

Series and parallel circuit patterns

Grade 7 science (Year 8 · Class 7) · Worksheet answers

Full answers are given for every problem, with the reasoning as well as the result. Predictions are marked correct only if the explanation mentions paths, branches or sharing the supply. The key result of each step is in bold.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS2-3

Problem 1 Two ways to join bulbs

1. **One path.**
2. **Two or more paths.**
3. A **parallel** circuit.

Problem 2 Name the circuits

1. **Circuit P:** the three bulbs are in one loop.
2. **Circuit Q:** each bulb is on its own branch.
3. **Circuit R:** one bulb in series with a parallel pair.

Problem 3 Circuit symbols

1. **A cell.**
2. **B bulb (lamp).**
3. C is an **open switch** and D is a **closed switch**. Only D lets current flow.

Problem 4 A blown bulb in series

1. **None.**
2. A series loop has one path. A broken bulb breaks the loop, so no current flows anywhere.
3. Replace each bulb in turn with a spare, or test them one at a time in a working holder.

Problem 5 A blown bulb in parallel

1. **Two** lamps stay lit.
2. Each lamp has its own branch to the supply, so the current to the others is not interrupted.
3. One failed lamp does not leave the rest of the house in the dark.

Problem 6 Counting cells

1. $4 \times 1.5 \text{ V} = \mathbf{6.0 \text{ V}}$.

2. **1.5 V.**
3. $9.0 \text{ V} \div 1.5 \text{ V} = \mathbf{6 \text{ cells.}}$

Problem 7 What a switch does

1. The open switch makes a gap, so the circuit is incomplete.
2. There is no complete path, so **no current flows** and the bulb is off.
3. A light switch on a wall.

Problem 8 Adding bulbs

1. **Both bulbs are dimmer** than the single bulb was.
2. The energy supplied by the cell is shared between two bulbs, so each gets less.
3. **Both stay as bright as before**, since each has its own path to the cell.

Problem 9 Garden lights

1. $6 \times 2.0 \text{ V} = \mathbf{12.0 \text{ V.}}$
2. All the other bulbs go out because the loop is broken.
3. $4.0 \text{ V} \div 2.0 \text{ V} = \mathbf{2 \text{ bulbs.}}$

Problem 10 Two switches

1. **L1 only** is lit. S and S1 are closed, but S2 is open, so L2 is off.
2. **Neither lamp:** the main switch S is open, which cuts off both branches.
3. S closed, S1 closed and S2 closed.

Problem 11 Bicycle lamps

1. The front lamp stays on because it has its own path to the dynamo.
2. Each lamp is connected directly across the supply, so each has the full supply voltage.
3. **In the main wire from the dynamo**, before the branches split.

Problem 12 Two cells in parallel

1. **1.5 V** (the same as one cell).
2. About **20 hours**, since the two cells share the work.
3. The voltage across the bulb has not changed, so the bulb is just as bright.

Problem 13 A wire across the bulb

1. **The bulb goes out.**
2. The current takes the easier path through the wire and bypasses the bulb. A large current flows.
3. The wire and cell can overheat and cause burns or a fire.

Problem 14 How a fuse works

1. A thin wire inside the fuse heats up and melts, which breaks the circuit.
2. All the current to the lamp must pass through the fuse, so it can protect it. In parallel only some of the current would pass.
3. **A circuit breaker.**

Problem 15 Torch design

1. In **parallel**.
2. In the main wire, on the same loop as the cell, so it controls both branches.
3. Cell, switch, then two bulbs on separate branches, then back to the cell.

Problem 16 Switch table

1. **L1 and L2** (S2 is open, so L3 is off).
2. **L1, L2 and L3** are all lit.
3. **None**: S1 is in the main wire.
4. **L1** is brightest because all the current for both L2 and L3 passes through it.

Problem 17 Ranking circuits

1. Circuit 1 and circuit 3 are equal and brightest; circuit 2 is dimmer: **circuits 1 and 3 equal, then circuit 2**.
2. Cell life, longest to shortest: **circuit 2, circuit 1, circuit 3**.
3. Two bulbs in series draw a smaller current, so the cell lasts longest. Two in parallel draw twice the current, so the cell runs down quickest.

Problem 18 Shorting a branch

1. **Both bulbs go out.**
2. The wire gives the current an easy path through the shorted branch, so almost no current reaches either bulb.
3. A very large current flows through the main wire, which can heat and melt the fuse. **That protects the circuit.**

Problem 19 Spot the errors

1. **Bulbs in parallel stay as bright as a single bulb**: each has its own path to the supply.
2. **Current flows through every component in a series loop** at the same rate, so all bulbs get current.
3. **A short circuit makes the bulb go out** because the current bypasses it.

Problem 20 Design for the job

1. **Parallel:** a closed switch in either branch completes a path for the alarm.
2. **Series:** both switches must be closed for a complete loop.
3. **Parallel:** independent bulbs each have their own branch, so one failed bulb does not switch off the others.