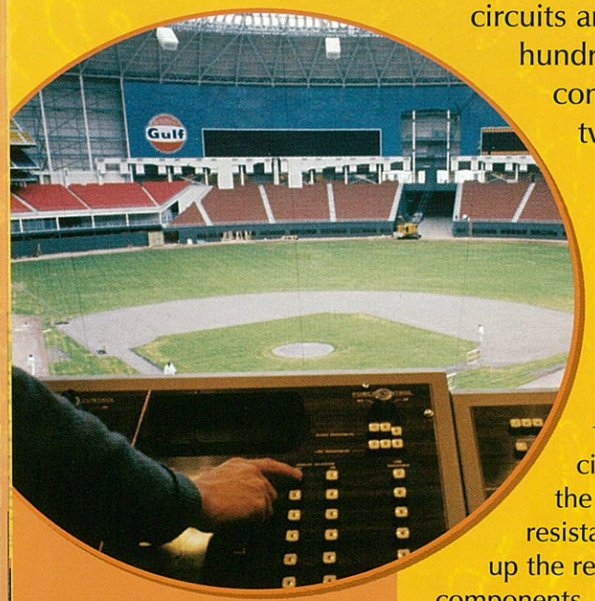
Circuits galore

Only a few electrical devices have a simple circuit with only one pathway for electricity to flow. A torch is one example. From the electricity source (the battery) current flows to the switch, then to the bulb, and then back to the battery. Most circuits are far more complicated, with hundreds of components and connections. But there are only two basic ways to join components together. These are called **series** and **parallel** circuits.



Let there be light!
One panel controls the lighting at this sports stadium. The rows or banks of lights connected into a parallel circuit all go brighter or dimmer together. Others, such as spotlights, each have their own individual circuits.

Series circuits

In a series circuit, the components are joined one after the other, in a line around the circuit. There is just one route for the current to follow. The total resistance is worked out by adding up the resistances of all the various components. The strength or voltage of the electricity source, such as a battery, must then be enough to overcome this total resistance and push electricity all around the circuit. If one of the components fails, this makes a gap in the circuit. No electricity flows and so all the components stop working.

Parallel circuits

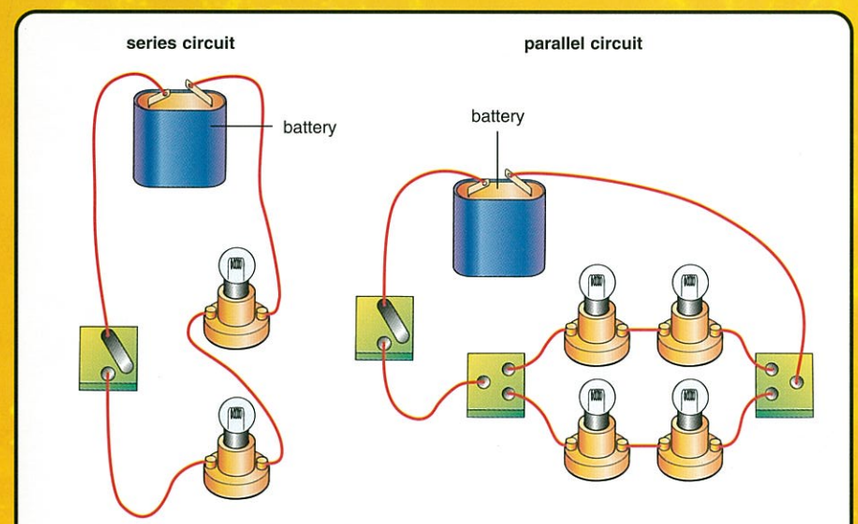
In a parallel circuit, the components are joined side by side, or in parallel to each other. It is like driving a car around a city. There are various routes to follow, and if one is blocked, this does not affect the others. Electricity tends to find the easiest route, with the least resistance. The total resistance is calculated by taking only a fraction of the resistance of each component. So it is much less than the same components connected in series. If one of the components fails, electricity can still flow through the others, along their own wires, and so they keep working.

Add up, share the load

Sources of electricity such as batteries can be connected in series or parallel. In a typical torch, two 1.5 volt batteries are linked in series. The total voltage they produce is 3 volts. The bulb of the torch must be suited to this voltage. If the batteries were connected in parallel, side by side, the total voltage they produce would be 1.5 volts. But they would be able to supply twice as much current, in amps, as the same batteries linked in series. What is gained in amps, is lost in volts.

One for all, all for one

If a row of decorative fairy lights is connected in series, and one of the lamps or bulbs fails, all the bulbs go out. If the lights are connected in parallel, and one of the bulbs fails, the other bulbs still glow. However in a parallel circuit, the total current flowing round the circuit stays the same. So each remaining bulb has to take an extra share of the current that would have flowed through the broken bulb. This means the remaining bulbs glow slightly brighter and get slightly hotter, making them more likely to fail. This is why, when one or two fairy lamps break and are not replaced, the rest may soon follow.



Series and parallel circuits
These diagrams show the differences between circuits wired in series and those wired in parallel.