Power Calculations

Cost to use electrical device

Cost to use = \text{power rating} \times \text{time} \times \text{cost rate}

(\text{C}) \quad (\text{kW}) \quad (\text{h}) \quad (\text{C/h})

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) | - convert watts to kilowatts  
|             | - cost = \text{power} \times \text{time} \times \text{cost of electricity} |
| S: (solve) | 300 watts ÷ 1000 = 0.300 kW  
|           | Cost = (0.300) \times (1.5) \times (11¢)  
|           | = 4.95 ¢  
|           | Can’t have 4.95 cents! So I round to a whole number  
|           | = 5¢ |
| P: (paraphrase) | 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 ¢/day \times 365 \text{ days} = 1806.75 ¢  

Convert to dollars \((\text{¢} \div 100 = \$)\)

1806.75 \div 100 = 18.0675 $
% 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) | % efficiency = \(\text{energy out} \times 100\% / \text{energy in}\) |
| ie: formula     |                  |
| **S:** (solve)  | % efficiency = \(850 / 1200\) x 100%  
|                | = 70.83%         
|                | Round to a whole number  
|                | = 71%           |
| **P:** (paraphrase) | The toaster oven is 71% efficient. |
| ie: write a sentence answer | |

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)