SOUND WAVES IN A GAS

-- propagating longitudinal pressure and density disturbances

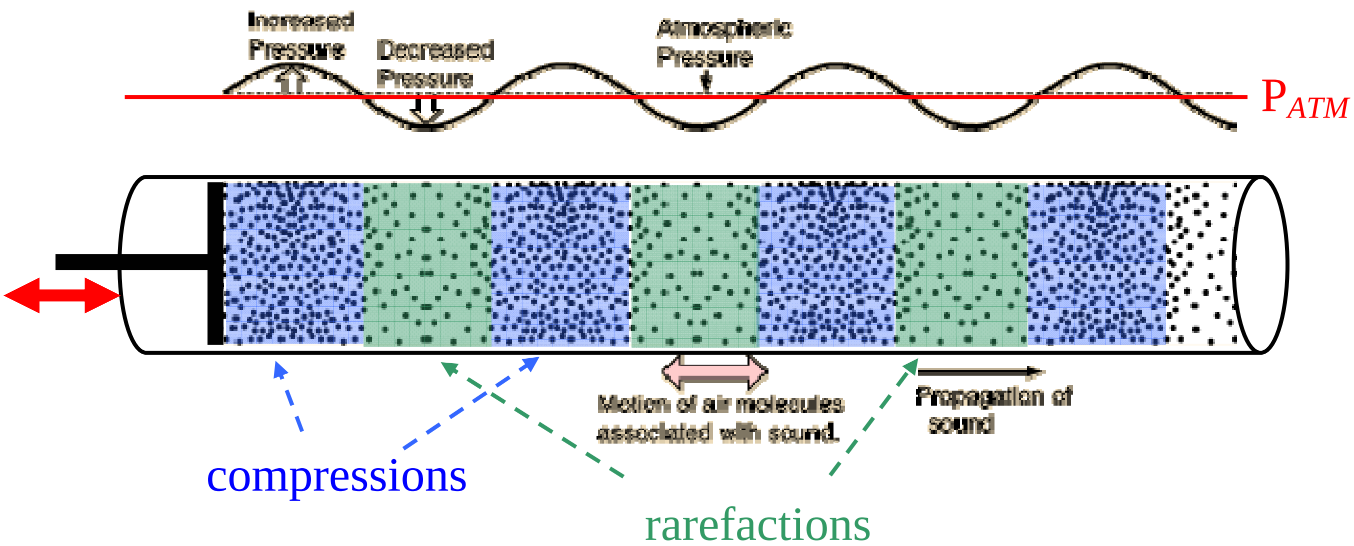
-- excited by a sudden local increase in pressure

-- In a gas $P = (N/V)\, kT$, where N/V is the number density in per meter cubed

- $\rightarrow$ a local increase in P leads to a local increase in density
- $\rightarrow$ as the gas re-expands it compresses the gas in the adjacent layer, and so on
- $\rightarrow$ a sound wave is formed which propagates at a speed, under normal conditions of T and P (stp)
  $v_S = 343$ m/s $\approx$ 1100 ft/s $\approx$ (1/5) mile per second.

[N. B. *This accounts for the rule of thumb for estimating how far away a lightning bolt occurred. When you see a lightning flash, you count the seconds until you hear the thunder. For each 5 seconds, the lightning occurred 1 mile away from your location. This works because the light travels at 300,000,000 m/s which is roughly a million times faster than the sound speed.]*

A harmonic sound wave



A harmonic sound wave consists of a series of high density (compressions) and low density (rarefactions) regions that propagate down the tube.

-- in the compressions, the pressure is slightly higher than the ambient atmospheric pressure

-- in the rarefactions, the pressure is slightly lower than the ambient atmospheric pressure

-- as the sound disturbance passes by, the air molecules jiggle back and forth along the direction of propagation

-- when the pressure disturbances enter your ear, they cause your eardrum (*a very sensitive, flexible membrane*) to vibrate. The inner ear organs convert the pressure vibrations into electrical signals which are carried by the auditory nerve to your brain which interprets them as SOUND!