Achievable

ASVAB DUMP SHEET

Electricity and circuits

Charge and materials

- Electricity is the movement of **electrons**
- Rubbing two objects together moves electrons between them, which is the shock from a doorknob
- **Conductor:** lets electrons flow: copper, silver
- **Insulator:** blocks the flow: rubber, glass, plastic
- **Semiconductor:** conducts better than an insulator, worse than a conductor: silicon

Ohm's law

	Unit	Like water in a pipe
Voltage V	Volts (V)	The pressure pushing it
Current I	Amps (A)	The rate it flows
Resistance R	Ohms (Ω)	A narrow pipe

- $V = IR$, so $I = \frac{V}{R}$ and $R = \frac{V}{I}$: cover the one you want in the triangle with V on top
- 2 A through 5 Ω takes 10 V; 12 V across 4 Ω drives 3 A
- **Potentiometer:** a variable resistor, in dimmers and volume knobs

Power

- $P = VI$ (watts): 12 V at 2 A is 24 W
- $P = I^2R$ and $P = \frac{V^2}{R}$: 3 A through 4 Ω is 36 W

Meters

- **Voltmeter:** connected **in parallel**, across two points
- **Ammeter:** connected **in series**, so the current flows through it
- **Ohmmeter:** sends its own current, so only on a part with the power off
- **Multimeter:** all three in one

Circuits

- **Closed circuit:** a complete loop, so current flows; **open circuit:** a break, so it stops
- A switch turned **on closes** the circuit; **off opens** it
- **Load:** what uses the power: a lamp, motor or heater

Series and parallel

	Series	Parallel
Paths	One	Several branches
Current	The same everywhere	Divides among the branches
Voltage	Divides among the parts	The same across each branch
Total resistance	$R_1 + R_2 + \cdots$; rises as parts are added	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$; falls as branches are added
Example	2, 3 and 5 Ω: 10 Ω	Two 4 Ω: 2 Ω
One part fails	Everything stops	The other branches stay on

A switch before the branches split controls them all; one inside a branch controls only that branch

Shorts and safety

- **Short circuit:** current takes an unintended path of almost no resistance
- At 120 V, a 10 Ω load draws 12 A; a 0.01 Ω short draws 12,000 A, enough to melt wires
- **Fuse:** a metal link melts and breaks the circuit; replace it once blown
- **Breaker:** a thermal strip or magnetic coil trips it open; reset it
- **Ground:** an easy path into the earth, like a lightning rod's, that carries dangerous current away