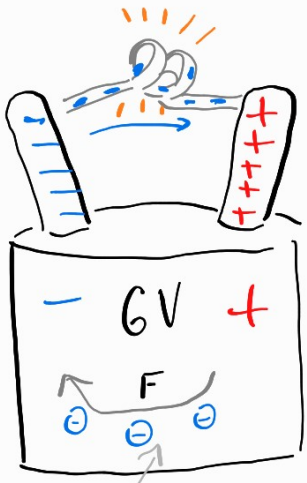
El. proud, energie



$W = qU$

$e \approx 1{,}6 \times 10^{-19}\ C$

→ směr pohybu e^-

← I

dohodnutý směr proudu

$$\left[I = \frac{Q}{t} \qquad Q = I \cdot t \right]$$

náboj, co proteče průřezem vodiče

$[A] = \left[\frac{C}{s}\right]$ $[C] = [A \cdot s]$

Původ sil

- chemický
- magnetický
- „fotoefekt"
- ...

Náboj, který je baterie schopna dodat

$1000\ mA \cdot h = 1A \cdot h = 1A \cdot 3600\ s$
$= 3600\ C$

$1\ mA \cdot h = 3{,}6\ C$

$1\ A \cdot h \rightarrow$ 1A po dobu 1h
2A po dobu 1/2 h ...
1/2 A po dobu 2h

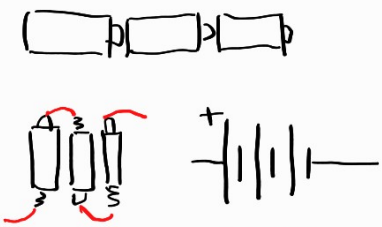
Napětí baterie

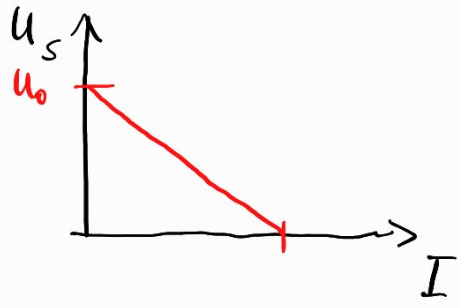

1,5V

3,7V


6V
4 × 1,5


12V
6 × 2,2V

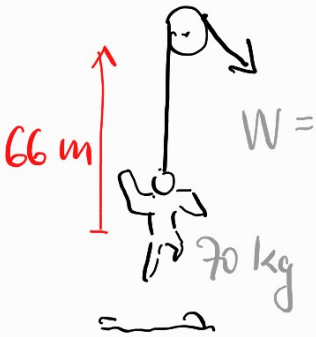

4,5V



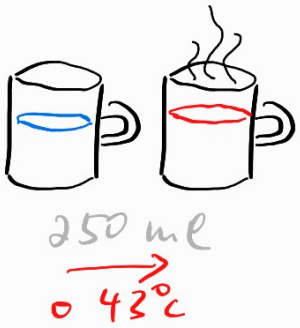
Energie baterie ↘ energie/práce, kterou je schopna dodat do obvodu

$$[W = Q \cdot U]$$

$$W = 3400\ mAh \cdot 3{,}7\ V$$
$$= 3400 \cdot 3{,}6\ C \cdot 3{,}7\ V \doteq 45{,}3\ kJ$$



