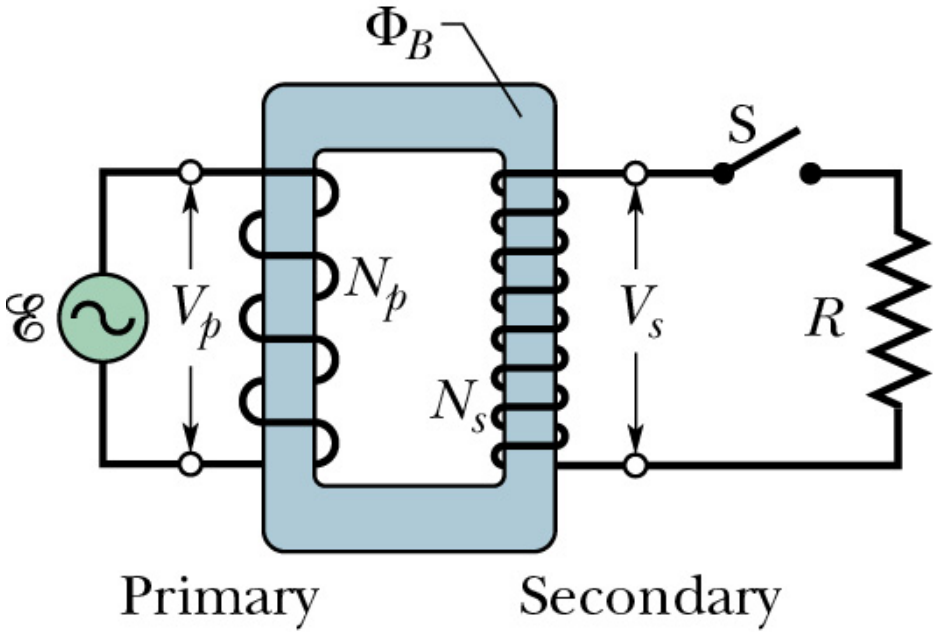
Transformers

- Transformer – device used to raise (for transmission) and lower (for use) the ac voltage in a circuit, keeping *iV* constant
  - Has 2 coils (primary and secondary) wound on same iron core with different #s of turns

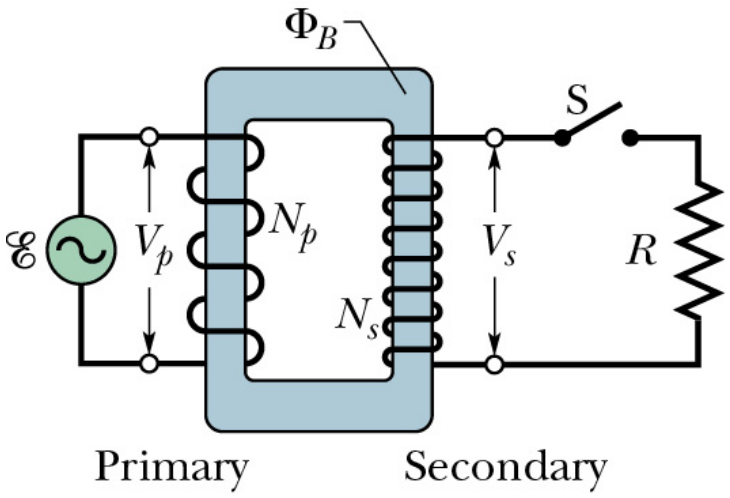


Transformers

- Alternating primary current induces alternating magnetic flux in iron core
- Same core in both coils so induced flux also goes through the secondary coil
- Using Faraday's law

