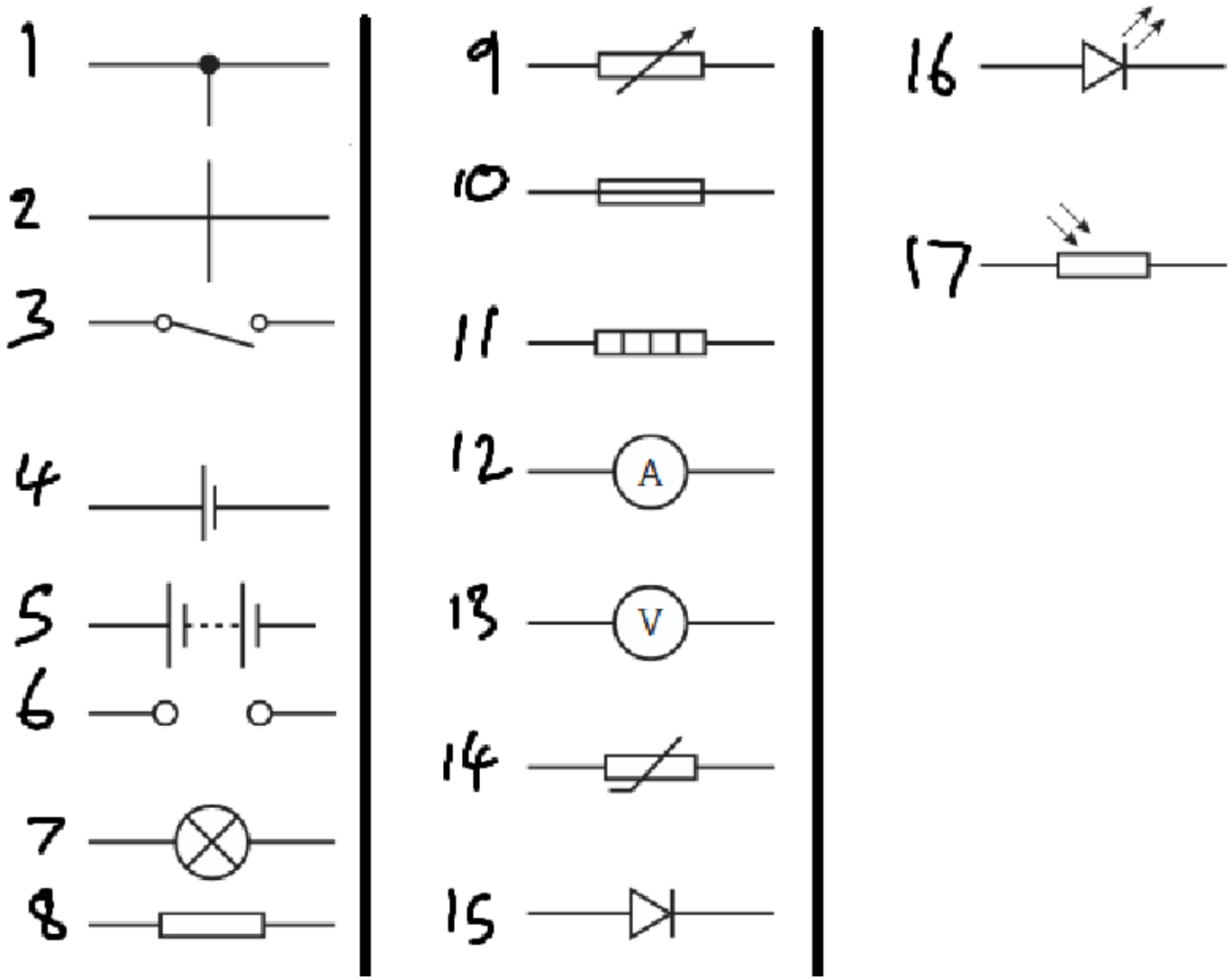
4.1 - Charge and Current

Key info and definitions

Electric Circuit Components



1. **Junction of conductors:** Allows current to split; resistance is typically low but increases with temperature.
2. **Conductors crossing (no connection):** Allows current to flow across a circuit without connecting to the crossing wire; resistance is typically low.

3. **Switch:** Turns current on and off; resistance is low when closed and very high (due to an air gap) when open.
4. **Cell:** Provides a source of energy or e.m.f. (electromotive force); resistance is low or negligible.
5. **Battery:** A combination of two or more cells; internal resistance increases as more cells are added in series.
6. **Terminals:** Provides a connection point for a source of energy; resistance is low.
7. **Lamp:** Transfers electrical energy into light; resistance increases as the current increases.
8. **Fixed resistor:** Controls the amount of current; resistance is fixed and determined by its material (often semiconductors like silicon).
9. **Variable resistor:** Controls current flow manually; resistance changes based on the slider or dial setting.
10. **Fuse:** A safety device that melts if current is too high; resistance is typically low and depends on the wire's dimensions and material.
11. **Heater:** Transfers electrical energy into thermal energy; resistance is typically high.
12. **Ammeter:** Measures the electrical current in a circuit; resistance is very low.
13. **Voltmeter:** Measures the potential difference (e.m.f.) across a component; resistance is very high.
14. **Thermistor:** Responds to environmental temperature; resistance changes in response to the temperature of the surroundings.
15. **Diode:** Restricts current to one direction; resistance is low in forward bias and very high in reverse bias.
16. **Light-emitting diode (LED):** Allows current in one direction and emits light; resistance is low in forward bias and high in reverse bias.
17. **Light-dependent resistor (LDR):** Changes current based on light levels; resistance decreases as light intensity increases.

Electric Current and Charge

Current is the rate of flow of electrical charge.

$$I = \frac{Q}{t}$$

... where Q is charge and t is time.

Atoms become charged when they gain or lose electrons.

Conventional current travels in the **direction of flow of positive charge** - i.e. the opposite of electron flow.

Kirchoff's Laws

1. The sum of electrical current into a junction is equal to the sum of electrical current out of a junction. Ensures conservation of charge, as flow of charge into a junction point = flow of charge out of the junction point.
2. In a closed loop of a circuit, the sum of potential differences is equal to the sum of emfs. Ensures conservation of energy, as energy into the circuit = energy out of the circuit.

Electron Drift Velocity

When conducting electricity, electrons move slowly through the wire at a drift velocity v.

$$I = nAve$$

... where I is current, n is number density of the wire's conducting material, A is the cross sectional area of the wire, v is the electron drift velocity, and e is the elementary charge, 1.6e-19C.

The larger the value of n, the greater the conductivity of the metal.

Revision #2
Created 2026-02-14 17:33:57 UTC by Asad
Updated 2026-02-15 12:57:53 UTC by Asad