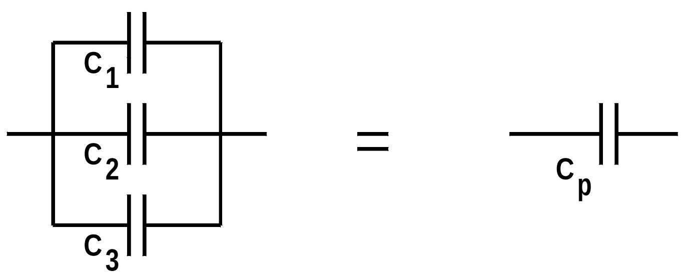
Units:— Coulombs, Farads, Volts.

$$Q = C \times V$$

Capacitors connected in parallel

$$C_p = C_1 + C_2 + C_3 + \cdots$$



$$\text{If} \quad V = V_0 \sin(2\pi f t)$$

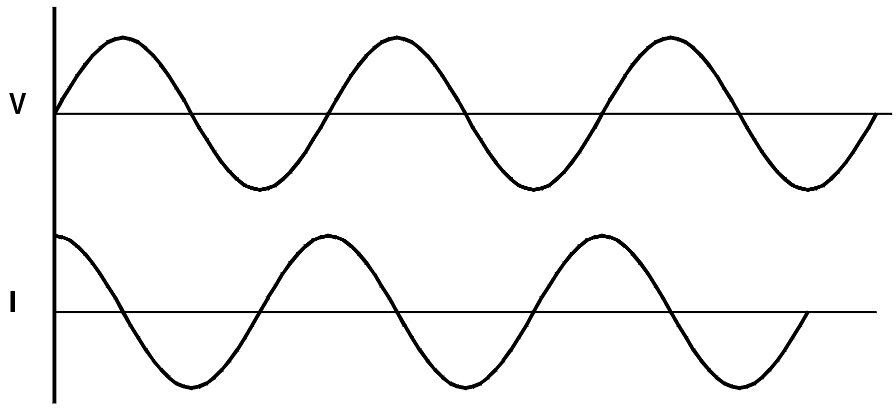
is applied across a capacitor, the current is 90^0 or $\frac{\pi}{2}$ radians out of phase with the driving voltage and is given by:—

$$I = C V_0 2\pi f \sin(2\pi f t + \frac{\pi}{2})$$

Differentiate $Q = CV$ to obtain the current:—

$$I = \frac{dQ}{dt} = C\frac{dV}{dt}$$

The current through a capacitance is proportional to the capacitance and to the rate of change of the voltage across the capacitor.



Apply a sinusoidal voltage waveform across a capacitor.

$$V = V_0 \sin(2\pi f t)$$

We then get
$$\begin{aligned} I &= C\frac{dV}{dt} \\ &= CV_0 2\pi f \cos(2\pi f t) \\ &= CV_0 2\pi f \sin(2\pi f t + \frac{\pi}{2}) \end{aligned}$$

For a sinusoid, the voltage and the current are 90^0 or $\frac{\pi}{2}$ out of phase
Phase of I is positive with respect to V
Current leads the voltage waveform.

If a $15V_{pp}$, 20kHz sinusoidal voltage is applied across a $0.1\mu F$ capacitor, calculate the current in the capacitor.

$$
\begin{aligned}
I &= CV_0 2\pi f \sin(2\pi f t + \frac{\pi}{2}) \\
&= 0.1 \times 10^{-6} \times 15 \times 2 \times \pi \times 20 \times 10^3 \\
&\quad \times \sin(2 \times \pi \times 20 \times 10^3 \times t + \frac{\pi}{2}) \\
&= 0.188 \sin(1.256 \times 10^5 \times t + 1.57)\text{Amps}_{pp}
\end{aligned}
$$