$$V_P = -N_P \frac{d\Phi_B}{dt} \qquad V_S = -N_S \frac{d\Phi_B}{dt}$$

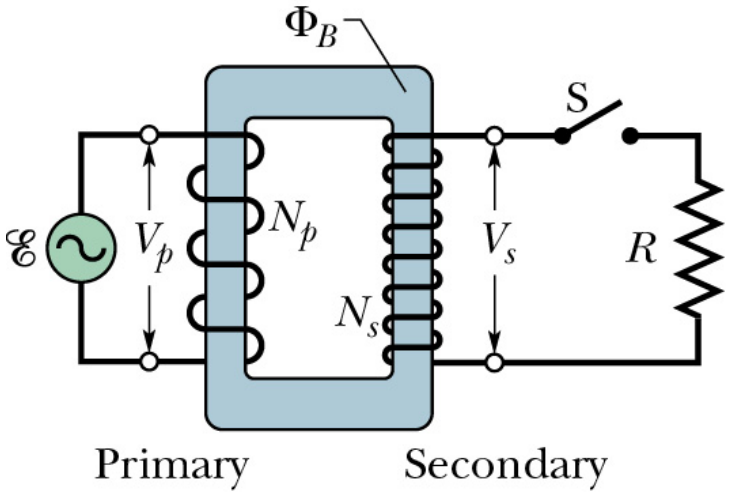
$$\frac{V_P}{N_P} = \frac{V_S}{N_S}$$



Transformers

- Transformation of voltage is
- If $N_S > N_P$ called a step-up transformer
- If $N_S < N_P$ called a step-down transformer

$$V_S = V_P \frac{N_S}{N_P}$$

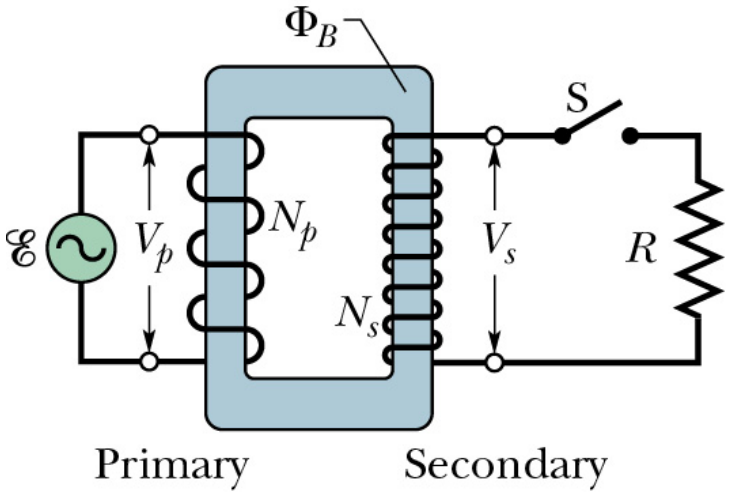


Transformers

- Conservation of energy

$$I_P V_P = I_S V_S$$

$$I_S = I_P \frac{V_P}{V_S} = I_P \frac{N_P}{N_S}$$



Transformers

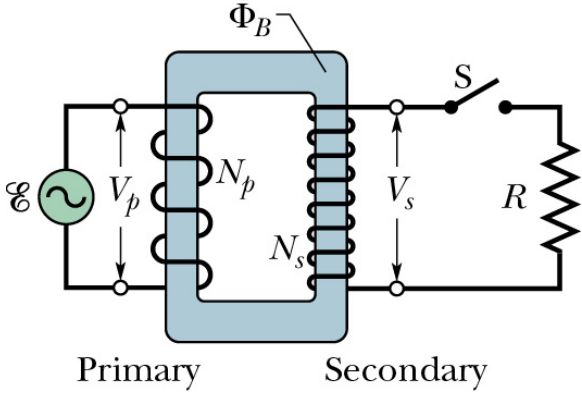
- An equivalent resistance R_{eq} appears in primary circuit due to R in secondary circuit.

$$I_P V_P = I_S V_S \qquad I_S = V_S / R$$

$$I_P = \frac{V_S}{R}\frac{V_S}{V_P} = \frac{1}{R}\frac{V_S^2}{V_P^2}V_P = \frac{1}{R}\left(\frac{N_S}{N_P}\right)^2 V_P$$