$W = mgh$



$$Q = mc\Delta T$$
$$= 0{,}25 \cdot 4200\ \frac{J}{kg \cdot K} \cdot \Delta T$$

Výkon el. proudu, příkon spotřebiče

$$\text{příkon} = \frac{\text{spotřebovaná energie}}{\text{čas}}$$

tempo spotřeby energie / konání práce

$$\text{výkon} = \frac{\text{vykonaná práce}}{\text{čas}}$$

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

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

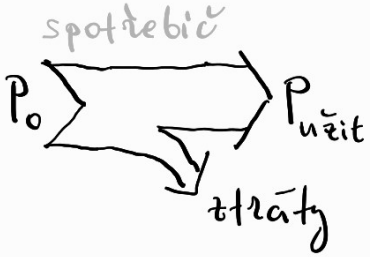
$P_o \geq P$

$[W] = [\frac{J}{s}]$

výkon el. proudu ve spotřebiči = příkon spotřebiče > užitečný výkon

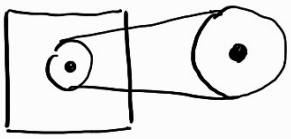
$W = P \cdot t$

$[J] = [W \cdot s]$



Kilowatthodina

spotřeba: $E = P_0 \cdot t$



$t = 5\,h$

$P_0 = 2\,kW$

$E = 2000\,W \cdot 5\,h$

$= 2000\,W \cdot 5 \cdot 3600\,s$

$= 36\,000\,000\,J = \underline{36\,MJ}$

$E = 2\,kW \cdot 5\,h$

$= 2.5\,kW \cdot h = \underline{10\,kW \cdot h}$

jednotka práce/energie

$1\,kW \cdot h = 3{,}6\,MJ$

elektrická energie: $\approx 5\,\frac{kč}{kWh}$

Tř: plotýnka

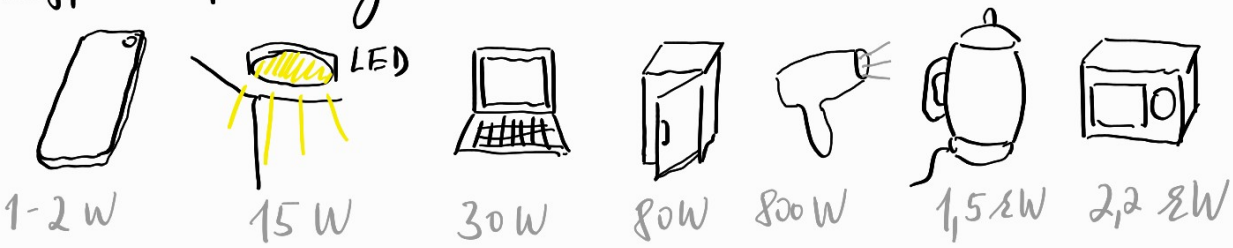
$t = 20\,min$

$P_0 = 1{,}8\,kW$

$E = 1{,}8\,kW \cdot \frac{1}{3}\,h = 0{,}6\,kW \cdot h$

↳ $0{,}6\,kWh \cdot 5\,\frac{kč}{kWh} = 3\,kč$

Typické příkony



1-2 W | 15 W | 30 W | 80 W | 800 W | 1,5 kW | 2,2 kW

360 MW

2 GW

asi 20% spotřeby ČR

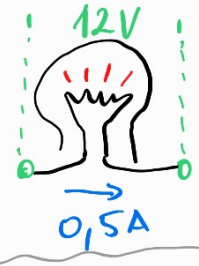
Výkon el. proudu

spotřebovaná energie = práce vykonaná el. proudem

$$E = Q \cdot U = I \cdot t \cdot U$$

výkon proudu = příkon spotřebiče

$$P = \frac{E}{t} = \frac{U \cdot I \cdot t}{t} = U \cdot I = P$$!



$P = 12\,V \cdot 0{,}5\,A = 6\,W$

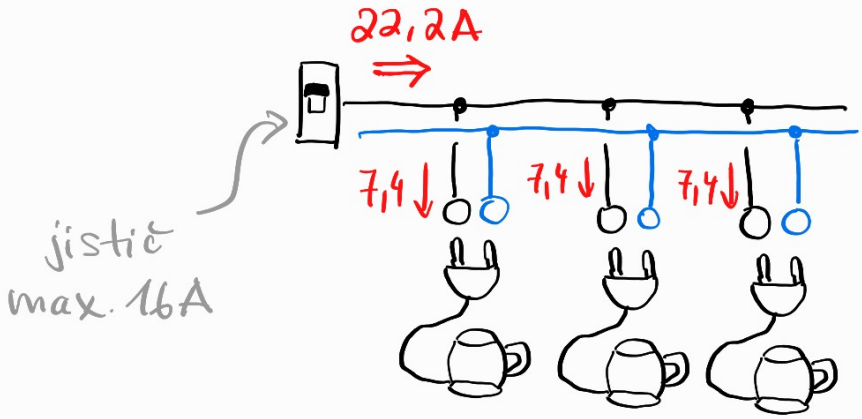
Př.

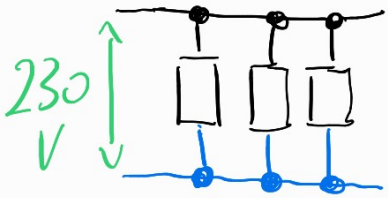
$I = ?$

$P = U \cdot I$

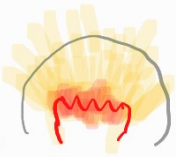
$\frac{P}{U} = I = \frac{1700\,W}{230\,V} = 7{,}4\,A$

Přetížení jističe

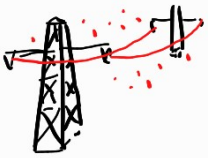


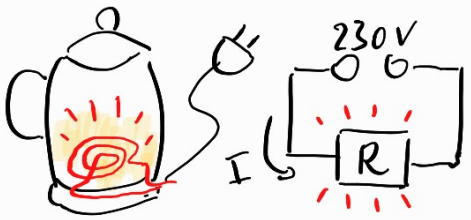


Tepelný výkon vodiče a jeho odpor



Každý vodič se průchodem el. proudu ZAHŘÍVÁ



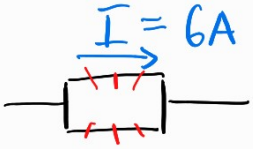


$P = 1500\ W$
$U = 230\ V$
$R = ?$

$P = U \cdot I$

$I = \frac{P}{U} \doteq 6{,}52\ A$

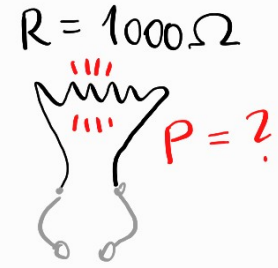
$R = \frac{U}{I} = \frac{230\ V}{6{,}52\ A} \doteq 35\ \Omega$



