



Reading Science

Name: _____ Date: _____

Supersonic Ships

1. Sound waves move differently through different media. Sound waves normally travel faster in liquids and solids than in air. The speed of sound in dry air is 343 m/s at 20°C. It is faster at sea level than at higher altitudes. This is because the air is denser at sea level. Humidity can increase the speed of sound waves by about 0.1–0.6%. Airplane speeds are often reported in Mach numbers. The Mach number depends on the medium that the object travels through. To calculate the Mach number, divide the speed of an object by the speed of sound in that medium.
2. Sound travels at a much higher speed through water. The speed of sound is 1,533 m/s through seawater. It is only 1,493 m/s through freshwater. Sound travels faster in warmer, more salty water. Sound also travels faster when water pressure increases. That means sound travels faster deep in the ocean. The speed of sound in steel is about 5,100 m/s. That means you can hear a train coming from farther away by putting your ear on the railroad track.
3. Have you ever been by an Air Force base? If so, you might have heard a boom as a fast fighter jet passed overhead. The boom means that the jet has broken the sound barrier. A flying airplane pushes the air ahead of it. As it approaches the speed of sound, the air does not have time to get out of the way. A sonic boom is created as the airplane breaks through the sound barrier. The sonic boom wave starts at the nose and moves along the plane. You can see this in the picture above. The sonic boom travels at the speed of sound away from the aircraft. It will reach your ears after the aircraft has passed overhead.
4. Charles “Chuck” Yeager was a pilot who flew the *Bell X-1*. On October 14, 1947, he was the first person to break the sound barrier in level flight. Since then, both military and commercial planes have broken the sound barrier. Unmanned planes have traveled faster than manned planes. The fastest manned plane is the SR-71 Blackbird. It has traveled at 936 m/s. That is about three times the speed of sound, Mach 3. The SR-71 Blackbird set records both speed and altitude.





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5. It was retired in 1999. The only supersonic commercial airplane ever flown was the Concorde. It crossed the Atlantic between New York and Paris at twice the speed of sound. The Concorde traveled at a speed of Mach 2. Only 20 Concorde were ever built. It was retired in 2003.
6. In contrast, the fastest ship was the Spirit of Alaska. It traveled at 142 m/s in 1978. If the Spirit of Alaska traveled in freshwater, its speed would be about 0.1 Mach. Merchant ships carry cargo. They are more concerned about fuel costs than transit time between ports. They travel about 11 m/s. Cruise ships carry passengers. They try to arrive in port in the morning so passengers have time to explore the city. They may travel at slightly higher speeds. The top published speed of Navy vessels is about 26 m/s. Navy ships may have to worry about torpedoes. Torpedoes are smaller and more streamlined. They still travel below the speed of sound. Maximum torpedo speed is about 103 m/s. Ships and submarines use sonar technology to detect torpedoes with sound waves. If they can detect the torpedo before it arrives, they can take action to avoid being struck.
7. Several factors make it difficult to build supersonic ships. The first factor involves the motion of an object through water. Water is much more dense than air. So water has much more drag than air due to friction and turbulence. At the same time, sound travels through water much faster than it travels through air. Combined, these facts make it difficult to build a supersonic ship.



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- 1 As the temperature of seawater increases from 15°C to 20°C, sound velocity through the seawater _____.
- A remains the same
 - B increases
 - C decreases
 - D depends on the distance of the observer from the sound source
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- 2 The first supersonic flight was in 1947. It was just above the speed of sound. Which altitude would you expect Captain Yeager to have used for his flight?
- A Sea level
 - B 1,000 m
 - C 13,700 m (within altitude used by commercial planes today)
 - D 85,000 m (where meteor showers originate)
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- 3 Which plane's velocity was greatest?
- A Yeager's *Bell X-1*
 - B *Concorde*
 - C *SR 71 Blackbird*
 - D None. They all traveled at the same speed.
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- 4 A torpedo is launched underwater, targeting a naval vessel about 5,000 m away. How can the vessel detect the torpedo before it reaches the vessel?
- A By seeing it flying above the water
 - B By listening for it in the air
 - C By listening for it underwater
 - D None of the above. It won't be able to detect it in time.



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- 5** A Navy vessel is traveling due north during wartime. A torpedo has been launched by an enemy directly toward the stern (rear) of the vessel. Can the vessel outrun the torpedo if both continue in a straight line due north?
- A** Yes, the Navy vessel is faster.
 - B** No, the Navy vessel is slower.
 - C** Maybe, since both travel at the same speed.
 - D** Maybe, based on the temperature of the water.
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- 6** Why is it harder to build a supersonic ship than a supersonic airplane?
- A** Sound velocity is greater in water, and it is harder to move through.
 - B** Sound velocity is greater in water, and it is easier to move through.
 - C** Sound velocity is greater in air, and it is harder to move through.
 - D** Sound velocity is smaller in air, and it is harder to move through.