

# Study Guide I.

## Additional Exercises

---

- A-1: During an Apollo moon landing, reflecting panels were placed on the moon. This allowed earth-based astronomers to shoot laser beams at the moon's surface to determine its distance. The reflected laser beam was observed 2.52 s after the laser pulse was sent. If the speed of light is  $3.00 \times 10^8$  m/s, what was the distance between the astronomers and the moon?
- A-2: The peregrine falcon is the world's fastest known bird and has been clocked diving downward toward its prey at constant vertical velocity of 97.2 m/s. If the falcon dives straight down from a height of 100. m, how much time does this give a rabbit below to consider his next move as the falcon begins his descent?
- A-3: The Belmont Stakes, the third horse race for the Triple Crown, was won on June 10, 1989 by Easy Goer with a time of 2 min 26.0 s. Only Secretariat in 1973 was able to run the Belmont Stakes in a faster time. If the race covers 2414 m, what was Easy Goer's average speed in m/s?
- A-4: For many years, the posted highway speed limit was 88.5 km/h (55 mi/h) but in recent years some rural stretches of highway have increased their speed limit to 104.6 km/h (65 mi/h). In Maine, the distance from Portland to Bangor is 215 km. How much time can be saved in traveling from Portland to Bangor at this new speed limit?
- A-5: A tortoise and a hare are in a road race to defend the honor of their breed. The tortoise crawls the entire 1000.-m distance at a speed of 0.2000 m/s while the rabbit runs the first 200.0 m at 2.000 m/s. The rabbit then stops to take a nap for 1.300 h and awakens to finish the last 800.0 m with an average speed of 3.000 m/s. a) Who wins the race and by how much time? b) Draw a graph of distance vs. time for the situation.
- A-6: Two physics professors challenge each other to a 100.-m race across the football field. The loser will grade the winner's physics labs for one month. Dr. Nelson runs the race in 10.40 s. Dr. Bray runs the first 25.0 m with an average speed of 10.0 m/s, the next 50.0 m with an average speed of 9.50 m/s, and the last 25.0 m with an average speed of 11.1 m/s. Who gets stuck grading physics labs for the next month?

Flip  
side →

- A-7: A caterpillar crawling up a leaf slows from  $0.75 \text{ cm/s}$  to  $0.50 \text{ cm/s}$  at a rate of  $-0.05 \text{ cm/s}^2$ . How long does it take the caterpillar to make the change?
- A-8: In the Wizard of Oz, Dorothy awakens in Munchkinland where her house has been blown by a tornado. If the house fell from a height of  $3000. \text{ m}$ , with what speed did it hit the Wicked Witch of the East when it landed?
- A-9: The Tambora volcano on the island of Sumbawa, Indonesia has been known to throw ash into the air with a speed of  $625 \text{ m/s}$  during an eruption. a) How high could this volcanic plume have risen? b) On Venus, where the acceleration due to gravity is slightly less than on Earth, would this volcanic plume rise higher or not as much as it does on Earth?
- A-10: Chief Boolie, the jungle dweller, is out hunting for dinner when a coconut falls from a tree and lands on his toe. If the nut fell for  $1.4 \text{ s}$ , how fast was it traveling when it hit Chief Boolie's toe?
- A-11: Here is a bet that you are almost sure to win! 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 advanced warning when it is going to drop. A dollar bill has a length of  $15.5 \text{ cm}$  and human reaction time is rarely less than  $0.20 \text{ s}$ . Do the necessary calculations—why is this almost a sure bet?

