AP Physics – Harmonium – 46

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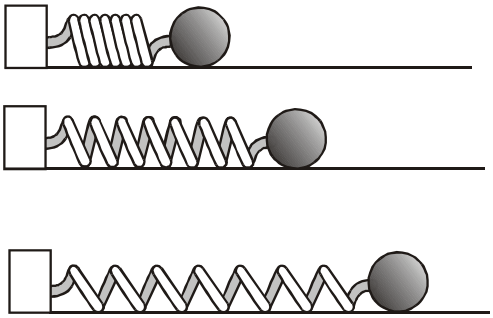
Identiphication_____Per___

The universe is not hostile, nor yet is it friendly. It is simply indifferent. -- John Hughes Holmes

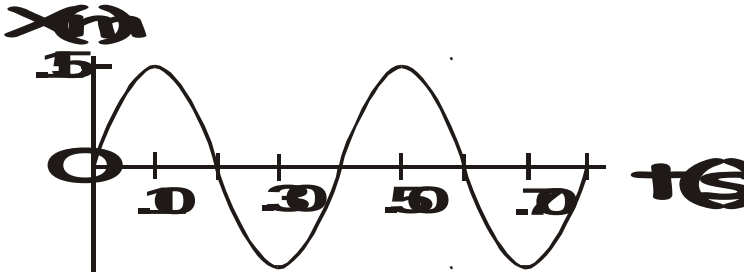
1. Cindy Lou has run up a staircase very quickly indeed. Cindy's mass is 35.2 kg. It took her 6.75 s to get to the top. If she developed 0.875 hp on the vertical trip, how high was the staircase?

2. A 255 g mass is hooked up to a spring (k = 175 N/m) and moves back and forth on your basic frictionless surface. If the mass is released from rest at x = 0.200 m, (a) find the force acting on the mass, (b) the max acceleration, (c) it's acceleration at x = 0 m, (d) its energy when released, and (e) its period.

3. The drawing shows the harmonic motion of a mass on a spring at the extremes of its motion. The middle drawing shows the midpoint of travel. Indicate on the drawing (a) the points of greatest and least velocity (v_{max} and v_{min}), (b) the points of greatest and least acceleration (a_{max} and a_{min}), (c) the points of greatest and least potential energy (U_{max} and U_{min}), and (d) the points of greatest and least kinetic energy (K_{max} and K_{min}).



4. Using this graph of position vs time for the simple harmonic motion of a weight on a string, determine (a) the amplitude of the motion, and (b) the period of the motion. Calculate (c) the frequency of the motion. Label the graph (d) where the velocity is zero, (e) where the acceleration is max and min, (f) where the kinetic energy is max, (g) where the potential energy is max.

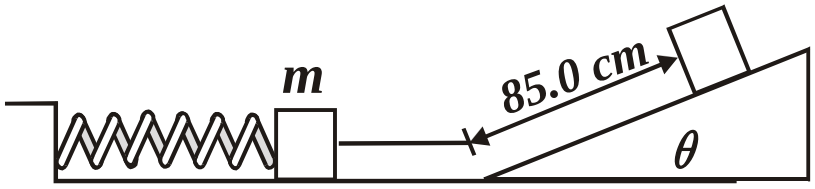


5. A 355 g mass is attached to a spring (k = 435 N/m). If the system is allowed to oscillate on a frictionless surface, what is the period and frequency of the motion?

6. You are designing a pendulum clock. You have determined that the pendulum must have a period of 0.500 s. What should be the length of the pendulum?

7. A 45.0 kg projectile is fired from a gun. The elevation angle of the gun is 30.0°. The projectile is in the air for 48.0 s before it hits the ground at the same height as it was fired. Ignoring friction find: (a) the projectile's initial velocity, (b) the horizontal distance the projectile traveled, (c) the potential energy of the projectile at it highest point in its trajectory.

8. A 545 g block is pushed into a spring (k = 195 N/m) a distance of 18.0 cm. (a) When the block is released, what is its velocity? The block slides across a smooth surface once it leaves the spring and then up a ramp. It travels up the ramp a distance of 85.0 cm. (b) What is the elevation angle of the ramp?



9. A 345 g ball is placed on a ramp as shown in the drawing. The ball rolls downward a distance of 50.0 cm and then goes into a vertical loop and then ends up at the bottom going from point ***C*** to point ***D***. While ignoring friction, determine the following: (a) the speed of the ball at the bottom of the ramp, point ***C***. (b) the speed of the ball at point ***A***. (c) Draw a FBD for the ball at point ***A***. (d) The force exerted on the ball by the track at point ***A***. (e) The speed of the ball at point ***B***. (f) Draw a FBD for the ball at point ***B***. (g) The speed of the ball at point ***D***. (h) Draw a FBD for the ball at point ***D***.