Solutions to Period 14 Exercises

E.1 Your residential neighborhood consists of 100 homes, each requiring 2000 watts of power. If this power is supplied by 2400 volt lines from a power substation, how large is the current drawn from the substation?

a) 83 amps
b) 830 amps
c) 8,300 amps
d) 83,000 amps
e) None of the answers are correct.

Power = 100 homes \times \frac{2000 \text{ W}}{\text{home}} = 2 \times 10^5 \text{ W}

Solve \( P = I V \) for \( I \): \( I = \frac{P}{V} \)

\[
I = \frac{2 \times 10^5 \text{ W}}{2.4 \times 10^3 \text{ V}} = 83 \text{ A}
\]

\[E.1 = a\]
E.2. What factors might determine whether a power company uses a 700,000 volt line, a 100,000 volt line, or a 25,000 volt line to deliver power to your neighborhood?

a) The power the line must deliver.

b) The distance over which the power is carried.

c) The cost of acquiring property on which to build the line.

d) All of the above.

E.2 = d
E.3 What is the voltage drop across a 0.5 ohm resistor carrying 10 amps of current? How large is the joule heating power in this resistor?

a) 5 volts and 5 watts  
b) 5 volts and 50 watts  
c) 20 volts and 20 watts  
d) 20 volts and 200 watts  
e) 50 volts and 500 watts

\[ V = I R = 10 \text{ A} \times 0.5 \Omega = 5 \text{ V} \]

\[ P_{\text{joule}} = I^2 R = (10 \text{ A})^2 \times 0.5 \Omega = 50 \text{ W} \]

E.3 = b
E.4 A current of 120 V flows into a transformer. A 10 amp current flows out of the transformer at 240 V. How much current flows into the transformer? Is this a step up or a step down transformer?

a) 5 amps; step up transformer
b) 5 amps, step down transformer
c) 20 amps; step up transformer
d) 20 amps; step down transformer
e) 40 amps; step down transformer

Solve $I_{in} \times V_{in} = I_{out} \times V_{out}$ for $I_{in}$

$I_{in} = \frac{I_{out} \times V_{out}}{V_{in}} = \frac{10 \text{ A} \times 240 \text{ V}}{120 \text{ V}} = 20 \text{ A}$

The voltage out is greater than the voltage in. Therefore, the transformer steps up the voltage.

E.4 = c
Solutions to Period 14 Exercises

E.1 = a

E.2 = d

E.3 = b

E.4 = c