Announcements 18 Feb 09

- **Homework**
  - Homework #3 due on Friday
- **Exam 1 Tue Feb 24 from 7 to 9 pm**
  - More info today
  - Get "Evening Exam Conflicts" form at Registrar's Office if you have a conflict
    → must schedule your makeup exam this week!

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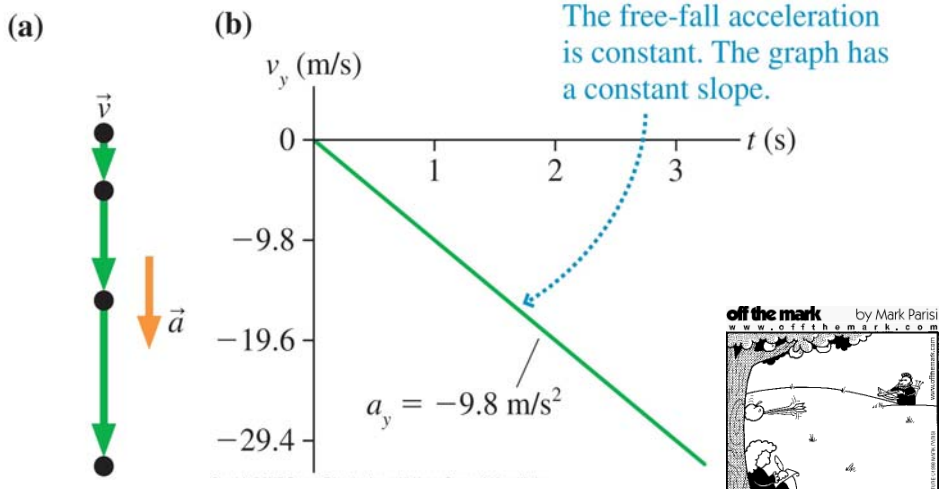
Free Fall

Magnitude of free-fall acceleration is g = 9.8 m/s²



***DEMO**: catch a dollar bill*

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Free Fall: Sample Problem 2.31

A person's reaction time is generally not quick enough to allow the person to catch a dollar bill dropped between the fingers. If a typical reaction time in this case is 0.25 s, how long would a bill need to be for a person to have a good chance of catching it?

Equations also applicable for motion along y axis simply replace x by y

$$(v_x)_f = (v_x)_i + a_x\Delta t$$
$$(v_x)_f^2 = (v_x)_i^2 + 2a_x\Delta x$$
$$x_f = x_i + (v_x)_i\Delta t + \tfrac{1}{2}a_x(\Delta t)^2$$

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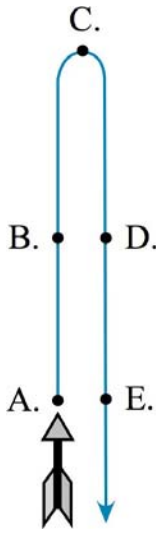
Free Fall Question

PRS

An arrow is launched vertically upward. It moves straight up to a maximum height, then falls to the ground. The trajectory of the arrow is noted. At which point of the trajectory is the arrow's acceleration the greatest? Ignore air resistance; the only force acting is gravity.



***DEMO**: Ball rolling up and down a ramp with motion detector*

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Free Fall: Basketball Player Jump

Spud Webb, height 5'7", was one of the shortest basketball players to play in the NBA. But he had an impressive vertical leap; he was reputedly able to jump 110 cm off the ground. To jump this high, with what speed would he leave the ground?

$$(v_y)_f = (v_y)_i + a_y \Delta t$$
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Free Fall: Football Punt

A football is punted straight up into the air; it hits the ground 5.2 s later.
What was the greatest height reached by the ball?
With what speed did it leave the kicker's foot?

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Which falls faster? Me or a nickel?

DEMO: Compare free fall of a nickel (mass = 5 g) and of a professor (mass = 100 kg)

DEMO: textbook vs. sheet of paper

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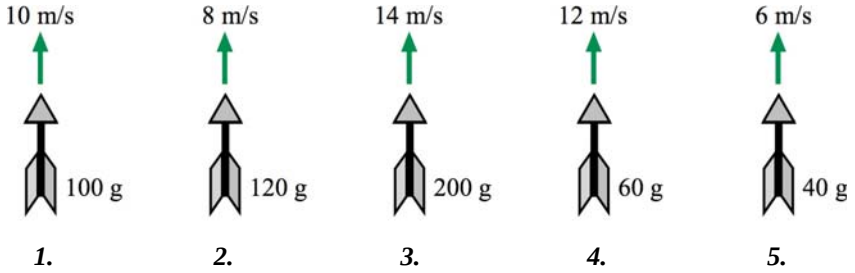
Free Fall Question

PRS

The figure below shows five arrows with differing masses that were launched straight up with the noted speeds. Rank the arrows, from greatest to least, on the basis of the maximum height the arrows reach. Ignore air resistance; the only force acting is gravity.

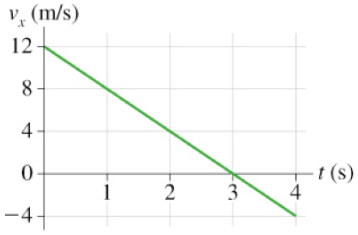


A: 1, 2, 3, 4, 5 **B: 5, 4, 1, 2, 3** **C: 3, 4, 1, 2, 5**

Motion with uniform acceleration: Problem 2.14 (Homework #3)

A car starts from x_i = 16 m at t_i = 0 and moves with the velocity graph to the right

A. What is the object's position at t = 2 s?
B. What is the object's position at t = 3 s?
C. What is the object's position at t = 4 s?
D. Does this car ever change direction?
E. If so, at what time?



Motion with uniform acceleration: Problem 2.34 (Homework #3)

In an action movie, the villain is rescued from the ocean by grabbing onto the ladder hanging from a helicopter. He is so intent on gripping the ladder than he lets go of his briefcase of counterfeit money when he is 130 m above the water. If the brief case hits the water 6.0 s later, what was the speed at which the helicopter was ascending?

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Motion with uniform acceleration: Rocket height (Homework #3)

A rocket, initially at rest on the ground, accelerates straight upward from rest with constant acceleration 34.3 m/s^2. The acceleration period lasts for time 7.00 s until the fuel is exhausted. After that, the rocket is in free fall. Find the maximum height ymax reached by the rocket. Ignore air resistance and assume a constant acceleration due to gravity equal to 9.80 m/s^2.

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