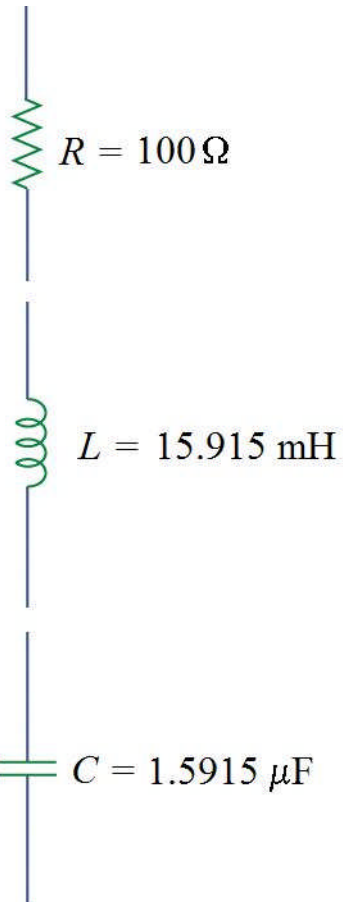


Example Problem 1

Calculate the impedance of a resistor, a capacitor and an inductor at the following frequencies.



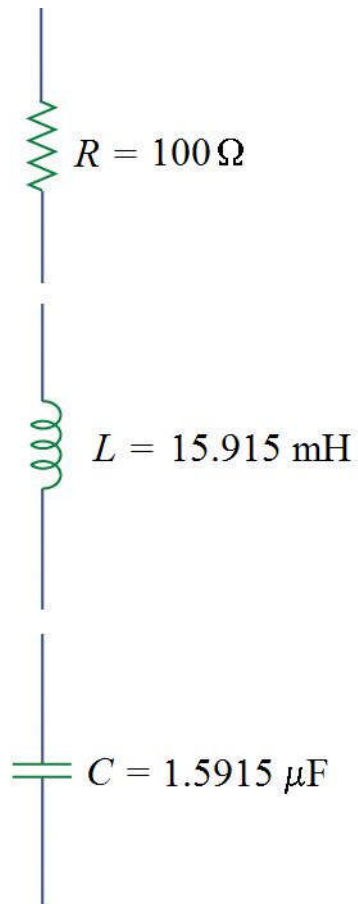
$$Z_C = \frac{-j}{2\pi f C}$$

$$Z_L = j2\pi f L$$

f	100 Hz	1000 Hz	10,000 Hz
R			
Z_L			
Z_C			

Example Problem 1

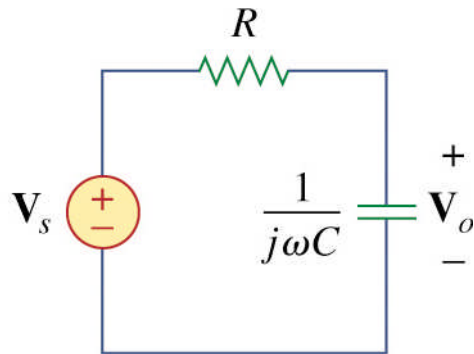
Calculate the impedance of a resistor, a capacitor and an inductor at the following frequencies.



f	100 Hz	1000 Hz	10,000 Hz
R	100 Ω	100 Ω	100 Ω
Z_L	$j10 \Omega$	$j100 \Omega$	$j1000 \Omega$
Z_C	$-j1000 \Omega$	$-j100 \Omega$	$-j10 \Omega$

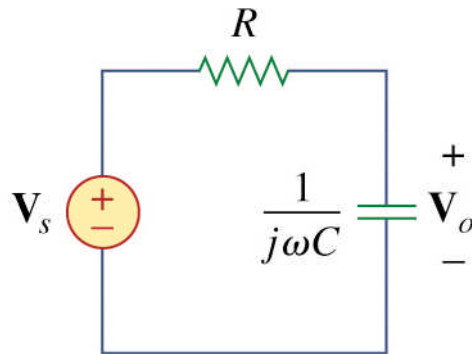
RC low-pass filter

- What is the ratio of the output voltage (v_o) to the input voltage (v_s)?



RC low-pass filter

- What is the ratio of the output voltage (V_o) to the input voltage (V_s)?



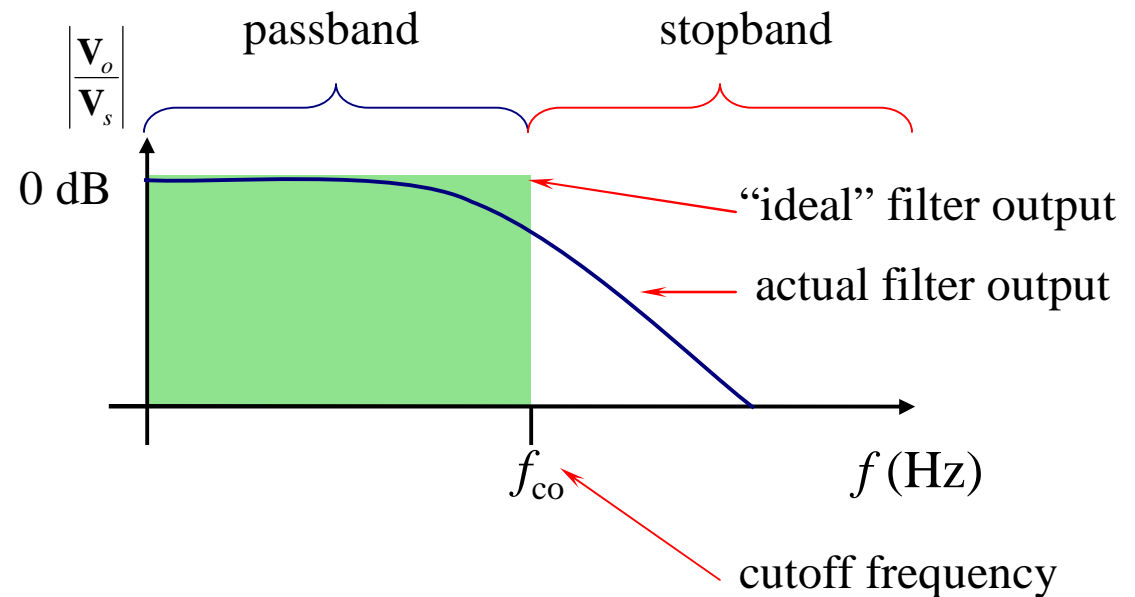
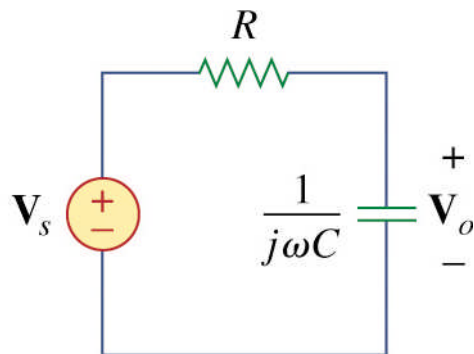
$$V_o = \frac{Z_C}{R + Z_C} V_s$$

$$\frac{V_o}{V_s} = \frac{1}{R + \frac{1}{j\omega C}} = \frac{1}{1 + j\omega RC}$$

$$\left| \frac{V_o}{V_s} \right| = \frac{1}{\sqrt{1 + (\omega RC)^2}}$$

RC low-pass filter

- A **low-pass filter** passes frequencies below a critical frequency called the cutoff frequency and attenuates those above.



RC low-pass filter response