Workbook Answers

Practice Exercises

Exercise 5: It is said that Galileo dropped objects off the Leaning Tower of Pisa to determine whether heavy or light objects fall faster. If Galileo had dropped a 5.0-kg cannon ball to the ground from a height of 12 m, what would have been the change in PE of the cannon ball?

$m = 5.0\,kg$
$h = 12\,m$
$PE = ?$

$PE = mgh$

$PE = (5.0\,kg)(9.8\,m/s^2)(12\,m)$ 588

590 J

Answer: _____

Exercise 6: The 2000 Belmont Stakes winner, Commendable, ran the horse race at an average speed of 15.98 m/s. If Commendable and jockey Pat Day had a combined mass of 550.0 kg, what was their KE as they crossed the finish line?

$V = 15.98\,m/s$
$m = 550.0\,kg$
$KE = ?$

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

$KE = \frac{1}{2}(550.0\,kg)(15.98\,m/s)^2$

$7.02 \times 10^4\,J$

Answer: _____

Exercise 7: Brittany is changing the tire of her car on a steep hill 20.0 m high. She trips and drops the 10.0-kg spare tire, which rolls down the hill with an initial speed of 2.00 m/s. What is the speed of the tire at the top of the next hill, which is 5.00 m high? (Ignore the effects of rotation KE and friction.)

$h_i = 20.0\,m$
$m = 10.0\,kg$
$v_i = 2.00\,m/s$
$h_f = 5.00\,m$
$v_f = ?$

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

$(10.0\,kg)(9.8\,m/s^2)(20.0\,m) + \frac{1}{2}(10.0\,kg)(2.00\,m/s)^2 =$
$(10.0\,kg)(9.8\,m/s^2)(5.00\,m) +$

$1960\,J + 20.0\,J = 490.\,J + \frac{1}{2}(10.0\,kg)v_f^2$

$(5.0\,kg)v_f^2$

$1980\,J = 490.\,J + (5.0\,kg)v_f^2$

$1490\,J = (5.0\,kg)v_f^2$

$298 = v_f^2$

$v_f = 17.3\,m/s$

Answer: _____

Exercise 8: A Mexican jumping bean jumps with the aid of a small worm that lives inside the bean. a) If a bean of mass 2.0 g jumps 1.0 cm from your hand into the air, how much potential energy has it gained in reaching its highest point. b) What is its speed as the bean lands back in the palm of your hand?

$m = 2.0\,g = .0020\,kg$

$h = 1.0\,cm = .010\,m$

$PE = ?$ $\quad PE = mgh$

$PE = (.0020\,kg)(9.8\,m/s^2)(.010\,m)$

$2.0 \times 10^{-4}\,J$

Answer: **a.** _____

$KE = 2.0 \times 10^{-4}\,J$

$m = .0020\,kg$

$v = ?$

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

$2KE = mv^2$

$v^2 = \frac{2KE}{m}$

$v = \sqrt{\frac{2KE}{m}}$

$v = \sqrt{\frac{2(2.0\times10^{-4}\,J)}{.0020\,kg}}$

$.45\,m/s$

Answer: **b.** _____

Exercise 9: A 500.-kg pig is standing at the top of a muddy hill on a rainy day. The hill is 100.0 m long with a vertical drop of 30.0 m. The pig slips and begins to slide down the hill. What is the pig's speed at the bottom of the hill? Use the law of conservation of energy.

$m = 500.\,kg$

$h_i = 30.0\,m$

$v_i = 0$

$h_f = 0$

$v_f = ?$

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

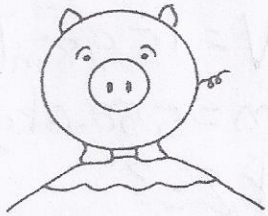
$mgh_i = \frac{1}{2}mv_f^2$

$(500.\,kg)(9.8\,m/s^2)(30.0\,m) = \frac{1}{2}(500.\,kg)v_f^2$

$1.47 \times 10^5\,J = (250.\,kg)v_f^2$

$v_f^2 = 588\,m^2/s^2$

$v_f = 24.2\,m/s$



Answer: _____

Exercise 10: While on the moon, the Apollo astronauts enjoyed the effects of a gravity much smaller than that on Earth. If Neil Armstrong jumped up on the moon with an initial speed of 1.51 m/s to a height of 0.700 m, what amount of gravitational acceleration did he experience?

$v_i = 1.51\,m/s$

$h_f = .700\,m$

$g = ?$

$h_i = 0$

$v_f = 0$

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

$\frac{1}{2}mv_i^2 = mgh_f$

mass cancels

$\frac{1}{2}(v_i^2) = gh_f$

$g = \frac{\frac{1}{2}v_i^2}{h_f}$

$g = \frac{\frac{1}{2}(1.51\,m/s)^2}{.700\,m}$

$1.63\,m/s^2$

Answer: _____