# CHAPTER 10 FREESTANDING PRACTICE QUESTIONS

**1.** When all the finger holes on a clarinet are closed, it can be approximated as a hollow tube with one closed end (mouthpiece) and one open end. When all the finger holes on a clarinet are closed, the lowest pitch that can be produced corresponds to the G below middle C (186 Hz). How long is the clarinet? (assume the speed of sound in air is 340 m/s).

A) 90 cm
B) 70 cm
C) 50 cm
D) 30 cm

**2.** A 75 cm glass pipe that is open at both ends is placed next to a student a cappella group. It was observed that the pipe first resonates when the choir produces a note at 450 Hz. At which subsequent frequencies will resonance again be observed? (The speed of sound through the pipe is 340 m/s.)

A) 675 Hz and 900 Hz
B) 675 Hz and 1350 Hz
C) 900 Hz and 1350 Hz
D) 900 Hz and 1800 Hz

**3.** The engine of a small and unmanned airplane produces a known and specific sound frequency (not given). A stationary sound detection device observes that the known emitted sound frequency is 90% of the perceived sound frequency. Relative to the detection device, in which direction and at what velocity is the plane moving?

A) Towards the detector, at 34 m/s
B) Away from the detector, at 34 m/s
C) Towards the detector, at 64 m/s
D) Away from the detector, at 64 m/s

**4.** An airplane is traveling 157 m/s north on a runway and is producing a sound of frequency $f$. A woman is seated in a car moving 43 m/s to the south, away from the airplane. What frequency will she observe? (assume the speed of sound in air is 343 m/s)

A) $1/2\,f$
B) $3/5\,f$
C) $f$
D) $2f$

**5.** If a man is exposed to a sound of 140 dB, how far would he have to travel in order to no longer be in pain (the threshold of pain is about 120 dB), given $I = P/A$ and $\beta = 10\log(I / I_0)$, where $I_0 = 10^{-12}\,\text{W/m}^2$.

A) 10 m
B) 20 m
C) 100 m
D) 1000 m

**6.** A stationary cat is purring. Which of the following correctly explains why its owner hears a frequency that is higher than that which is produced by the cat?

A) The owner is moving towards the cat.
B) The owner is moving away from the cat.
C) Both are on an accelerating train.
D) Both are on a decelerating boat.

**7.** A herpetologist studying alligators at the Kennedy Space Center is 1000 m from the launch pad, when a siren sounds, signaling 30 minutes to launch. After running for 4000 m, the herpetologist turns to watch the launch. How does the intensity of sound produced by the siren at his new location compare to the original intensity, $I_1$, given $I = P/A$?

A) $5\,I_1$
B) $1/5\,I_1$
C) $1/25\,I_1$
D) $1/50\,I_1$