Practice Problems E

SOLUTIONS

(Energy/Power)

Must Show All Work:

1) An electrical device has an internal resistance of 24Ω and a current rating of 1.75A. The device is used for 6hours.

a) Calculate the Power of the device.

① $V = I \cdot R$

$V = 1.75(24)$

$V = 42v$

② $P = V \cdot I$

$P = 42(1.75)$

$P = 73.5w$

b) Calculate the energy consumed in Joules(J), Kilojoules(kJ), and Kilowatt-hours(kW•h)

6 hrs = 21600s

① $E = P \cdot t$

$E = (73.5 \text{ watts})(21600 s)$

$E = 1587600$ Joules

÷1000

② 1587.6 kJ

÷1000

③ $73.5w = 0.0735 kw$

$E = P \cdot t$

$E = (0.0735)(6)$

$E = 0.441$ kw·h

2) To charge a typical smartphone, a charger operates with a voltage of 5V and a current of 1.5 A. Assuming that it takes 3hours every night to charge the phone, how much will it cost to charge the smartphone for an entire year. The cost of electricity is $0.09/kW•h.

① $P = I \cdot V$

$P = (1.5)(5)$

$P = 7.5$ watts

↓ ÷1000

$P = 0.0075$ kw

② Cost = Price of Energy · Power (kw) · Time (h)

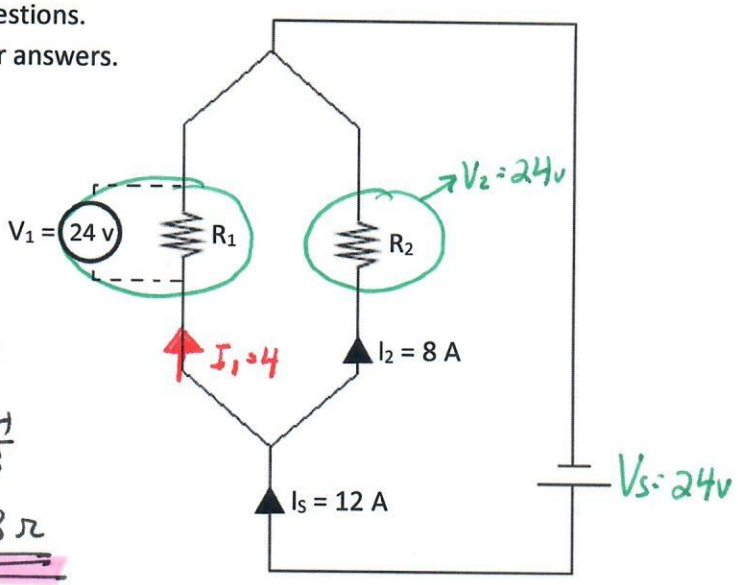
Cost = $(0.09)(0.0075)(3)$

Cost = $0.002025

× 365

= $0.74

3) Study the following circuit to answer the following questions.
Give a full explanation of each step used to get to your answers.



a) What is the value of R_1 and R_2

① $V_S = V_1 = V_2$
$= 24\,v$

② $I_S = I_1 + I_2$
$12 = I_1 + 8$
$I_1 = 4\,A$

③ $R_1 = \frac{V_1}{I_1}$ $\quad R_2 = \frac{V_2}{I_2}$

$R_1 = \frac{24}{4}$ $\quad R_2 = \frac{24}{8}$

$R_1 = 6\,\Omega$ $\quad R_2 = 3\,\Omega$

b) If the circuit operates for a total of 3 hours, what is the **Energy consumed by resistor R_1**
Give your answer in Joules and KW•h

$V_1 = 24v$
$I_1 = 4A$
$3hrs = 10\,800\,sec$

① $P_1 = V_1 \cdot I_1$
$P_1 = 24(4)$
$P_1 = 96\,watts$
$\div 1000$
$P_1 = 0.096\,KW$

② $E_1 = P_1 \cdot t$
$E_1 = 96\,(10800)$
$E_1 = 1\,036\,800\,J$

② $E_1 = P_1 \cdot t$
$E_1 = (0.096)(3)$
$E_1 = 0.288\,kw \cdot h$

c) If the circuit operates for a total of 3 hours, what is the **Energy consumed by the entire circuit.**
Give your answer in Joules and KW•h

$V_S = 24V$
$I_S = 12A$
$3hr = 10800\,sec$

① $P_T = V_S \cdot I_S$
$P_T = 24\,(12)$
$P_T = 288\,w$
$\div 1000$
$P_T = 0.288\,kw$

② $E_T = P_T \cdot t$
$E_T = 288(10800)$
$E_T = 3\,110\,400\,J$

③ $E_T = P_T \cdot t$
$E_T = 0.288(3)$
$E_T = 0.864\,kw \cdot h$