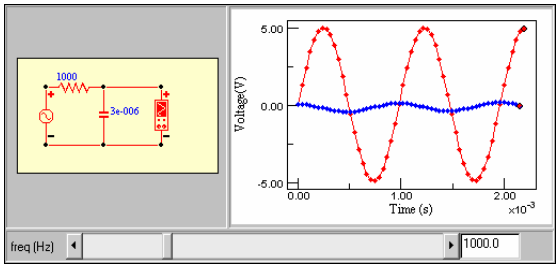
Worksheet for Exploration 31.3: Filters



Since the reactance varies with frequency, we can use capacitors (or inductors) to filter out different frequencies. The voltage of the source is **red**, while the oscilloscope voltage is the **blue** plot on the graph **(voltage is given in volts and time is given in seconds)**.

a. At very low frequencies does the capacitor have a high or low a reactance?

b. Therefore, at low frequencies, will the current through the capacitor be large or small?

Capacitor filter: Try Filter 1.

c. Will this circuit allow high or low frequency signals to reach the oscilloscope? Explain.

d. Try it.
e. Is the amplitude of the voltage measured by the oscilloscope bigger at low or high frequencies?

i. Was your prediction correct or incorrect? If incorrect, how do you need to modify your reasoning?

If it is bigger at higher frequencies, then it "allows" high frequencies through more readily than lower frequencies and it is called a high-pass filter. If it "allows" low-frequencies through, it is a low pass filter. Look at the circuit for Filter 2.

f. Do you think this is a high-pass or low-pass filter? Why?

g. Try it and determine which kind of filter it is.

Many signals are not simply made up of one single frequency. They are a combination of frequencies and this is where filters are useful. Try a wave function composed of two different frequency waves with the low pass filter. Try this wave function with the high pass filter. (Note: you can not change the frequency of this wave function with the slider bar in this animation.)

h. What is the difference between the oscilloscope signals in the two cases?

i. Explain.