Doppler Effect

1. A train is moving at a speed of 90.0 m/s and emits a whistle of frequency 400.0 Hz. Find the frequency observed by an observer who is at rest
   a. in advance of the moving source and
   b. behind the moving source.

2. A stationary police car turns on a siren at a frequency of 300 Hz. Find the observed frequency if
   a. the observer is approaching the police car at 35.0 m/s and
   b. the observer is receding from the police car at 35.0 m/s.

3. A species of bat navigates by emitting short bursts of sound waves that have a frequency range that peaks at 58.0 kHz. If a bat is flying at 4.0 m/s toward a stationary object,
   a. What is the frequency of the sound waves that reach the stationary object?
   b. What is the frequency of the reflected sound waves detected by the bat?

4. A police car traveling at 90.0 m/s, turns on a siren at a frequency of 350 Hz as it tries to overtake a gangster's car moving away from the police car at a speed of 85 m/s. Find the frequency heard by the gangster.

5. Two trains are approaching each other, each at a speed of 100 m/s. They each emit a whistle at a frequency of 225 Hz. Find the frequency that each train engineer hears.

6. A train moving east at a velocity of 20 m/s emits a whistle at a frequency of 348 Hz. Another train, farther up the track and moving east at a velocity of 30 mis, hears the whistle from the first train. What is the frequency of the sound heard by the second train engineer?

7. You hear the siren of a fire engine as you stand on the side of the road. As it approaches, the siren which broadcasts at a frequency of 645 Hz is heard by you as being 660 Hz. How fast is the fire engine traveling?

8. A friend talks to you as she walks past you at a speed of 2.25 m/s. Why do you not notice a Doppler shift in her voice as she passes? Use a 300 Hz sound to solve for the results.