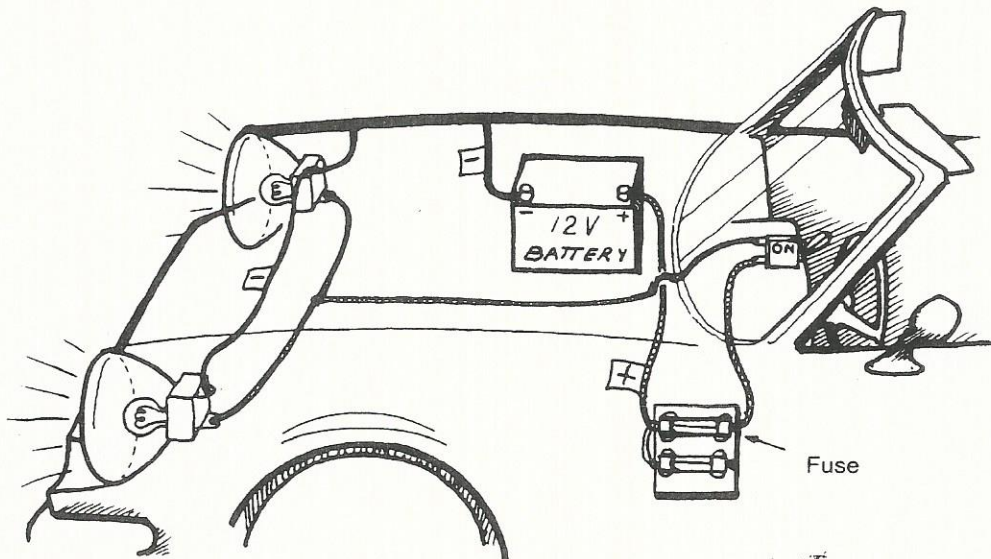


More on Parallel Circuits

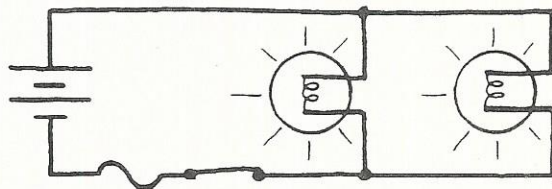
What to Connect in Parallel and When

Elements are connected in parallel if they are required to function independently using the same voltage. Because of this independent property, most circuits are connected in parallel. The car headlights connected in parallel in Figure below on this page receive power from a single 12-V power supply. When one headlight burns out, the other remains lit, forming a closed circuit with the power supply. The voltage across its terminals does not change and the current flowing through it stays the same. The total current furnished by the power supply is cut in half because it is supplying only one headlight.

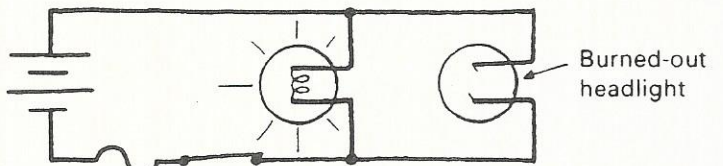
Car headlights



a) Actual representation



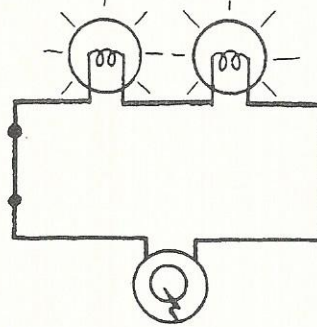
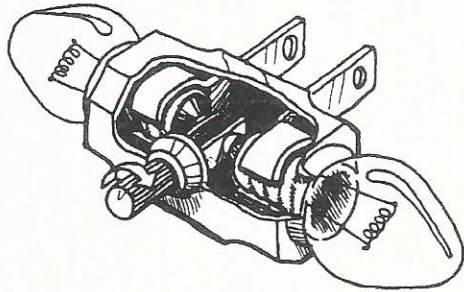
b) Circuit diagram



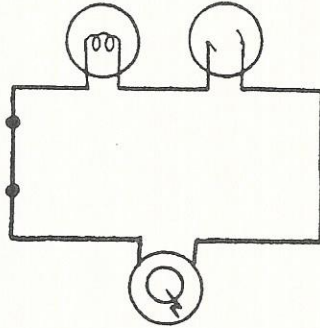
c) Circuit including a burned-out headlight

More on Series Circuits

Circuit with two light bulbs and one switch connected in series



a) The two light bulbs light up when the switch is closed.



