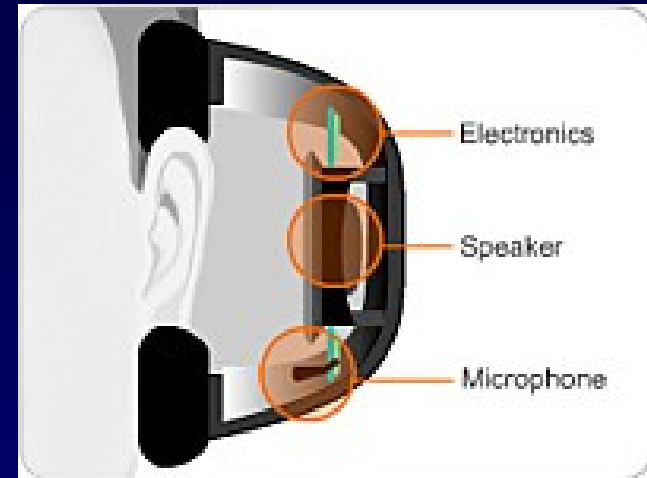


# Solution

Noise-canceling headphones work using interference. A microphone on the earpiece monitors the instantaneous amplitude of the external sound wave, and a speaker on the inside of the earpiece produces a sound wave to cancel it.



1. What must be the phase of the signal from the speaker relative to the external noise?

- a. 0      b.  $90^\circ$       **c.  $\pi$**       **d.  $-180^\circ$**       e.  $2\pi$

Destructive interference occurs when the waves are  $\pm 180^\circ$  out of phase.

$180^\circ = \pi$  radians!

2. What must be the intensity  $I_s$  of the signal from the speaker relative to the external noise  $I_n$ ?

- a.  $I_s = I_n$       b.  $I_s < I_n$       c.  $I_s > I_n$