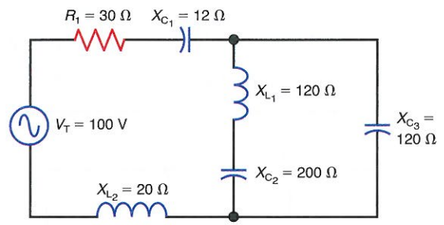
Figure 23–31




c. Fig. 23–28.
d. Fig. 23–29.

**23–28** Calculate the real power, apparent power, and power factor for each of the following circuit conditions:
a. A parallel *RLC* circuit with $V_A = 120$ V, $I_T = 5$ A, and $\theta_I = -45°$.
b. A parallel *RLC* circuit with $V_A = 240$ V, $I_T = 18$ A, and $\theta_I = -26.56°$.
c. A parallel *RLC* circuit with $V_A = 100$ V, $I_T = 3$ A, and $\theta_I = 78°$.
d. A parallel *RLC* circuit with $V_A = 120$ V, $I_T = 8$ A, and $\theta_I = 56°$.

## Critical Thinking

**23–29** In Fig. 23–32, what value of *L* will produce a circuit power factor of 0.8?

**23–30** In Fig. 23–33, what value of *C* in parallel with *R* and *L* will produce a power factor of 0.8?

Figure 23–32 Circuit for Critical Thinking Prob. 23–29.


Figure 23–33 Circuit for Critical Thinking Prob. 23–30.


## Answers to Self-Reviews

**23–1** a. 0°
b. 0°

**23–2** a. 90°
b. −90°

**23–3** a. −90°
b. 90°

**23–4** a. 20 Ω
b. 1 A

**23–5** a. 30 Ω
b. 30 Ω
c. 180°

**23–6** a. 3 A
b. 3 A

**23–7** a. 200 Ω
b. 200 Ω
c. 100 Ω

**23–8** a. watt
b. volt-ampere
c. real

**23–9** a. true
b. true

**23–10** a. real power
b. *V*

**23–11** a. *R*
b. $X_L$
c. $X_C$

**23–12** a. $V_L$ and $V_C$
b. $I_R$ and $I_L$



## Laboratory Application Assignment

In this lab application assignment you will examine the real power, apparent power, and power factor (PF) in a parallel *RL* circuit. You will also examine how a capacitor can be added in parallel to bring the power factor closer to 1 or unity. The procedure of adding a capacitor in parallel to raise the power factor is called power factor correction.
**Note:** *In this lab we will assume that the dc resistance, $r_l$, of the inductor is negligible.*

**Equipment:** Obtain the following items from your instructor.
- Function generator
- Oscilloscope
- DMM
- 100-mH inductor
- 0.22-μF capacitor
- 10-Ω and 680-Ω resistors

### Real Power, Apparent Power, and Power Factor

Examine the parallel *RL* circuit in Fig. 23–34*a*. (Ignore the 0.22-μF capacitor.) Calculate and record the following circuit values:
$X_L =$ _____, $I_L =$ _____, $I_R =$ _____,
$I_T =$ _____, $Z_{EQ} =$ _____
$\theta_I =$ _____, real power = _____,
apparent power = _____, PF = _____

Construct the circuit in Fig. 23–34*a*. (Again, ignore the 0.22-μF capacitor.)
Adjust the applied voltage, $V_A$, to exactly 5 Vrms. With a DMM, measure and record the following circuit values:
$I_L =$ _____, $I_R =$ _____,
$I_T =$ _____

Using the measured values of $I_L$ and $I_R$, calculate the total current, $I_T$ as $I_T = \sqrt{I_R^2 + I_L^2}$. Does this value agree with the measured value of total current? _____ If not, list one possible reason why. _____
_____

Using the measured values of $I_L$ and $I_R$, calculate the circuit's phase angle, $\theta_I$. (Recall that in a parallel circuit, $\tan \theta_I = -I_L/I_R$.)
$\theta_I =$ _____. Next, using measured values, determine the following: real power = _____, apparent power = _____, PF = _____ How do these experimental values compare to those initially calculated? _____
_____
_____

### Power Factor Correction

Mentally connect the 0.22-μF capacitor in Fig. 23–34*a*. Calculate and record the following circuit values:
$X_L =$ _____, $X_C =$ _____, $I_L =$ _____,
$I_C =$ _____, $I_X =$ _____
$I_R =$ _____, $I_T =$ _____, $Z_{EQ} =$ _____,
$\theta_I =$ _____, apparent power = _____,
real power = _____, PF = _____

Construct the circuit in Fig. 23–34*a* including the 0.22-μF capacitor. Adjust the applied voltage, $V_A$, to exactly 5 Vrms. With a DMM, measure and record the following circuit values:
$I_L =$ _____, $I_C =$ _____,
$I_R =$ _____, $I_T =$ _____

Figure 23–34