**Chapter 12**

 **Sound** compression:

![j0333130[1]]()![hm00483_[1]]()![an03325_[1]]() rarefaction:

 20 Hz 20,000 Hz

![j0352697[1]]()Fundamental frequency determines pitch.

![j0364230[1]]() high f = low f =

 Number and intensity of an instrument’s

 harmonics give it its unique sound

 quality, or \_\_\_\_\_\_\_\_

* ***The Doppler Effect*** Relative motion between wave source and observer causes

 a change in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ frequency.



Other examples of Doppler effect:

![j0398547[1]]()

![pe05685_[1]]() Sun

 R O Y G B V

![bd07389_[1]]() most stars

* ***Traveling Very Fast***

supersonic: “faster than sound” (vs. subsonic)

 shock wave:

 sonic boom:

* ***Sound Intensity***

![j0307389[1]]()

EX. If a piano’s power output is 0.302 W,

 find the sound intensity at a distance of…

 A. …1.0 m

 B. …2.0 m

Intensity is related to volume (or relative intensity):

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-- measured in decibels (dB)

 A difference of 10 dB changes

 the sound intensity by a factor 50 dB 🡪 40 dB 60 dB 🡪 90 dB

 of 10 and the volume by a factor of 2.

* ***Beats*** 🡪 alternating loud-and-soft sounds resulting from interference between two slightly-different frequencies

 Equation:

 **Forced Vibrations and Resonance**

natural frequency:

forced vibration:

resonance:

 -- result of resonance =

 Examples: