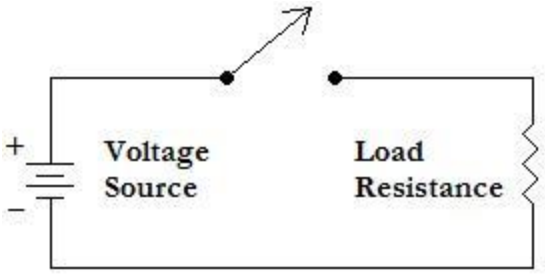
Enhanced Guided Notes: Set 4

Voltage and Current

Topics:

- **A. Ohm's Law**
- **B. Power**
- **C. Energy**
- **D. Efficiency**

A. Ohm's Law



$$\frac{V}{I} = k$$

Where V=

I=

Discovered by Georg Simon Ohm

ΔT = O ➥ Double V ➔ Double I
Triple V ➔ Triple I

Conclusions

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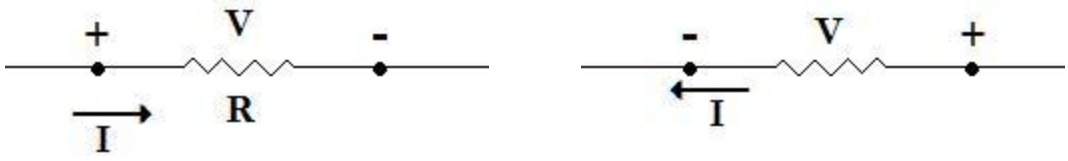
Now, we can say that $\frac{V}{I} = R$

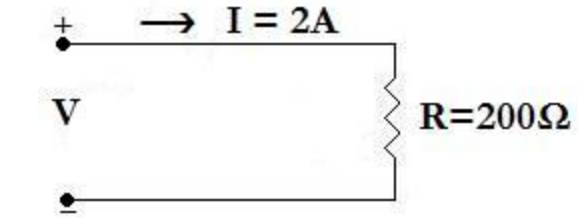


❋ Examples:

Calculate the resistance of a lamp if a current of 100 mA flows through a lamp when a voltage of 12V is applied to its terminals.

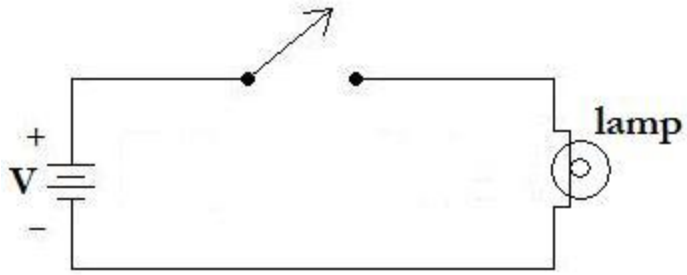
R = _____ = _____ =

Calculate the voltage that must be applied across the electric kettle to establish a current of 2A through the heating element if its internal resistance is 200 Ω.



V=

=

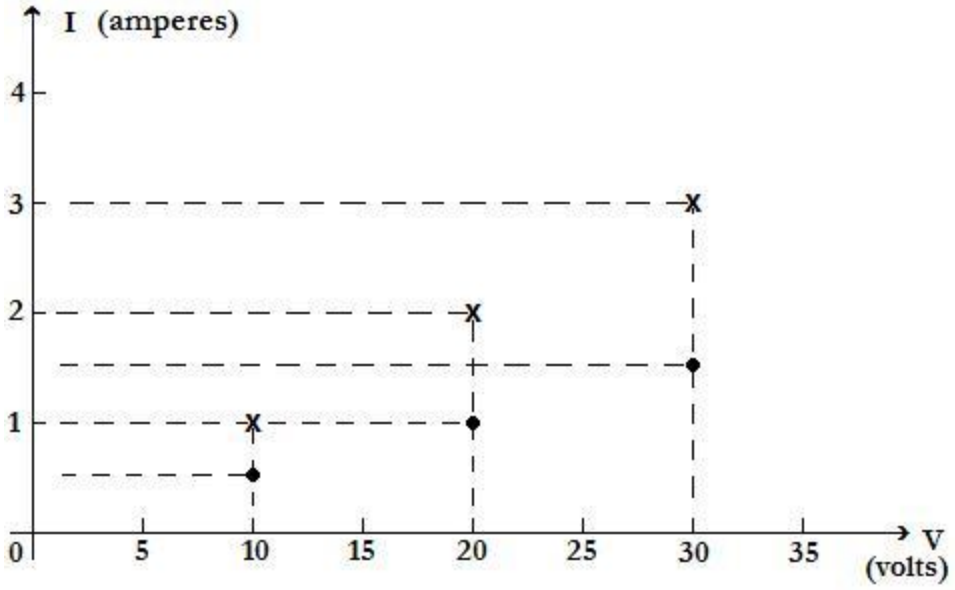


How do we dim the lamp?