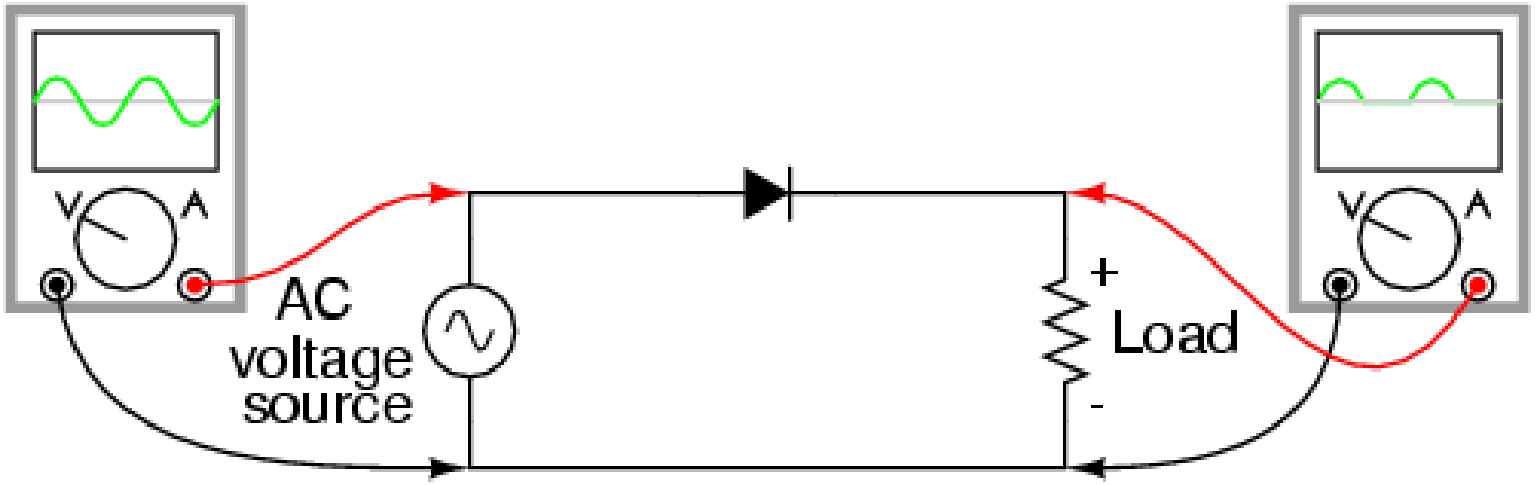
- Has for of $I_P = V_P/R_{eq}$ where

$$R_{eq} = \left(\frac{N_P}{N_S}\right)^2 R$$



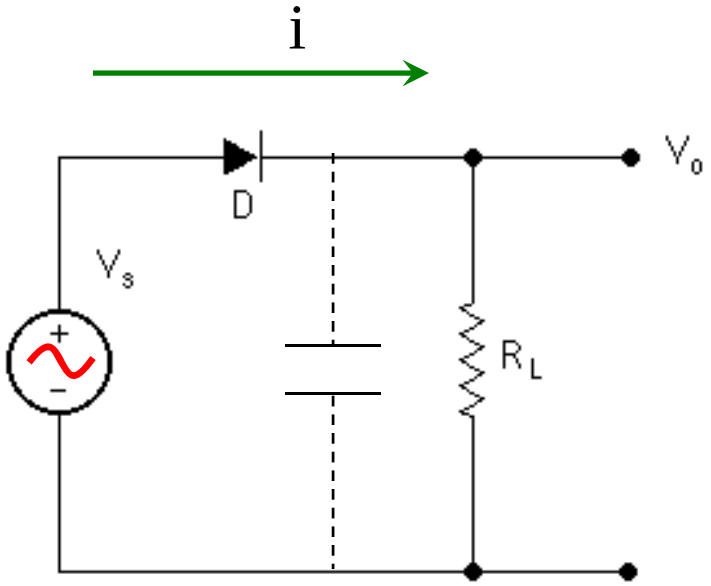
Rectifiers

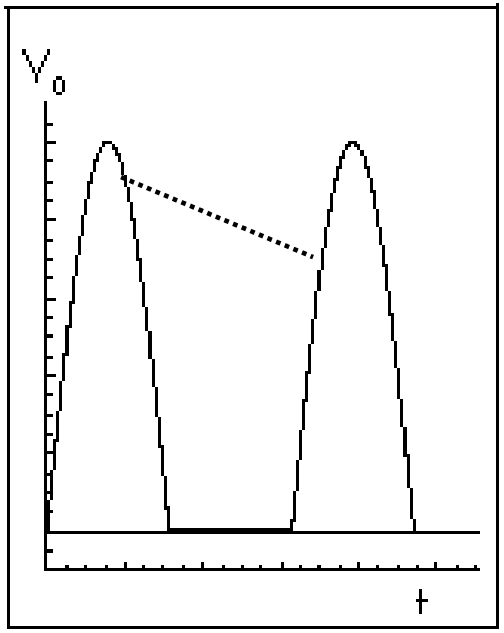
