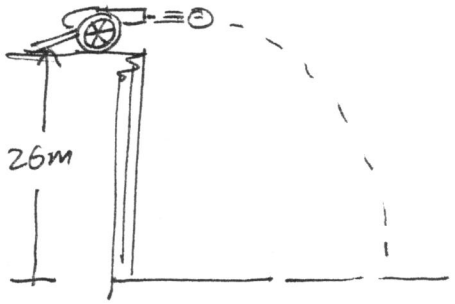
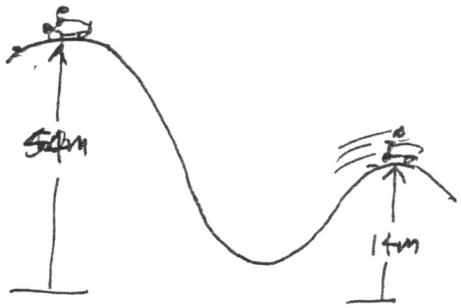
Energy Problem Set I

Do all work in your journal. Be sure to list givens and unknowns, write a generic and specific energy equation, and solve in the appropriate format.

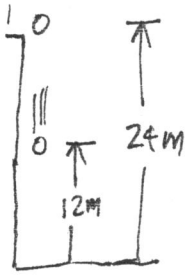
1. A cannon shoots a cannonball of the edge of a cliff that is 26 m high. If the initial speed is 35 m/s how fast is it going just before striking the ground below?



2. A roller coaster starts at rest at the top of a hill before rolling down into a valley and back up to the top of a second hill. If the first hill is 54 m high and the second hill is 14 m high, how fast is it going over the second hill?

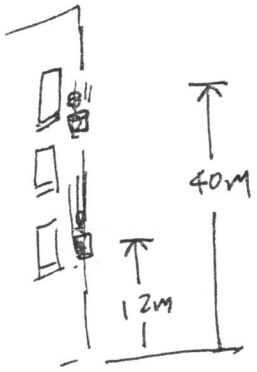


3. A rock is dropped out the window from a height of 24 m. How fast is it going when it is half way down?



4. A base ball flies away with a speed of 45 m/s. When it strikes a fan in the bleachers who is sitting 14 m above the batter, how fast is it going?

5. A flowerpot is thrown downwards from a 40 m high window with an initial speed of 25 m/s. How fast is it going when it passes another window that is only 12 m off the ground?



Helpful Hints

Use ***only*** when you are stumped. Pay attention to when you need help so you can ask good questions in class when we go over this.

① $h_i = 26m$
$v_i = 35 \frac{m}{s}$
$v_f = ?$

$PE_i + KE_i = KE_f$

② $h_i = 54m$
$v_i = 0$
$h_f = 14m$
$v_f = ?$

$PE_i + \cancel{KE_i^0} = PE_f + KE_f$

③ $h_i = 24m$
$v_i = 0$
$h_f = 12m$
$v_f = ?$

$PE_i = PE_f + KE_f$

④ $h_i = 0$
$v_i = 45 \frac{m}{s}$
$h_f = 14m$
$v_f = ?$

$KE_i = PE_f + KE_f$

⑤ $h_i = 40m$
$v_i = 25 \frac{m}{s}$
$h_f = 12m$
$v_f = ?$

$PE_i + KE_i = PE_f + KE_f$

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Energy I Answers

(1) $v_i = 30\ m/s$
$v_f = 0$
$h = ?$

$KE_i = PE_f$

$\frac{1}{2}mv_i^2 = mgh_f$ so $h_f = \frac{v_i^2}{2g} = \frac{\left(30\frac{m}{s}\right)^2}{2\left(9.8\frac{m}{s^2}\right)} = 45.9\ m$

(2) a) $h_i = 14\ m$
$v_i = 30\frac{m}{s}$
$v_f = ?$

$PE_i + KE_i = KE_f$

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

$v_f = \sqrt{2\left(gh_i + \frac{1}{2}v_i^2\right)} = \sqrt{2\left[\left(9.8\frac{m}{s^2}\right)(14m) + \frac{1}{2}\left(30\frac{m}{s}\right)^2\right]}$

$= 34.3\frac{m}{s}$

b) Exactly the same as a)

c) It makes no difference.

(3) $m = 11\ kg$
$h_i = 2.0\ m$
$v_i = 0$
$h_f = 0.5\ m$
$v_f = ?$

$PE_i = PE_f + KE_f$

$mgh_i = mgh_f + \frac{1}{2}mv_f^2 \Rightarrow v_f = \sqrt{2(gh_i - gh_f)}$

$= \sqrt{2\left(9.8\frac{m}{s^2}\right)(2.0m - 0.5m)}$

$= 5.42\frac{m}{s}$

(4) $v_i = 8\frac{m}{s}$
$v_f = 0$
$h_f = ?$

$KE_i = PE_f$

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

$h_f = \frac{v_i^2}{2g} = \frac{\left(8\frac{m}{s}\right)^2}{2\left(9.8\frac{m}{s^2}\right)} = 3.27\ m$

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