1. a) $P = U \cdot I = 6.0\ \text{V} \cdot 6.0\ \text{A} = \underline{36\ \text{W}}$

   b) $I = \dfrac{P}{U} = \dfrac{18\ \text{W}}{6.0\ \text{V}} = \underline{\underline{3.0\ \text{A}}}$

   c) $U = \dfrac{P}{I} = \dfrac{36\ \text{W}}{3.0\ \text{A}} = \underline{\underline{12\ \text{V}}}$

   d) $I = \dfrac{P}{U} = \dfrac{100\ \text{W}}{220\ \text{V}} = \underline{\underline{0.45\ \text{A}}}$

2. a) $I = \dfrac{P}{U} = \dfrac{75\ \text{W}}{220\ \text{V}} = \underline{\underline{0.34\ \text{A}}}$

   b) $R = \dfrac{U}{I} = \dfrac{220\ \text{V}}{0.34\ \text{A}} = \underline{\underline{645\ \Omega}}$

3. a) $I = \dfrac{U}{R} \qquad P = U \cdot I = U \cdot \dfrac{U}{R} = \dfrac{U^2}{R}$

   b) $U = R \cdot I P = U \cdot I = R \cdot I \cdot I = R \cdot I^2$

4. a) $I = \dfrac{P}{U} = \dfrac{1'000\ \text{W}}{220\ \text{V}} = \underline{\underline{4.55\ \text{A}}}$

   b) $R = \dfrac{U}{I} = \dfrac{220\ \text{V}}{4.55\ \text{A}} = \underline{\underline{48.4\ \Omega}}$

   c) $I = \dfrac{U}{R} = \dfrac{110\ \text{V}}{48.4\ \Omega} = \underline{\underline{2.27\ \text{A}}}$

   d) $P = U \cdot I = 110\ \text{V} \cdot 2.27\ \text{A} = \underline{\underline{250\ \text{W}}}$ *or*: $P = \dfrac{U^2}{R} = \dfrac{\left(110\ \text{V}\right)^2}{48.4\ \Omega} = \underline{\underline{250\ \text{W}}}$

   e) $I = \dfrac{U}{R} = \dfrac{440\ \text{V}}{48.4\ \Omega} = \underline{\underline{9.09\ \text{A}}}$

   f) $P = U \cdot I = 440\ \text{V} \cdot 9.09\ \text{A} = \underline{\underline{4'000\ \text{W}}}$ *or*: $P = \dfrac{U^2}{R} = \dfrac{\left(440\ \text{V}\right)^2}{48.4\ \Omega} = \underline{\underline{4'000\ \text{W}}}$

5.

	voltage	current	resistance	work	time	power
a)	$U = R \cdot I$ = 24.0 V	2.00 A	12.0 Ω	$W = P \cdot t$ = 5760 J	2.00 min	$P = U \cdot I$ = 48.0 W
b)	150 V	6.00 A	$R = \frac{U}{I}$ = 25 Ω	$W = P \cdot t$ = 72'000 J	80.0 s	$P = U \cdot I$ = 900 W
c)	220 V	$I = \frac{P}{U}$ = 0.0109 A	$R = \frac{U}{I}$ = 20.1 kΩ	13.0 kJ	1.50 h	$P = \frac{W}{t}$ = 2.41 W
d)	$U = R \cdot I$ = 6'000 V	10.0 A	600 Ω	5.00 kJ	$t = \frac{W}{P}$ = 0.0833 s	$P = U \cdot I$ = 60.0 kW
e)	4.00 V	$I = \frac{P}{U}$ = 5.00 A	$R = \frac{U}{I}$ = 0.800 Ω	120 J	$t = \frac{W}{P}$ = 6.00 s	20.0 W
f)	$U = \frac{P}{I}$ = 4.50 V	20.0 mA	$R = \frac{U}{I}$ = 225 Ω	$W = P \cdot t$ = 7'776 J	1.00 Tag	90.0 mW

6. a) In J: $W = P \cdot t$ = 1500 W · 7'200 s = 10'800'000 J = 10.8 MJ

In kWh: $W = P \cdot t$ = 1.5 kW · 2.0 h = 3.0 kWh kostet 3.0 kWh · 20 $\frac{\text{Rp.}}{\text{kWh}}$ = 60 Rp.

b) In J: $W = P \cdot t$ = 50 W · 36'000 s = 1'800'000 J = 1.8 MJ

In kWh: $W = P \cdot t$ = 0.050 kW · 10 h = 0.50 kWh kostet 0.50 kWh · 20 $\frac{\text{Rp.}}{\text{kWh}}$ = 10 Rp.

7. a) in kWh: $W = P \cdot t$ = 1'020'000 kW · 24 h = 24'480'000 kWh = $2.45 \cdot 10^7$ kWh

in J: $W = P \cdot t$ = 1'020 $\cdot 10^6$ W · 24 · 60 · 60 s = $8.81 \cdot 10^{13}$ J

b) price: 24'480'000 kWh · 0.20 $\frac{\text{Fr.}}{\text{kWh}}$ = 4'896'000 Fr. (almost 5 Mio. Fr per day!)

8. a) $Q = I \cdot t = 0.20\ \text{A} \cdot 8.0 \cdot 3'600\ \text{s} = \underline{5'760\ \text{C}}$

b) $P = U \cdot I = 4.5\ \text{V} \cdot 0.20\ \text{A} = \underline{\underline{0.90\ \text{W}}}$

c) In J: $W = P \cdot t = 0.90\ \text{W} \cdot 28'800\ \text{s} = \underline{25'920\ \text{J}}$

In kWh: $W = P \cdot t = 0.00090\ \text{kW} \cdot 8.0\ \text{h} = \underline{0.0072\ \text{kWh}}$

d) 0.0072 kWh cost 2.00 Fr. $\Rightarrow$ 1 kWh costs $\dfrac{2.00\ \text{Fr}}{0.0072\ \text{kWh}} = \underline{\underline{278\ \text{Fr.}}}$

e) $0.0072\ \text{kWh} \cdot \dfrac{20\ \text{Rp}}{\text{kWh}} = \underline{\underline{0.144\ \text{Rp}}}$

9. a) $I = \dfrac{P}{U} = \dfrac{100\ \text{W}}{220\ \text{V}} = 0.455\ \text{A}$ $\qquad R = \dfrac{U}{I} = \dfrac{220\ \text{V}}{0.455\ \text{A}} = \underline{\underline{484\ \Omega}}$

or: $R = \dfrac{U^2}{P} = \dfrac{(220\ \text{V})^2}{100\ \text{W}} = \underline{\underline{484\ \Omega}}$

b) $I = \dfrac{P}{U} = \dfrac{40\ \text{W}}{220\ \text{V}} = 0.182\ \text{A}$ $\qquad R = \dfrac{U}{I} = \dfrac{220\ \text{V}}{0.182\ \text{A}} = \underline{\underline{1'210\ \Omega}}$

or: $R = \dfrac{U^2}{P} = \dfrac{(220\ \text{V})^2}{40\ \text{W}} = \underline{\underline{1'210\ \Omega}}$

10. a) $E = \dfrac{E_{\text{useful}}}{\eta} = \dfrac{460.0\ \text{kJ}}{0.700} = \underline{657\ \text{kJ}}$

b) $P_{\text{extracted}} = P_{\text{supplied}} \cdot \eta = 50.0\ \text{kW} \cdot 0.700 = \underline{35.0\ \text{kW}}$

11. a) Electrical energy is converted into gravitational potential energy and internal energy

b) Input (E): Electrical energy, output (E_{useful}): gravitational potential energy, “waste”: internal energy

c) $W = m \cdot g \cdot h = 400.0\ \text{kg} \cdot 9.81\ \dfrac{\text{m}}{\text{s}^2} \cdot 15.0\ \text{m} = \underline{\underline{58'860\ \text{J}}} = \underline{\underline{58.9\ \text{kJ}}}$

d) $E_{\text{useful}} = W = \underline{\underline{58.9\ \text{kJ}}}$

e) $E = \dfrac{E_{\text{useful}}}{\eta} = \dfrac{58'860\ \text{J}}{0.75} = 78'480\ \text{J} = \underline{78\ \text{kJ}}$

f) 78 kJ is $\dfrac{78'000\ \text{J}}{3'600'000\ \frac{\text{J}}{\text{kWh}}} = 0.022\ \text{kWh}$. The price is $0.022\ \text{kWh} \cdot \dfrac{20\ \text{Rp}}{\text{kWh}} = \underline{\underline{0.43\ \text{Rp}}}$