Since $v = \sqrt{T/\mu}$, the string tension T on the Hi-E string of the guitar is:

$T = \mu v^2 = (3.242\times10^{-4}\ kg/m)*(421.6\ m/s)^2 = 57.6\ kg\text{-}m/s^2 = 57.6\ N \approx 12.95\ lbs$ of force.

1 N = 0.2248 *lbs* of force, 1 *lb* of force = 4.448 N

The typical string tension on a steel-stringed acoustic and/or electric guitar is $T \sim 50 - 60\ N$.

⇒ For steel 6 (12)-string guitar, ***total*** string tension is ~ 300 – 360 (600 – 720) N !!!

PROPAGATION OF SOUND WAVES IN 2 & 3 DIMENSIONS
SOUNDWAVES EMANATING FROM A POINT SOURCE

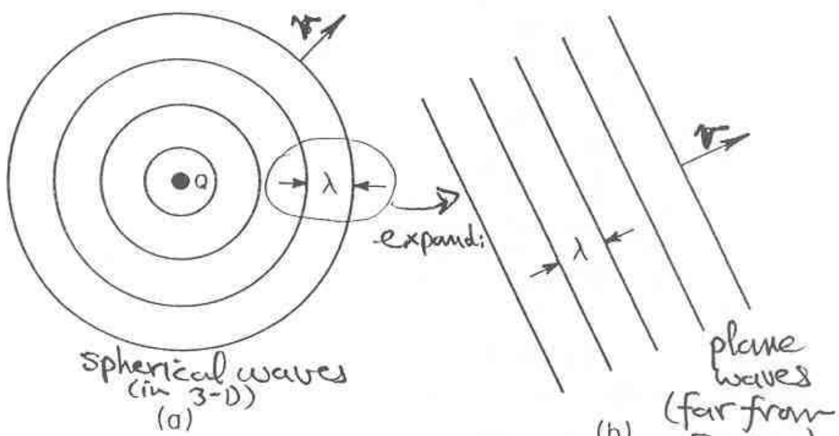

FIG. 13. Wave fronts. (a) Waves spreading out from a small source. (b) Plane waves.

PROPAGATION OF SOUND WAVES IN A 3-D GAS (*e.g.* AIR)

A sound wave freely propagating in a gas = ***longitudinal*** compression/rarefaction of the gas.

Gives rise to a ***longitudinal*** displacement wave. If ***harmonic/sinusoidal*** in nature, far away from the sound source we have traveling plane waves, *e.g.* propagating in the + z-direction:

$\boxed{\xi_z(z,t) = \xi_o \cos(\omega t - kz)}$ = mean (or avg.) ***longitudinal*** (*i.e.* z-) displacement of air molecules

and a corresponding ***over-pressure*** wave of the form: $p(z,t) = P(z,t) - P_{atm}$, where $P(z,t)$ is the instantaneous absolute pressure, and P_{atm} = atmospheric pressure = **constant**, typically ~ 14.7 *psi* ≈ 1.03×10^5 *Pascals* (*Pa*) at NTP (*i.e.* sea level and temperature $T = 20\ ^oC$).

For a harmonic traveling plane wave, the instantaneous over-pressure is: $\boxed{p(z,t) = p_o \sin(\omega t - kz)}$

Sound waves can propagate through elastic, compressible media as ***longitudinal*** waves.