$P = U \cdot I = R \cdot I \cdot I = 360\ W$

$U = R \cdot I$

$P = R \cdot I^2$

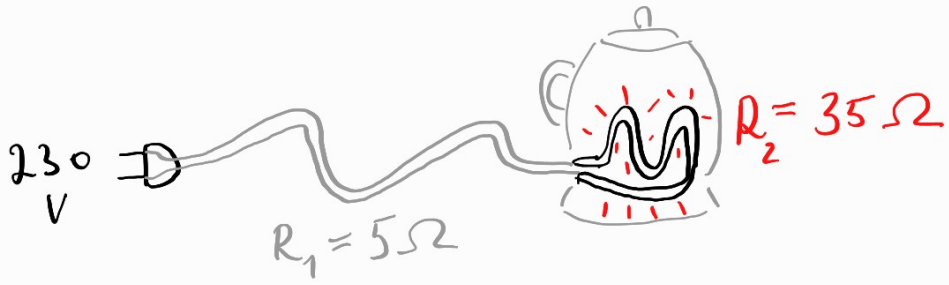


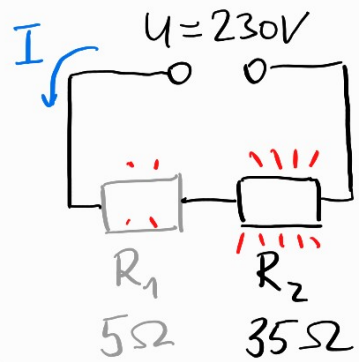
$P = U \cdot I = U \cdot \frac{U}{R} = \frac{230^2}{1000} \doteq 53\ W$

$I = \frac{U}{R}$

$P = \frac{U^2}{R}$

štítek: $P = 1511\ W$





$$I = \frac{U}{R_1 + R_2} = \frac{230V}{40\Omega} = 5{,}75\ A$$

ZTRÁTY $\neq \frac{230^2}{5}$!

$$P_1 = R_1 \cdot I^2 = 5 \cdot 5{,}75^2 \doteq 165{,}3\ W$$

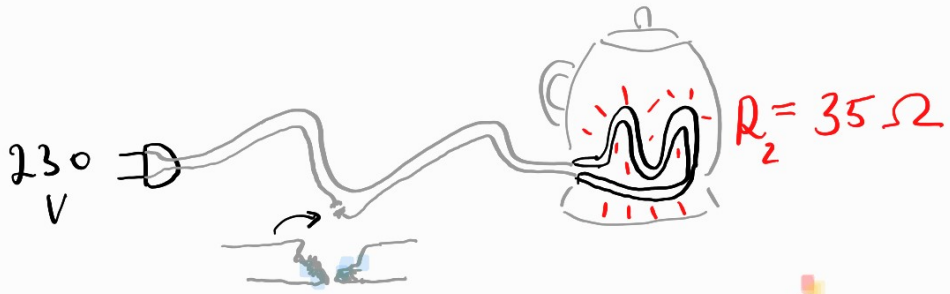
$$P_2 = R_2 \cdot I^2 = 35 \cdot 5{,}75^2 \doteq 1157{,}2\ W$$

celkem

$P = 1322{,}5\ W$

$= \frac{230^2}{40}$

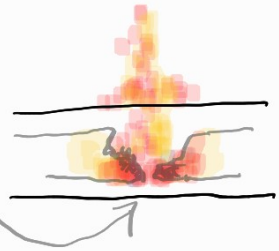
kdyby $R_1 = 0$: $P = \frac{U^2}{R} = 1511\ W$



ŠPATNÝ KONTAKT

$R = 5\Omega$

$P = 165{,}3\ W$

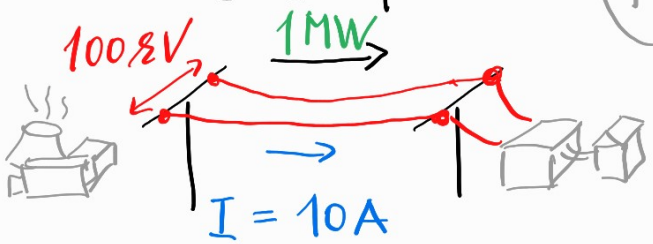


V ZÁSUVCE

ZKRAT

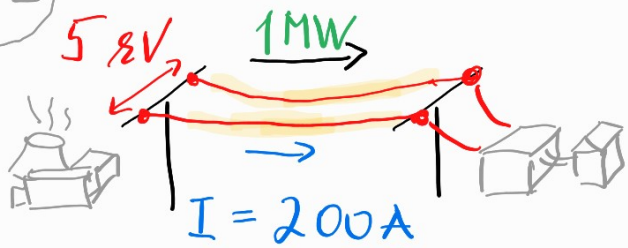
PROČ VYSOKÉ NAPĚTÍ?

chceme přenášet $P = U \cdot I$



$R_{vedení} = 10\Omega$

ztráty $P = RI^2 = 1\ kW$



$R_{vedení} = 10\Omega$

ztráty $P = RI^2 = 400\ kW$