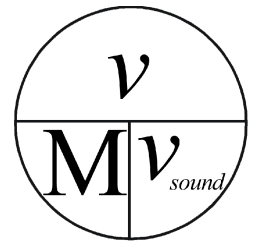


Speed of Sound

The speed of sound is affected by the medium. Particles are closest in solids and furthest apart in gases. Since sound is transmitted by collisions between molecules of the medium, sound usually travels fastest in solids and slowest in gases. The higher the temperature is, the faster the molecules move. The faster the molecules move the higher the rate of collisions is. As a result, the speed of sound increases as temperature increases. A whip or a bullet go faster than sound. Prior to the 1950s, however, aircraft could not exceed the speed of sound (343 m/s or 1,235 km/h), due to drag and instability. As a result, the speed of sound actually was a barrier! Changes in airplane design eventually broke through the barrier. On October 14, 1947, Chuck Yeager officially broke the sound barrier in level flight. A jet makes a sonic boom much like the loud crack a whip when it breaks the sound barrier. A sonic boom is a shock wave that forms from bunched up sound waves. Ernst Mach, an Austrian physicist, described and photographed shock waves. The Mach Number is named after him. The Mach Number describes the speed of an object in a medium relative to the speed of sound. Mach 1 is the speed of sound. Mach 2 is twice the speed of sound. The Mach number depends on the medium.

$$M = \frac{v}{v_{\text{sound}}}$$

- M = mach number
- v = speed relative to the medium
- v_{sound} = speed of sound in the medium



Answer the questions below based on your reading above, and on your knowledge of physics.

1. The speed of sound in various media is shown in the table to the right.

Why is it faster in some of the media than others. _____

2. Calculate the mach number for a sound wave traveling 2,225 m/s in

a. air: _____

b. water: _____

c. steel: _____

Speed of Sound Through Different Materials	
Material	Speed (m/s)
Air	343
Water	1,483
Steel	5,940
Glass	5,640

3. Why was the speed of sound in air considered a “sound barrier” prior to the 1950s? _____

4. As temperature increases, what happens to the speed of sound? _____