PHY2048 Spring 2018 Homework # 3

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Abstract

In this homework assignment, you'll be solving problems dealing with Energy Physics (chapters 7 and 8 in Ohanian). This homework set is due **Wednesday, March 21**.

1. The following force

$$\vec{F} = (3x^2 - 2x^3)\hat{i} + (-1.2x + 3.4x^3)\hat{j}$$

   is applied on a 3.2kg box, which slides 1.5m across a horizontal surface. How much work is done by the force? Assume that the numeric coefficients of each term in $\vec{F}$ have the appropriate SI units, and that the box moves in the $+x$ direction along the horizontal surface.
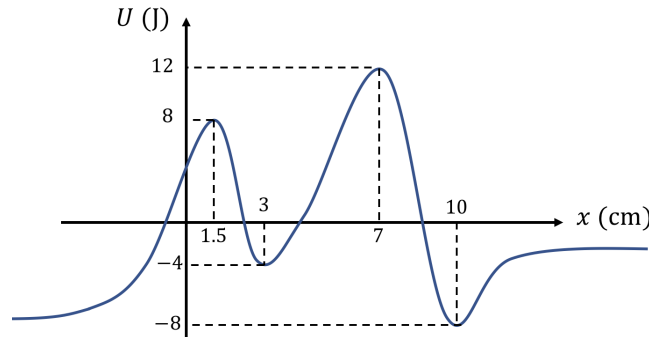
2. Consider a 3.5kg object under the influence of the potential energy graphed in the figure above.

   (a) List all stable and unstable equilibrium points.

   (b) If the object starts from $x = -\infty$ with an energy $E = 9J$, describe the object's motion.

   (c) If the object starts from $x = 3$cm with an energy $E = 5J$, describe the object's motion.

   (d) If the object starts from $x = -\infty$ with an energy $E = 9J$, how fast is the object going at $x = 3$cm?
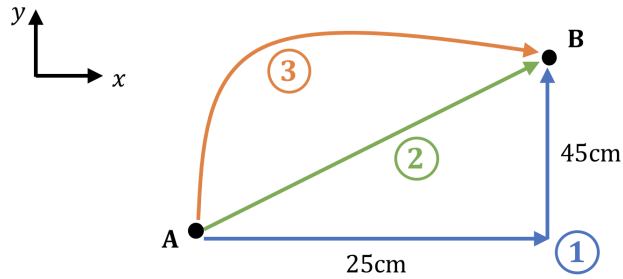
3. Consider moving a 3kg mass along one of three possible paths, as shown in the figure above. What is the work done by gravity along each path?

4. A 350g ball is dropped from a height of 24cm, bouncing off of the floor. If the ball loses 20% of its total energy in the bounce, to what height does the ball bounce back up to?

5. A car drives up a 20m hill, starting at 8 m/s and reaching the top at 10 m/s.

    (a) How much work was done by gravity during this trip?

    (b) Assuming no air resistance, how much work was done by the car's engine?
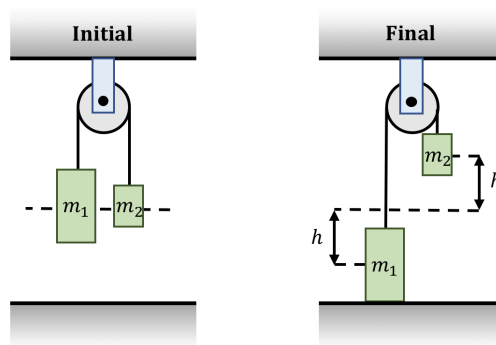
6. In the above figure is an Atwood machine: a machine composed of two blocks, one of mass $m_1 = 250$g and one of mass $m_2 = 100$g, a massless rope and a massless pulley. If the two masses are released from rest as shown in the figure, at what speed does m_1 hit the ground after falling some $h = 12$cm?