Why?

Plotting Ohm's Law

What would the graph look like?



M = slope = Δy / Δx = _____

∴ R = Δ_____ / Δ_____ (ohm)

Conclusions:

B. Power

What is power?

Therefore, power (P) =

And the unit for power is _____ =

P = w/t = _____ = _____

We know that I = _____

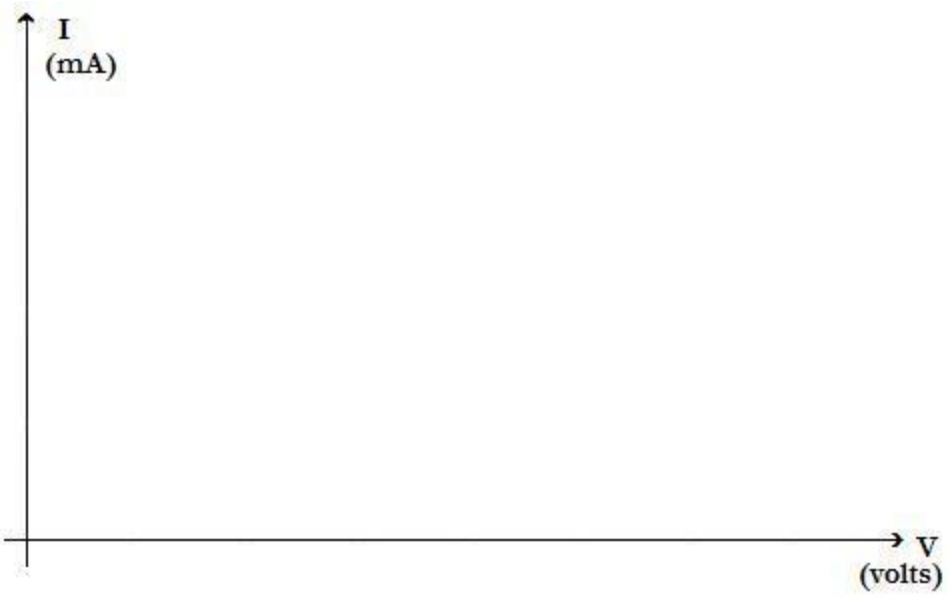
∴ P = = =

I = and V =

❋ Examples:

What is the power dissipated by a 10 Ω resistor if the current is 5A.

What do we know about the I-V characteristics of a light bulb?



C. Energy

W = P t (wattseconds, Ws or J)

Unit: kwh = power (W) * time (h) / 1000 = _____

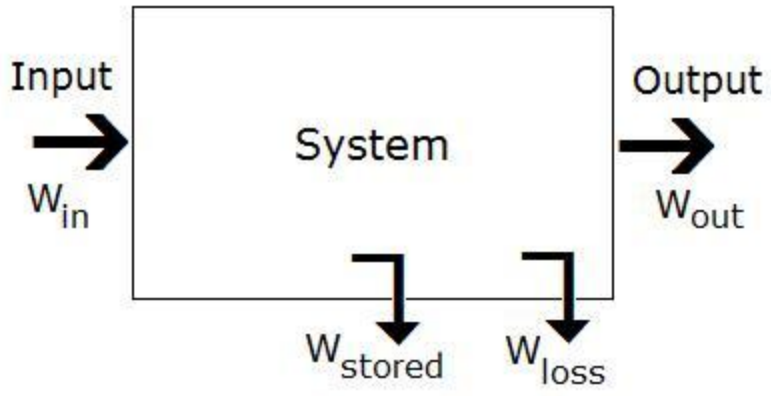
❋ Examples:

At 10☐ per kilowatt hour, how much will it cost to leave a 100 watt lamp burning for five days?

What is the total cost of using all of the following at 10☐ per kilowatt hour?

- A 1200 W toaster for 30 min
- Six 50W bulbs for 4 hours
- A 400 W washing machine for 45 min
- A 4800 W electric clothes dryer for 20 min

E. Efficiency



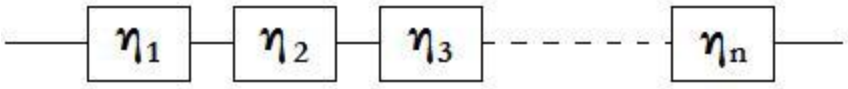
Energy input = energy output plus energy lost or stored by the system

$$W_{in} = W_{out} + W_{\text{lost or stored by the system}}$$

$$P_{in} = P_{out} + P_{\text{lost or stored}}$$

$$\eta = P_{out} / P_{in} \quad = \quad W_{out} / W_{in}$$

For a cascaded system



$$\eta_{total} = \eta_1 * \eta_2 * \eta_3 * - - - * \eta_n$$

❋ Example:

What is the input power for an electric motor that has an output of 24 hp and an efficiency of 85%?

P_{out} =

P_{in} = _____ = _____ =