Mighty Physics Problem Set

KINEMATICS: ONE DIMENSION

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1. The peregrine falcon is the world's fastest known bird when diving toward its prey at a vertical velocity of 97.2 m/s. If it dives down from a height of 100.m, how much time does this give a rabbit to consider his next move as the falcon begins his descent?
Ans: 1.03 sec

2. The Kentucky Derby, the first of three horse races for the triple crown, was won on May 7, 2000 by Fusaichi Pegasus with the time of 121.1s. If the race covers 2011.25m, what was Fusaichi Pegasus' average speed in a) m/s? b) mi/h?
Ans: a) 16.6 m/s b) 36.83 mi/hr

3. A tortoise crawls 1000.m at a speed of 0.2000m/s while a rabbit runs the first 200.0m at 2.000m/s. The rabbit then stops to take a nap for 1.300h and awakens to finish the last 800.0m with an average speed of 3.000m/s. a) Who wins the race and by how much time? b) Draw a graph of distance vs. time for the situation.
Ans: tortoise wins by 47 seconds

4. A caterpillar crawling up a leaf slows from 0.75cm/s to 0.50cm/s at a rate of -0.05cm/s^2. How long does it take the caterpillar to make the change?
Ans: 5 seconds

5. In the Wizard of Oz, Dorothy awakens in Munchkinland where the house has been blown by a tornado. If the house fell from a height of 3000.m, with what speed did it hit the Wicked Witch of the East when it landed?
Ans: 245 m/s

6. If the a nut fell for 1.4s, how fast was it traveling when it hit the ground?
Ans: 14 m/s

7. Try dropping a dollar bill through a friend's fingers and offer to let her keep it if she can catch it. The bill should be started just at the finger level and your friend shouldn't have any warning when it is going to drop. A dollar bill has a length of 15.5cm and human reaction time is rarely less than 0.20s. Why is this almost a sure bet?
Ans: 0.20 m. US currencty notes aren't long enough.

8. While repairing a radio transmitter 442 m in the air, Lyle drops his hammer that falls to the ground. a) How long will it take to fall? b) What speed will the hammer hit the pavement? c) How far will the hammer have fallen after 1.50s?
Ans: a) 9.4 sec b) 94 m/s c) 11.3 m

9. Sergey Bubka of the Ukraine has the pole-vaulting record at 6.14m. How long did it take Bubka to return to the ground from the highest part of his vault?
Ans: 1.11 sec

10. You are the first Mars explorer and when you dropped a hammer it took 0.68s to fall 0.90m to the ground. What would you calculate for the gravitational acceleration on Mars?
Ans: 3.9 m/s^2

11. A ball is thrown up in the air at 5.3 m/s, how long is it in the air for?
1.1 seconds

12. A basketball player is in the air for a dunk for 0.92 seconds. How high is their vertical jump?
1.03 m

13. A rocket is launched vertically. When it comes back down, hit hits the ground at 35 m/s. (a) How high did it go? (b) How long was it in the air?
(a) 62.5 m (b) 7.14 sec