1D Kinematics Review

Physics

(These problems are from the school's old textbook; p. 29 #38, 39, 44, and 45)

Please note: there are HINTS to all these problems on the next page and answers are on the third page!

38. A kangaroo jumps to a vertical height of 2.8 m. How long was it in the air before returning to earth?

39. A helicopter is ascending vertically with a speed of 8.00 m/s; at a height of 120 m above the earth, a package is dropped from a window. How much time does it take for the package to reach the ground?

44. A falling stone takes 0.30 s to pass a window 2.4 m high. In other words, as the stone is falling, 0.30 seconds pass AS the stone falls past the window. From what height above the top of the window did the stone fall?

45. A stone is thrown vertically upward with a speed of 18.0 m/s.
    a) How fast is it moving when it reaches a height of 16.0 m?
    b) How long is required to reach this height?
    c) Why are there two answers to (b)?

HINTS! (Don't look unless you get stuck…)

38. You can solve this in two ways: first, by recognizing that the kangaroo's velocity at the top of its leap is zero, finding the time to that highest point, then finding the time back to the ground. A more elegant way is to use the first Big 4 equation (with starting and ending positions of zero). When you solve for *t*, there will be two solutions: zero, and the actual answer.

39. The helicopter doesn't matter! What's important is that when the package is "dropped", it is moving upward with the same 8.00 m/s velocity that the helicopter had (this is its initial velocity). The acceleration will be 9.8 m/s^2 downward (so make sure you establish a frame of reference and use the correct sign for both the initial velocity and the acceleration).

44. You'll have to use the Big 4 a couple of times to figure this out. First, find the velocity the stone must have had at the top of the window in order to make it to the bottom of the window in 0.30 s. Once you find that velocity, use the Big 4 again to find out how fall it must have fallen (with a starting velocity of 0 m/s) in order to achieve that velocity. (Remember, acceleration will be 9.8 m/s^2 downward.)

45. a) Remember that the initial velocity and the acceleration are in the opposite direction, so they will have opposite signs. Once you have those values correct, you should get the right answer from the Big 4. (You can do it in one equation if you pick the right one!)
    b) With the information you know (you don't need the velocity from part a) you can find this with one equation. You'll need to use the quadratic formula.
    c) What goes up must come down …

Answers:

38. 1.51 s

39. 5.83 s

44. 2.18 m

45a. 3.22 m/s

45b. 1.51 s and 2.16 s

45c. The stone will reach that height both on the way up (at 1.51 s) and on the way back down (at 2.16 s).