W1.11

Physics 1 Algebra-Based Linear Motion Problems

1. A car slows from 30 m/s to 10 m/s in 5 seconds. How far does it go during that time?

2. A VW beetle can accelerate from 0 to 40 m/s in 8.2 seconds. How far does it go while doing so?

3. A student slides a salt shaker across a dining room table. The salt shaker decelerates at 4 m/s^2. How fast should he slide the shaker so that it goes exactly across the 6 meter wide table?

4. A ball thrown upward at 12m/s from the roof of a building misses the edge and strikes the ground below at 26.3 m/s. How high is the building?

5. A bus goes a distance of 250m while braking from 30m/s to 20m/s at constant acceleration. What was its constant braking acceleration?

6. A champagne bottle is held so that the cork is 1.2 meters above the floor. The cork pops off, rises vertically, and hits the floor 1.4 seconds later. What was the cork's maximum height above the floor?

7. A golf cart has an acceleration of 0.4 m/s^2. What is its velocity after going 10 meters from rest?

8. An amusement park ride initially travels at a horizontal velocity of 30 m/s. If is continually decelerates at 2.7 m/s^2, how long does it take to reach the operator standing 120 meters away?

9. A bus has a maximum acceleration of 5 m/s^2, a maximum speed of 20 m/s, and a maximum deceleration of 10 m/s^2. What is the shortest time in which it can cover the 270 meters between stops? (Hint: draw a v-graph of the motion before attempting to solve. Use the graph to give you ideas on how to proceed.)

10. A sprinter accelerates evenly from rest until her speed reaches 12 m/s. She then continues running at 12 m/s until she finishes the 100 m race. The total time for the race is 11 seconds. a) Sketch a v vs t graph for the sprinter. b) How long did it take her to reach her maximum speed?

11. An orangutan throws a coconut vertically upward at the foot of a cliff 60 meters high while his mate simultaneously drops another coconut from the top of a cliff. The two coconuts collide at a height of 42 meters. How fast was the coconut thrown upward from the bottom of the cliff?

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ANSWERS:

1. 100 m
2. 164 m
3. 6.93 m/s
4. 27.4 m
5. $-1\ m/s^2$
6. First you need to find the initial velocity of the cork. This turns out to be +6.14 m/s. Given this you can find the time it takes the cork to reach its peak (0.614 sec). The peak is therefore 1.88 m above the initial starting point or 3.08 m above the floor.
7. 2.83 m/s
8. 5.23 sec
9. Break the trip into three parts. The initial acceleration takes 4 seconds. The final deceleration takes 2 seconds. These two "legs" cover 40 meters and 20 meters respectively. Therefore the middle portion of the trip (210 m) will take 10.5 (@ 20 m/s) and so the total trip is 16.5 seconds.
10. 5.33 sec
11. 31.61 m/s (up)…the time for the top ball to fall 18 m from rest is 1.9 sec. In order for the second ball to move upward 42 m in the same time, it turns out that the initial upward velocity must have been 31.61 m/s. Why? Call the initial speed v_o. The speed at impact is v_f which equals v_o-10t. Thus v_{ave} must be v_o-5t (Do you see why?). Use $\Delta s = v_{ave}\Delta t = (v_o-5t)t$ to solve for v_o.