

Something more applied...

Felix Baumgartner breaks the speed of sound in freefall Oct. 14, 2012



Breaking the speed of sound refers to surpassing the speed at which sound waves are produced in the air. The speed of sound is affected by temperature so where the air is colder, sound travels more slowly. At about 100,000 feet (30480m) above sea level, Felix Baumgartner would have to go 690 miles per hour to match the speed of sound, known as Mach 1. Then if he continues to accelerate and surpasses the speed of sound, he'll be "supersonic." On Oct. 14 Felix reached an estimated speed of 833.9 mph, surpassing the speed of sound.

Felix jumped from 128100ft = 39044.88m

So given that Felix started his jump from rest, and accelerated to 833.9m/h calculate the distance it took him to achieve this velocity in and the time it took him to reach this speed.

N.B. (1m/h = 0.44704m/s):



$$\begin{aligned}
 u &= 0 & a &= 9.81 \text{ m/s}^2 \\
 v &= 833.9 \text{ m/h} \times 0.44704 \\
 &= 372.787 \text{ m/s} \\
 s &= ? \\
 v^2 &= u^2 + 2as \\
 \therefore s &= \frac{v^2 - u^2}{2a} = \frac{372.787^2 - 0^2}{2 \times 9.81} \\
 s &= 7083.07 \text{ m}
 \end{aligned}$$



$$\begin{aligned}
 t &= ? \\
 v &= u + at \\
 t &= \frac{v - u}{a} = \frac{372.787 - 0}{9.81} = 38 \text{ seconds}
 \end{aligned}$$