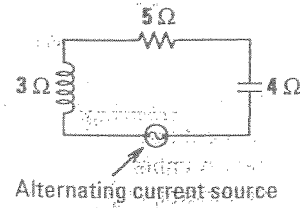# Chapter 4: Use Complex Numbers in Real Life - Electricity
Please write neatly, use complete sentences where needed, and show all work.

Overview
Circuit components such as resistors, inductors, and capacitors all oppose the flow of current. This opposition is called *resistance* for resistors and *reactance* for inductors and capacitors. A circuit's total opposition to current flow is *impedance*. All of these quantities are measured in ohms (Ω).

Component and symbol	Resistor —W—	Inductor —elle—	Capacitor —|⊢
Resistance or reactance	R	L	C
Impedance	R	Li	$-Ci$

Alternating current source

The table shows the relationship between a component's resistance or reactance and its contribution to impedance.

Series Circuits
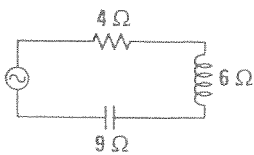A *series circuit* is also shown with the resistance or reactance of each component labeled.

The impedance for a series circuit is the sum of the impedances for the individual components. Find the impedance of the circuit show above.

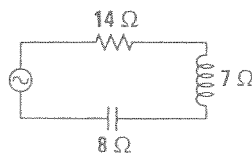$$\text{Impedance} = 5 + 3i + 4i$$
$$5 + (-1i)$$
$$5 - 1 \, \Omega \, \text{ohms}$$
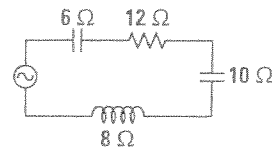
Find the impedance of the circuits below.

$4 + 6i - 9i$

$\boxed{4 - 3i \, \Omega}$

$14 - 7i - 8i$

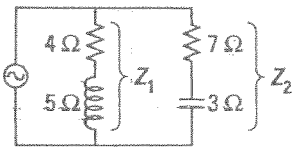$\boxed{14 - 1i \, \Omega}$

$12 - 6i + 8i - 6i$

$\boxed{12 - 8i \, \Omega}$

Parallel Circuits
In a _parallel circuit_, there is more than one pathway through which the current can flow. To find impedance Z of a parallel circuit with two pathways, first calculate the impedances Z_1 and Z_2 of the pathways separately by treating each pathway as a series circuit. Then apply this formula:

$$Z = \frac{Z_1 Z_2}{Z_1 + Z_2}$$

What is the impedance of each parallel circuit shown below?
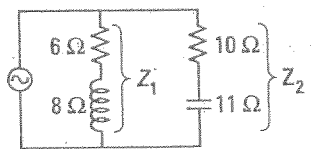

$Z_1 = 4 + 5i$ ohms

$Z_2 = 7 + -3i$
     $7 - 3i$ ohms

$$\frac{(4+5i)(7-3i)}{}$$

$$\frac{28 + 35i - 12i - 15i^2}{11 + 2i}$$

$$Z = \frac{-8i}{} \quad \frac{4+5i + 7 + (-3i)}{}$$

$$Z = 473 \; \boxed{-8i} \; 12 - 53i - 46i^2$$

$$125$$

$$+ \; \frac{2 \cdot (43 + 23i)}{(11 + 2i)} \quad \frac{(11-2i)}{(11-2i)}$$

(-1)

$$\boxed{Z = \frac{514 - 246i}{125} \; \Omega}$$

$Z_1 = 6 + 8i$ ohms

$Z_2 = 10 + -11i$ ohms

$$Z = \frac{2368 + 444i + 224i + 42i^2}{256 - 9i^2}$$

$$\boxed{Z = \frac{2326 + 668i}{265} \; \Omega}$$

$$60 - 66i + 80i - 88i^2$$

$$Z = \frac{(6 + 8i)(10 - 11i)}{(6 + 8i) + (10 - 11i)}$$

$$16 + 3i$$

$$Z = \frac{(248 + 14i)}{(16 - 3i)} \cdot \frac{(16 + 3i)}{(16 + 3i)}$$