2.6 Freely Falling Bodies

- **Intro:** Physics Approach
- **Free fall**
  - What we mean by “free”
  - $g$ Near Earth Acceleration do to gravitation, $g$.
- **Trajectory**
  - No initial velocity.
  - Initial velocity up
  - Initial velocity down
- **CQ 11** An experimental vehicle slows down and comes to a halt with an acceleration whose magnitude is 9.8 m/s$^2$. After reversing direction in a negligible amount of time, the vehicle speeds up with an acceleration of 9.8 m/s$^2$. Other than being horizontal, how is this motion different, if at all, from the motion of a ball that is thrown straight upward, comes to a halt, and falls back to earth?

(Working some problems)

- **Conceptual: Balloon Race.** Say you’re in a hot air balloon race. You’ve just launched and you’re rising. You realize that you’ve got some unnecessary baggage. You want to toss it overboard to reduce the load, but you don’t want to damage it. If you’re going to toss it, what’s your best bet? (a) drop it, (b) toss it down, (c) toss it up?

- **Work through Pr. 36.** In the one-hundred-meter dash a sprinter accelerates from rest to a top speed with an acceleration whose magnitude is 2.68 m/s$^2$. After achieving top speed, he runs the remainder of the race without speeding up or slowing down. If the total race is run in 12.0 s, how far does he run during the acceleration phase?

- **CQ 11** An experimental vehicle slows down and comes to a halt with an acceleration whose magnitude is 9.8 m/s$^2$. After reversing direction in a negligible amount of time, the vehicle speeds up with an acceleration of 9.8 m/s$^2$. Other than being horizontal, how is this motion different, if at all, from the motion of a ball that is thrown straight upward, comes to a halt, and falls back to earth?

- **Example 1 (pr. 52)** (warning: I like this problem – mathematically simple, no numbers) Drop distance $H$ and achieve final velocity $v$. Drop distance $D$ and achieve final velocity $2v$. What is the relationship between $D$ and $H$?

- **Example 2 / HW (Pr. 78)** A Roofing tile falls from a roof. An observer inside the building notices that it takes 0.20 s to pass her window which is 1.6 m tall. How far above the top of her window is the roof?
CH 2

78. A roof tile falls from rest from the top of a building. An observer inside the building notices that it takes 0.20 s for the tile to pass her window, whose height is 1.6 m. How far above the top of this window is the roof? Note: I set it up and you finish it.

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4. The altitude of a hang glider is increasing at a rate of 6.80 m/s. At the same time, the shadow of the glider moves along the ground at a speed of 15.5 m/s when the sun is directly overhead. Find the magnitude of the glider’s velocity.

8. A skateboarder, starting from rest, rolls down a 12.0-m ramp. When she arrives at the bottom of the ramp her speed is 7.70 m/s. (a) Determine the magnitude of her acceleration, assumed to be constant. (b) If the ramp is inclined at 25.0° with respect to the ground, what is the component of her acceleration that is parallel to the ground?