Half-wave rectifier circuit



Rectifiers

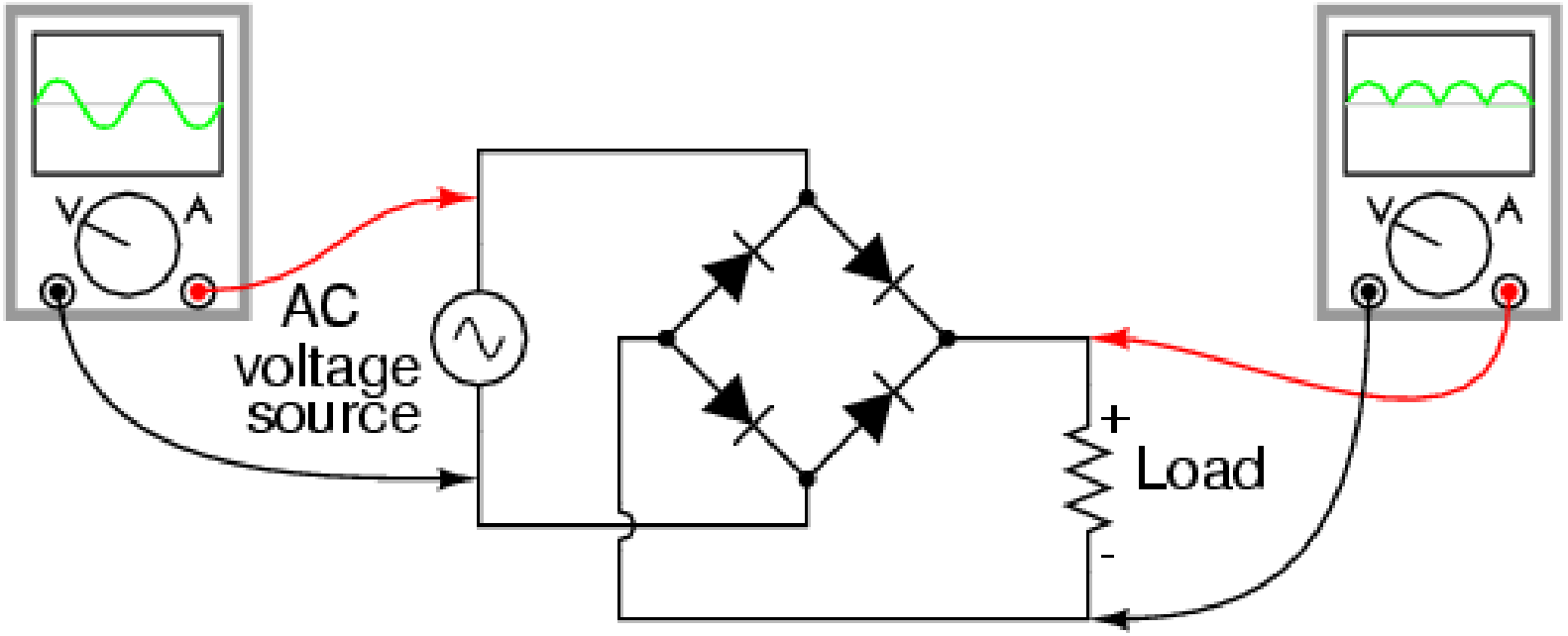
- half-wave rectifier with capacitor





Rectifiers

Full-wave rectifier circuit
(bridge design)



Rectifiers

- full-wave rectifier with capacitor