Transformers

The turns ratio, and why transformers only work on AC.

Physics

The ratio of secondary to primary voltage equals the ratio of secondary to primary turns.

$$V_s/V_p = N_s/N_p \cdot V_pI_p = V_sI_s \text{ (ideal)}$$

Step up voltage — **Current steps down**

Power is conserved.

Why transmit at high voltage — **Low current means lower I^2R losses**

On DC — **Nothing happens**

No changing flux.

THE COMMON MISTAKE

× **Expecting a transformer to work on DC**

✓ **It requires a changing flux**

Steady DC produces constant flux, so dΦ/dt is zero and no EMF is induced in the secondary.

Losses: resistance in the windings, eddy currents in the core, hysteresis and flux leakage. Laminated cores address eddy currents.