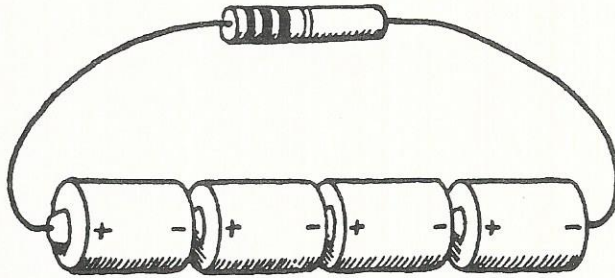
b) A burned-out light bulb cuts off the current to the entire circuit.

You hang a string of lights on a Christmas tree. After some time, all the lights suddenly go out even though nobody unplugged them. Can you explain what happened?

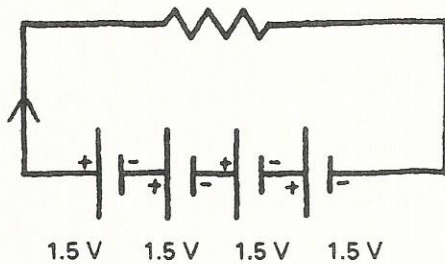
Cells Connected in Series

We have seen that it is possible to connect resistors, that is, the consumer components of a circuit, in series. Power supplies can also be connected in series. A battery of cells connected in series therefore has an emf equal to the sum of the individual emfs. A flashlight, for example, powered by two 1.5-V cells connected in series operates at 3 V.

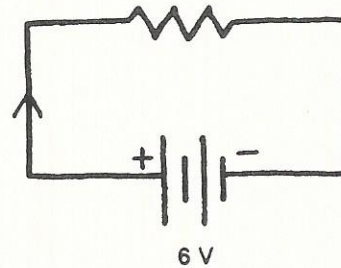
Figure 3.14
Cells connected in series



- a) The emf of a battery of four cells connected in series is equal to the sum of the individual emfs. The positive terminal of the first cell is connected to the negative terminal of the second cell, and so on.



- b) Diagram of a circuit comprising four cells

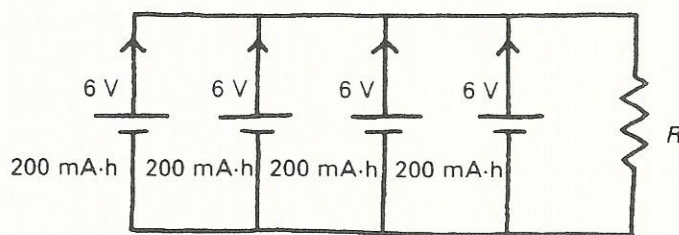


- c) A simplified circuit diagram: the symbol for the battery replaces the one for the cells.

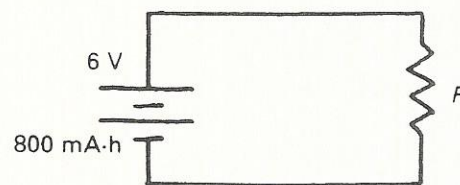
Cells Connected in Parallel

Identical cells or batteries are connected in parallel to make them last longer. The newly created battery has a charge equal to the sum of the individual charges, but its emf remains the same as that of the individual cells.

A battery of cells connected in parallel



a) Four 6-V and 200-mA-h cells connected in parallel power a resistor.



b) The cells from Figure a) form a 6-V and 800 mA-h battery.

The use of several identical cells connected in parallel increases the available charge without changing the emf.

Remember that current is a flow of charges. The total current or number of charges for a given circuit will therefore be four times as great if a battery made up of four cells connected in parallel is used instead of a single cell. The battery will take four times as long to discharge, since each cell supplies only a quarter of the current that would be supplied if it were alone.

A battery of cells connected in parallel is used to ensure a steady supply over a long period of time or when the power supply or facility is not easily accessible.

QUESTIONS :

- The emergency lighting in one wing of a hospital is powered by a 12-V battery. When the time comes to replace the battery, two 12-V batteries are installed.
 - Should the batteries be connected in series or in parallel?
 - What is the advantage of using two batteries instead of one?
- A child's toy operates on a power supply of 4.5-volts. Three 1.5-volt batteries are required. Should the batteries be connected in series or in parallel? Explain.