

Power Calculations



Cost to use electrical device

$$\begin{array}{ccccccc} \text{Cost to use} = & \text{power rating} & \times & \text{time} & \times & \text{cost rate} & \\ (\text{¢}) & (\text{kW}) & & (\text{h}) & & (\text{¢/h}) & \end{array}$$

Use GRASP method to solve mathematical problems

1. How much does it cost to run a TV with a power rating of 300 watts for 1.5 hours a day if the cost of electricity is 11¢ per hour?

G: (givens)	Power = 300 watts Time = 1.5 hours Cost rate = 11¢/hour
R: (required)	Cost to use = ?
A: (analysis) ie: formula	- convert watts to kilowatts - cost = power x time x cost of electricity
S: (solve)	300 watts ÷ 1000 = 0.300 kW Cost = (0.300) x (1.5) x (11¢) = 4.95 ¢ Can't have 4.95 cents! So I round to a whole number = 5¢
P: (paraphrase) ie: write a sentence answer	It cost 5¢ to run the TV.

2. How much does it cost to run for a whole year given this daily pattern?

Hint: Use your most precise answer.

$$4.95 \text{ ¢/day} \times 365 \text{ days} = 1806.75 \text{ ¢}$$

Convert to dollars (¢ ÷ 100 = \$)

$$1806.75 \div 100 = 18.0675 \text{ \$}$$

or.... \$ 18.07

Joules

% Efficiency

An efficient device uses energy well and doesn't waste much.

For these calculations, we are not concerned with how fast the device uses energy (that's **watts** and **kilowatts**). We are concerned with the actual amount of energy (that's **joules**)

3. A toaster oven uses 1200 J of energy to produce 850 J of thermal energy. Calculate the percent efficiency of the toaster.

G: (givens)	Energy in = 1200 J Energy out = 85 J
R: (required)	% efficiency = ?
A: (analysis) ie: formula	% efficiency = $\frac{\text{energy out}}{\text{energy in}} \times 100\%$
S: (solve)	% efficiency = $(850 / 1200) \times 100 \%$ = 70.83 % Round to a whole number = 71%
P: (paraphrase) ie: write a sentence answer	The toaster oven is 71% efficient.

4. a) What % of energy is wasted?

b) Where does the 'wasted' energy go?

The 'wasted' energy becomes ...

Remember our note on how electrical energy converts to other energies (heat, sound, light and movement)