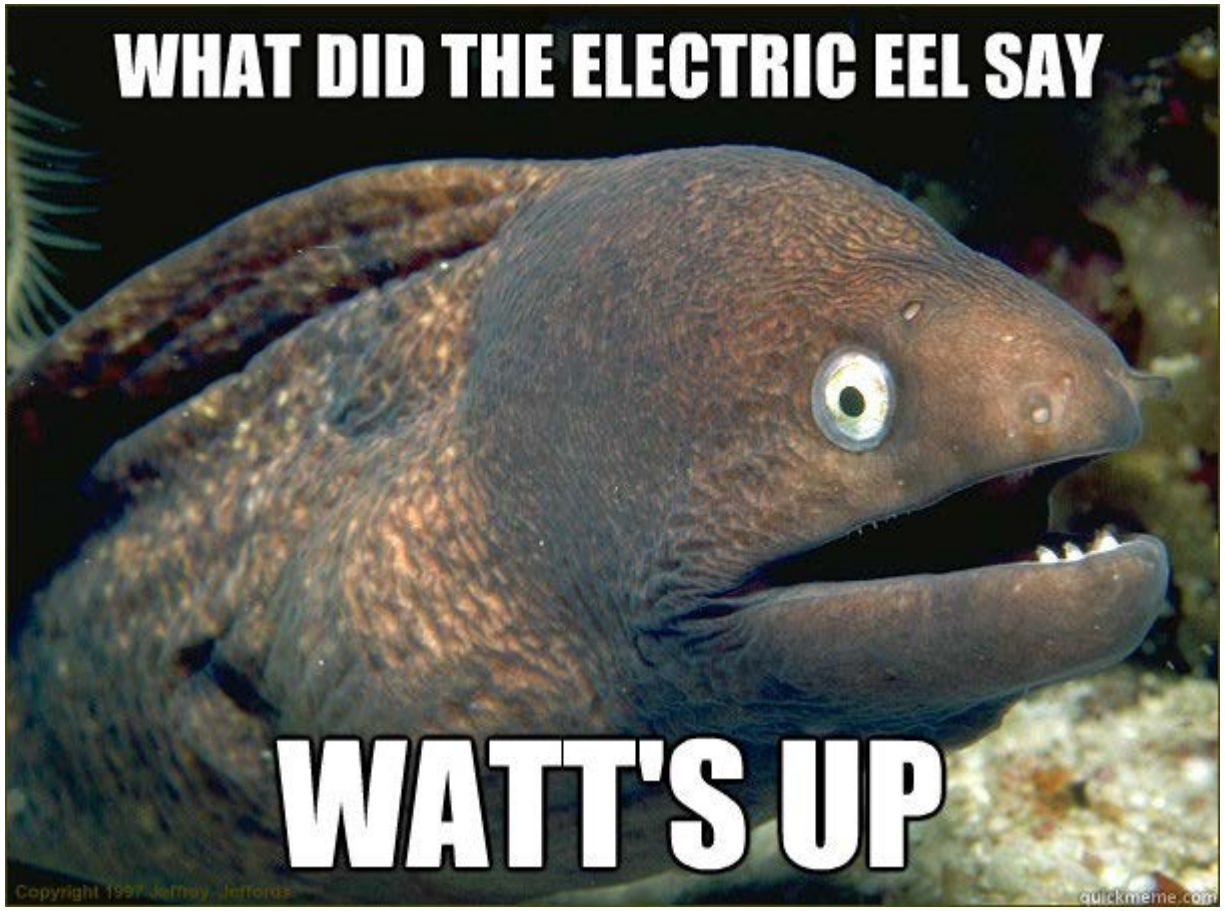
Power

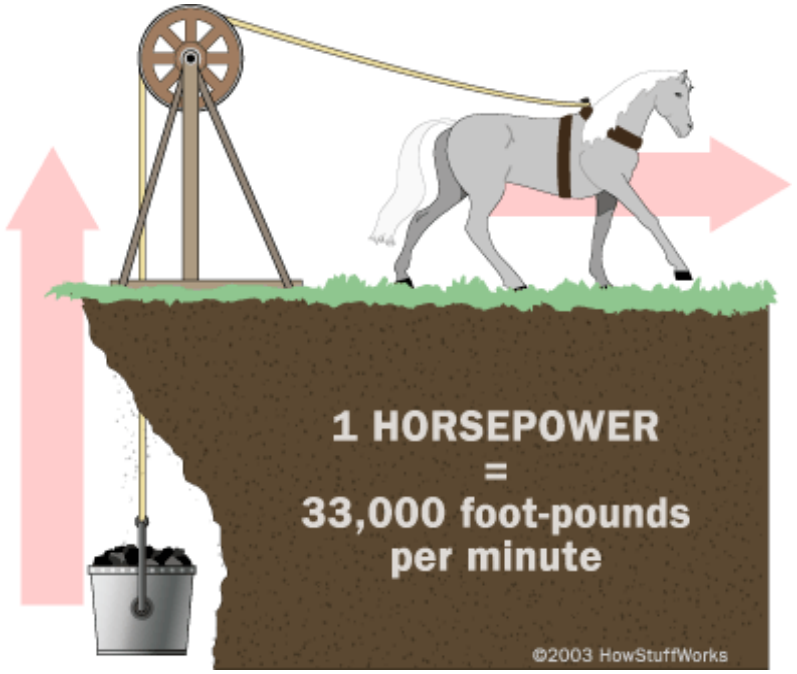


S1-3-20 Define electrical power as energy per unit time, and solve related problems. Include: P = E/t.

James Watt (1736-1819):

Improved the efficiency of the **STEAM ENGINE**. He tried to describe the **POWER** of these engines by comparing them to **HORSES**.

They used **HORSES** to get **COAL** out of mines with a system of **PULLEYS**.



→ an average horse could lift about 1000 pounds 33 feet in one minute

Later, scientists defined power as **ENERGY** per **UNIT TIME**.

Power:

ELECTRICAL POWER describes the amount of **ELECTRICAL ENERGY** converted to **LIGHT**, **HEAT**, **SOUND**, **MOTION**, etc. every **SECOND**.

Power can also be the amount of energy transferred from one place to another every second.

$$P = \frac{E}{t}$$

Where,

- E = Energy in Joules (J)
- t = Time in seconds (s)
- P = Power in Watts (W)

In honour of James Watt, we call 1 J/s a **WATT *(W)*** – the unit for Power**.**

NOTE: You must always convert time into seconds!!!!

1 min = 60 seconds ***1 hour = 3600 seconds***

Power:

You can also calculate Power if you know **POTENTIAL DIFFERENCE** (**VOLTS**) and **CURRENT** (**AMPS**)…

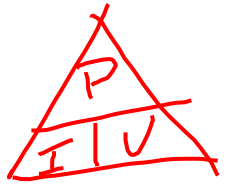
$$P = I \times V$$

