

- A ball is launched upward at 35 m/s. Ignoring air resistance, find the following:
 - the height of the peak
 - the acceleration of the ball at the peak
 - the time(s) when the ball is 30 meters off the ground
 - The **velocity** of the ball when it is 30 meters off the ground on the way down
 - Draw an s vs. t, v vs. t and a vs. t plots for the entire flight of the ball.
 - If the same ball is shot upward from the top of a 300 m cliff with the initial velocity of 35 m/s, what is the ball's velocity the instant before hitting the ground at the base of the cliff?
- A ball is launched on a level surface toward a wall 80 meters away. If the launch angle is 36.87° and the initial speed is 50 m/s how high on the wall does the ball hit? Is it on its way up or down at the time? What is the speed of the ball when it hits the wall?
- A box on a 30° incline is found not to be moving in the absence of all applied forces. What is the smallest coefficient of friction (μ) that will permit this to happen? If a different box is seen to accelerate down the same incline at 2 m/s^2 (again, in the absence of applied forces) what is the value of μ consistent with that observation? What physical difference in the two situations would account for the different values of μ ?
- A box of mass $3m$ on a level, frictionless surface is connected via an ideal pulley to a hanging object of mass m by a rope. In terms of m and g determine the acceleration of the box and the tension in the rope. Explain why the tension is not equal to the weight of the hanging mass.
- A 10 kg object drops to the ground from a height of 45 meters, and hits the ground at a speed of 25 m/s. How much energy is lost to air friction during the fall? What is the average force of air resistance on the way down? Explain how you could prove to someone that the effect of air resistance was significant in this case.
- A car traveling at constant speed of 30 m/s on a level highway experiences a total resistive force of 2000 N. What power must the engine supply in order for the car to maintain that constant velocity?
- The engine of a lifting crane supplies a power of 4000 Watts. How long would it take that crane to lift a 800 kg load 60 meters?
- A horizontal beam of mass 30 kg and length 10 meters is pivoted around a point 4 meters from the left end. Where must a child of mass 20 kg stand to balance the beam? What is the largest mass object that can be placed on the left end of the beam (with no one on it) and keep it in balance?

- a. 61.25 m; b. 10 m/s^2 ; c. 1 or 6 seconds; d. -25 m/s ; f. -85 m/s
- a. 40 m high; b. on the way up ($v_f = +10 \text{ m/s}$ upward); -41.23 m/s
- a. $\mu = 0.58$; b. $\mu = 0.346$
- a. $0.25g$; $T = 0.75mg$

- a. -1375J ; $F_{\text{ave}} = 30.6\text{N}$
- $P = 60,000 \text{ W}$
- $t = 120 \text{ seconds}$
- a. $x = 1.5 \text{ m}$ to the left of the fulcrum
b. mass = 7.5 kg