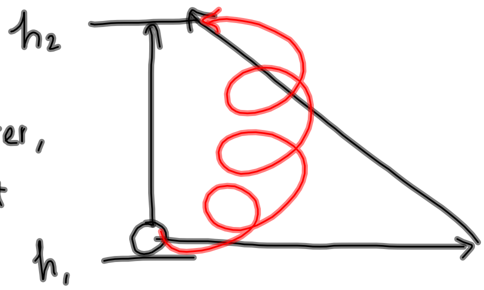
§7.1 Energy Transformations

Conservative Force

- the path does not matter, you do the same amount of work (gravity)

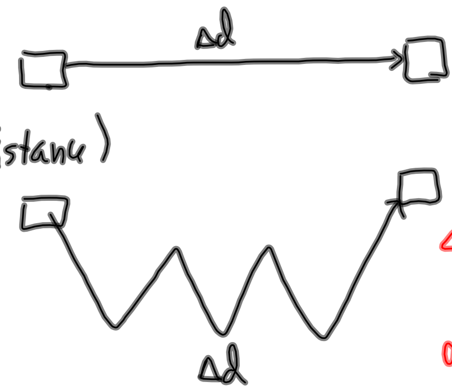


Consider lifting a rock from h_1 to h_2.

Non-Conservative force

The path that the object takes affects the amount of work done (friction/air resistance)

Bird's Eye View (pushing a crate along a rough surface)



← Doing more work here against friction

Read more on p 281

Consider a falling rock starting with 100 J of gravitational potential energy

$E_g = 100\ J$	$E_K = 0\ J$	$E_{TOT} = 100\ J$
$E_g = 65\ J$	$E_K = 35\ J$	$E_{TOT} = 100\ J$
$E_g = 35\ J$	$E_K = 65\ J$	$E_{TOT} = 100\ J$
$E_g = 0\ J$	$E_K = 100\ J$	$E_{TOT} = 100\ J$

As the rock falls, the gravitational potential energy decreases and the kinetic energy is increasing. The total energy stays the same. (neglecting air resistance)

Law of Conservation of Mechanical Energy

$$E_{total} = E'_{total}$$

(before) (after)

$$E_K + E_g + E_e = E'_K + E'_g + E'_e$$

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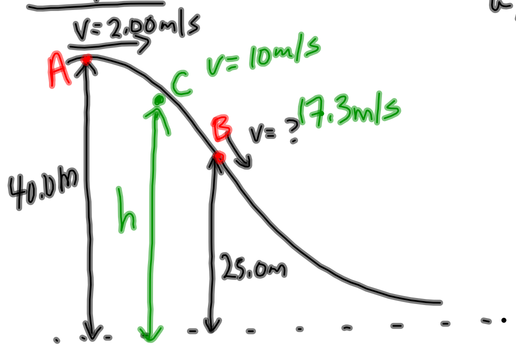

a)

$$E_{total} = E'_{total}$$

(A) (B)

$$E_{k_A} + E_{g_A} = E_{k_B} + E_{g_B}$$

$$\frac{1}{2}mv_A^2 + mgh_A = \frac{1}{2}mv_B^2 + mgh_B$$

$$\frac{1}{2}\left(2.00\frac{m}{s}\right)^2 + \left(9.81\frac{m}{s^2}\right)(40.0m) = \frac{1}{2}v_B^2 + \left(9.81\frac{m}{s^2}\right)(25.0m)$$

$$2.00\frac{m^2}{s^2} + 392.4\frac{m^2}{s^2} = \frac{1}{2}v_B^2 + 245.25\frac{m^2}{s^2}$$

$$149.15\frac{m^2}{s^2} = \frac{1}{2}v_B^2$$

$$v_B^2 = 298.3\frac{m^2}{s^2}$$

$$v_B \doteq 17.3\frac{m}{s}$$

b)

$$E_{total} = E'_{total}$$

(A) (C)

$$E_{k_A} + E_{g_A} = E_{k_C} + E_{g_C}$$

$$\frac{1}{2}mv_A^2 + mgh_A = \frac{1}{2}mv_C^2 + mgh_C$$

$$\frac{1}{2}\left(2.00\frac{m}{s}\right)^2 + \left(9.81\frac{m}{s^2}\right)(40.0m) = \frac{1}{2}\left(10.0\frac{m}{s}\right)^2 + \left(9.81\frac{m}{s^2}\right)h_c$$

$$2.00\frac{m^2}{s^2} + 392.4\frac{m^2}{s^2} = 50.0\frac{m^2}{s^2} + \left(9.81\frac{m}{s^2}\right)h_c$$

$$344.4\frac{m^2}{s^2} = \left(9.81\frac{m}{s^2}\right)h_c$$

$$h_c \doteq 35.1m$$

TO DO:

① PP|287|1-4

② Video Analysis of a falling object.