Law of Conservation of Energy Worksheet

Use the Law of Conservation of Energy to solve the following problems.

1. Physics student is dropped (don't ask why or you're next). If they reach the floor at a speed of 3.2 m/s, from what height did they fall?

$E_{ki} + E_{pi} = E_{kf} + E_{pf}$

$\frac{1}{2}mv_i^2 + mgh_i = \frac{1}{2}mv_f^2 + mgh_f$

$E_{pi} = E_{kf}$

$d = 0.52$ m

$v = v_0 + at$ $\quad 0.3265\ s = t$

$3.2 = 0 + 9.8t$ $\quad d = v_0t + \frac{1}{2}at^2$

$\frac{3.2}{9.8} = \frac{9.8t}{9.8}$ $\quad d = (0) + \frac{1}{2}(9.80)(0.3265)^2$

2. A heavy object is dropped from a vertical height of 8.0 m. What is its speed when it hits the ground?

$d = v_0t + \frac{1}{2}at^2$ $\quad v = v_0 + at$

$8.0 = \frac{1}{2}(9.80)t^2$ $\quad v = (9.80)(1.27755313)$

$v = 12.5$ m/s

$\frac{8.0}{4.9} = \frac{4.9t^2}{4.9}$

$\sqrt{1.6} = \sqrt{t^2}$

$1.27755313\ s = t$

3. A bowling ball is dropped from the top of a building. If it hits the ground with a speed of 37.0 m/s, how tall was the building?

$v^2 = v_0^2 + 2ad$

$(37.0)^2 = (0)^2 + 2(9.80)d$

$\frac{-1369}{-19.6} = \frac{-19.6d}{-19.6}$

$69.8\ m = d$

4. A safe is hurled down from the top of a 1.3×10^2 m building at a speed of 11.0 m/s. What is its velocity as it hits the ground?

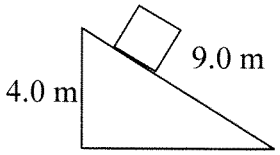
$v^2 = v_0^2 + 2ad$

$v^2 = (11.0)^2 + 2(9.80)(130)$

$v^2 = 2669$

$v = 52$ m/s

5.



A box slides down a frictionless ramp. If it starts at rest, what is its speed at the bottom?

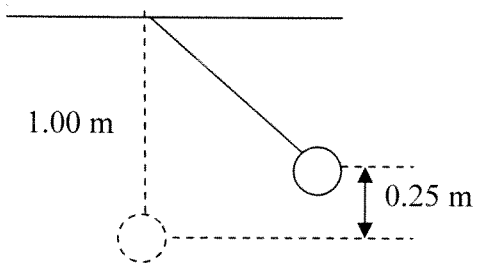
$v^2 = v_0^2 + 2ad$

$v^2 = (0)^2 + 2(9.80\ m/s^2)(4.0\ m)$

$\sqrt{v^2} = \sqrt{78.4}$

$v = 8.9$ m/s

6.



A pendulum is dropped from the position shown, 0.25 m above its equilibrium position. What is the speed of the pendulum bob as it passes through its equilibrium position?

$1.00\ m - 0.25\ m = 0.75\ m$

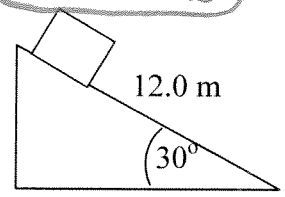
$v^2 = v_0^2 + 2ad$

$v^2 = (0)^2 + 2(9.80)(0.25)$

$\sqrt{v^2} = 4.9$

$v = 2.2$ m/s

7.



A box slides down a frictionless incline as shown. If the box starts from rest, what is its speed at the bottom?

