Chapter 11, Solution 54.

For the network in Fig. 11.73, find the complex power absorbed by each element.

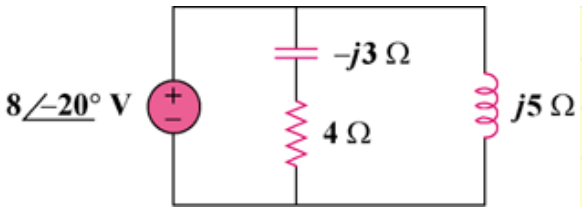

Figure 11.73
For Prob. 11.54.

Solution

Consider the circuit shown below.

$$\mathbf{I}_1 = \frac{8\angle -20^\circ}{4 - j3} = 1.6\angle 16.87^\circ$$

$$\mathbf{I}_2 = \frac{8\angle -20^\circ}{j5} = 1.6\angle -110^\circ$$

$$\mathbf{I} = \mathbf{I}_1 + \mathbf{I}_2 = (-0.5472 - j1.504) + (1.531 + j0.4643)$$
$$\mathbf{I} = 0.9839 - j1.04 = 1.432\angle -46.58^\circ$$

For the source,

$$\mathbf{S} = \mathbf{V}\mathbf{I}^* = (8\angle -20^\circ)(1.432\angle 46.58^\circ)$$
$$\mathbf{S} = 11.456\angle 26.58^\circ = \mathbf{(10.24+j3.12)\ VA}$$

For the capacitor,

$$\mathbf{S} = |\mathbf{I}_1|^2 \mathbf{Z}_c = (1.6)^2(-j3) = \mathbf{-j7.68\ VA}$$

For the resistor,

$$\mathbf{S} = |\mathbf{I}_1|^2 \mathbf{Z}_R = (1.6)^2(4) = \mathbf{10.24\ VA}$$

For the inductor,

$$\mathbf{S} = |\mathbf{I}_2|^2 \mathbf{Z}_L = (1.6)^2(j5) = \mathbf{j12.8\ VA}$$