100 W = (15A)(~~1000~~)

Why?

- Because the amount of electrical **POWER** in a circuit depends on how **FAST** the electrons are moving, and how much **FORCE** (**VOLTAGE**) they have.
- More **PRESSURE** & **FASTER SPEED** = more **POWER**!

Power Eamples:



$$P = \frac{E}{t} \qquad P = I \times V$$

Examples:

1. A Television is on for 1 hour, and uses 720 000 J of energy. Find the power rating of the T.V.

$t: 1hr = 3600s$

$E = 720{,}000\ J$

$P = ??$

$P = \frac{E}{t}$

$P = \frac{720000J}{3600s} = 200W$

2. You turn on a light for 60s to find something. It has a power rating of 60W. How much energy did it use?

$t = 60s$

$P = 60W$

$E = ?$

$P = \frac{E}{t}$

$E = P \cdot t$

$E = (60W)(60s) = 3600\ J$

Power Eamples:

$$P = \frac{E}{t} \qquad P = I \times V$$

Examples:

3. A c.d. player has a power rating of 85W, and it used 5100J of energy. How long was it on for?

4. A light bulb has a power rating of 100W. If it is on a 120V system, how much current must flow?

P = 100W

V = 120V

I = ?

$P = I \cdot V$

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

$I = \frac{100W}{120V} = 0.83A$

Power Eamples:

$$P = \frac{E}{t} \qquad P = I \times V$$

Examples:

5. A kettle draws 5 amps of current and is rated for 550 watts. What is the minimum voltage needed?