$\sin(30^\circ) = \frac{opp}{12.0\ m}$ $\quad 12.0\ m$

$v = 10.8$ m/s

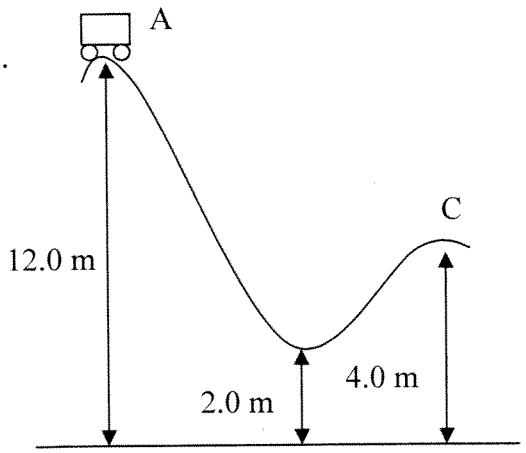
$6\ m = opp$

$v^2 = v_0^2 + 2ad$

$v^2 = (0)^2 + 2(9.80)(6)$

$\sqrt{v^2} = \sqrt{117.6}$

8.



A roller coaster car starts from rest at point A. What is its speed at point C if the track is frictionless?

$E_{pi} = E_{kf}$

$mgh_i = \frac{1}{2}mv^2$

$V = \sqrt{2gh_i}$

$V = \sqrt{2(9.80)(8)}$

$V = 13\ m/s$

9. A 2.5 kg object is dropped from a height of 10.0 m above the ground. Calculate the speed of the object as it hits the ground.

$E_{pi} = E_{kf}$

$E_p = (2.5\ kg)(9.80\ m/s^2)(10.0\ m)$

$= 245\ J$

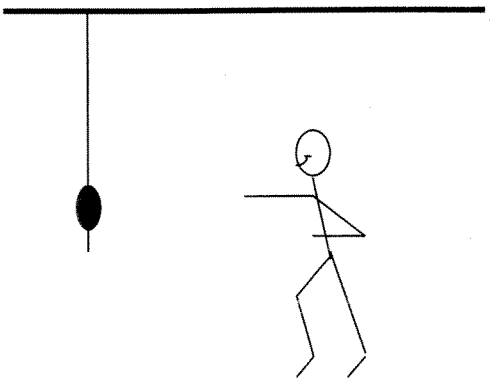
$245\ J = \frac{1}{2}(2.5)(v)^2$

$\frac{245\ J}{1.25} = \frac{1.25v^2}{1.25}$

$\sqrt{196} = v^2$

$14\ m/s = v_f$

10.



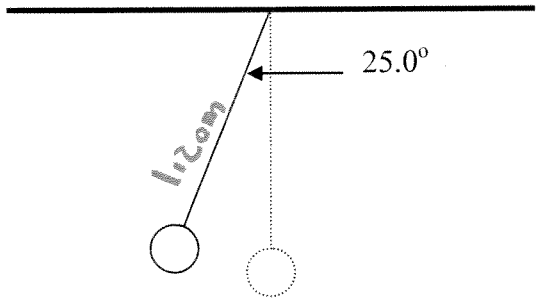
An 80.0 kg student running at 3.5 m/s grabs a rope that is hanging vertically. How high will the student swing?

$E_{kf} = \frac{1}{2}mv^2 = \frac{1}{2}(80.0\ kg)(3.5\ m/s)^2$

$= 490\ J$

$h = \frac{E_p}{mg} = \frac{490\ J}{784} = 0.63\ m$

11.



A pendulum is 1.20 m long. If the pendulum is pulled until it makes a 25.0° angle to the vertical, what is the speed of the pendulum bob when it passes through its equilibrium position? HINT: Determine the vertical drop of the pendulum bob first.

$\cos(25.0) = \frac{ADJ}{1.20\ m}$

$\times 1.20\ m$

$1.08\ m = ADJ$

$1.20\ m - 1.08\ m$

$= 0.12\ m$

$V = \sqrt{2gh_i}$

$V = \sqrt{2(9.80)(0.12)}$

$V = 1.5\ m/s$

1) 0.52 m 2) 13 m/s 3) 69.8 m 4) 52 m/s 5) 8.9 m/s 6) 2.2 m/s 7) 10.8 m/s 8) 13 m/s 9) 14 m/s 10) 0.63 m 11) 1.49 m/s