

CW 1.3 - Equations of Motion Problems

1. In 1865, Jules Verne proposed sending men to the Moon by firing a space capsule from a 220-metre-long cannon with final speed of 10.97 km/s. What would have been the unrealistically large acceleration experienced by the space travelers during their launch? Compare your answer to g .
2. A speedboat increases its speed uniformly from 20 m/s to 30 m/s in a distance of 200 m. Find (a) the magnitude of its acceleration and (b) the time it takes the boat to travel the 200-m distance.
3. A truck on a straight road starts from rest and accelerates at 2.0 ms^{-2} until it reaches a speed of 20 m/s. Then the brakes are applied, stopping the truck in a uniform manner in an additional 5.0 s. (a) How long is the truck in motion? (b) What is the average velocity of the truck during the motion described?
4. A jet plane lands with a speed of 100 m/s and can accelerate at a maximum rate of -5.0 ms^{-2} as it comes to rest. (a) From the instant the plane touches the ground, what is the minimum time needed before it can come to rest? (b) Can this plane land on a small tropical island airport where the runway is 0.800 km long?

CHALLENGING QUESTIONS:

5. Two students are on a balcony 19.6 m above the street. One student throws a ball vertically downward at 14.7 m/s; at the same instant, the other student throws a ball vertically upwards with the same speed. The second ball just misses the balcony on the way back down. (a) What is the difference in the two balls' time in the air? (b) What is the velocity of each ball as it strikes the ground? (c) How far apart are the balls 0.800 s after they are thrown?
6. A ball is thrown upward from the ground with an initial velocity of 25 m/s; at the same instant, another ball is dropped from a building 15 m high. After how long will the balls be at the same height?