

Class Problems

1D Kinematics

"You do not know anything until you have practiced."

Richard P. Feynman

1. A light plane must reach a speed of 32 m/s for takeoff. How long a runway is needed if the (constant) acceleration is 3.0 m/s^2 .
2. A car driver going at 30 m/s suddenly sees a deer at 70 m in front of his car. Considering he hits the brakes 0.5 s after he sees the deer, and that the maximum deceleration of his car is 8 m/s^2 , can the driver stop before hitting the deer or must he turn the wheel to avoid the animal?

Frathouse

The faculty resident of a dormitory sees an illegal water-filled balloon fall vertically past his window. Having lightning reflexes, he observes that the balloon took 0.15 s to pass from top to bottom of his window—a distance of 2 m. Assuming the balloon was released from rest, how high above the bottom of his window was the guilty party?

Lost in space

An astronaut shipwrecked on a distant planet with unknown characteristics is on top of a cliff, which he wishes to descend. He does not know the acceleration due to gravity on the planet, and he only has a good watch with which to make measurements. He wants to learn the height of the cliff, and to do this, he makes two measurements. First, he lets a rock fall from rest off the cliff edge; he finds that the rock takes 4.15 s to reach the distant ground. Second, he releases the rock from the same spot but tosses it upward so that it rises a height of what he estimates to be 2 m before it falls to the ground below. This time the rock takes 6.30 s to reach the ground.

What is the height of the cliff?

Answers:

1. 171 m
2. The driver would need 56.25 m to stop, so he must turn the wheel in order to avoid the deer.
3. The culprit was 10.1 m above the bottom of the faculty resident's window.
4. Height of the cliff = 10.8 m