KRETANJE TELA U GRAVITACIONOM POLJU

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DA PONOVIMO OBRASCI

SLOBODAN PAD

$$v = g \cdot t$$

$$h = \frac{g \cdot t^2}{2}$$

$$v^2 = 2 \cdot g \cdot h$$

HITAC NANIŽE

$$v = v_0 + g \cdot t$$

$$h = v_0 \cdot t + \frac{g \cdot t^2}{2}$$

$$v^2 = v_0^2 + 2 \cdot g \cdot h$$

HITAC NAVIŠE

$$v = v_0 - g \cdot t$$

$$h = v_0 \cdot t - \frac{g \cdot t^2}{2}$$

$$v^2 = v_0^2 - 2 \cdot g \cdot h$$

$$h_{mah} = \frac{v_0^2}{2 \cdot g}$$

$$t_{mah} = \frac{v_0}{g}$$

v_0 – *početna brzina tela*

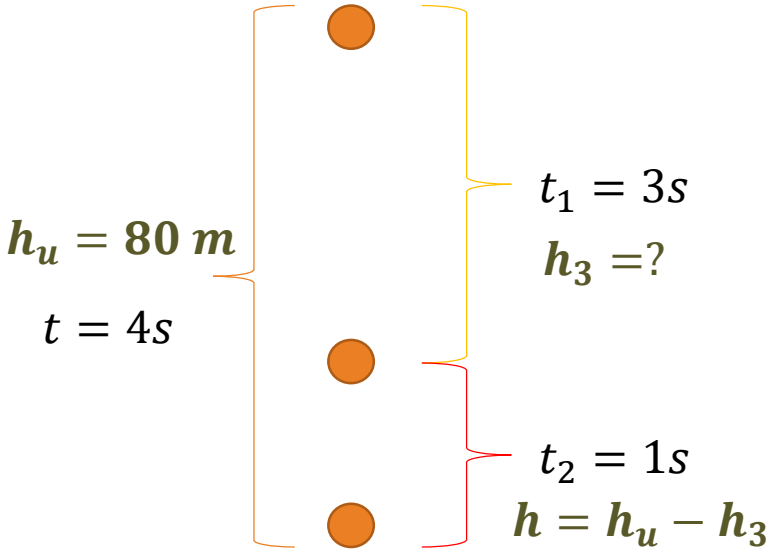
v – *konačna brzina tela*

h – *visina, put koji telo pređe*

t – *vreme*

1. Telo slobodno pada sa visine 80 m. Koliki put pređe u poslednjoj sekundi kretanja?

h_U =80 m



$$h = \frac{g \cdot t^2}{2}$$

$$t^2 = \frac{2 \cdot h}{g}$$

$$t^2 = \frac{2 \cdot 80\ m}{10\ \frac{m}{s^2}}$$

$$t^2 = 16s^2$$

$$t = \sqrt{16s^2}$$

$$t = 4\ s$$

$$h = \frac{g \cdot t^2}{2}$$

$$h_3 = \frac{10\ \frac{m}{s^2} \cdot (3s)^2}{2}$$

$$h_3 = \frac{10\ \frac{m}{s^2} \cdot 9\ s^2}{2}$$

$$h_3 = 45\ m$$

$$h = h_U - h_3$$

$$h = 80m - 45m$$

$$h = 35m$$

2. U dvema tačkama putanje tela koje slobodno pada brzine iznose 2 m/s i 6 m/s. Za koje vreme telo pređe to rastojanje? Koliko iznosi rastojanje između tačaka?

$v_1 = 2\frac{m}{s}$

$v_2 = 6\frac{m}{s}$

$v = g \cdot t \Rightarrow t = \frac{v}{g}$

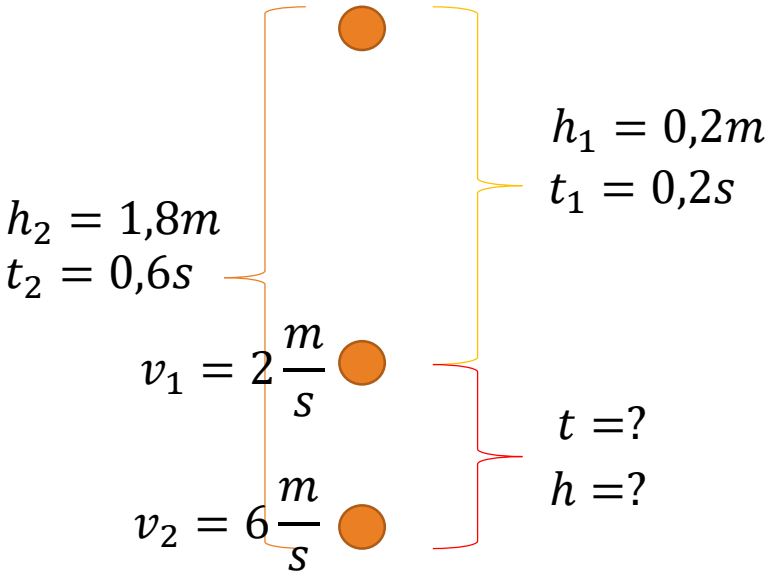
$t_1 = \frac{v_1}{g} = \frac{2\frac{m}{s}}{10\frac{m}{s^2}} = 0{,}2s$

$t_2 = \frac{v_2}{g} = \frac{6\frac{m}{s}}{10\frac{m}{s^2}} = 0{,}6s$

$t = t_2 - t_1$

$t = 0{,}6s - 0{,}2s$

$t = 0{,}4s$



$v^2 = 2 \cdot g \cdot h \Rightarrow h = \frac{v^2}{2 \cdot g}$

$h_1 = \frac{{v_1}^2}{2 \cdot g} = \frac{(2\frac{m}{s})^2}{2 \cdot 10\frac{m}{s^2}}$

$h_1 = \frac{4\frac{m^2}{s^2}}{20\frac{m}{s^2}} = 0{,}2m$

$h_2 = \frac{{v_2}^2}{2 \cdot g} = \frac{(6\frac{m}{s})^2}{2 \cdot 10\frac{m}{s^2}}$

$h_2 = \frac{36\frac{m^2}{s^2}}{20\frac{m}{s^2}} = 1{,}8m$

$h = h_2 - h_1$

$h = 1{,}8m - 0{,}2m$

$h = 1{,}6m$

3. Telo je bačeno vertikalno naviše početnom brzinom 24 m/s. Koliki put pređe za 4 s?

$v_0 = 24\frac{m}{s}$

$t = 4s$

$h = ?$

$v = v_0 - g \cdot t$ $\quad v = 0\frac{m}{s}$ ⇒ $t_{mah} = \frac{v_0 - v}{g} = \frac{24\frac{m}{s} - 0\frac{m}{s}}{10\frac{m}{s^2}} = 2{,}4s$

$t_{pad} = t - t_{mah} = 4s - 2{,}4s = 1{,}6s$

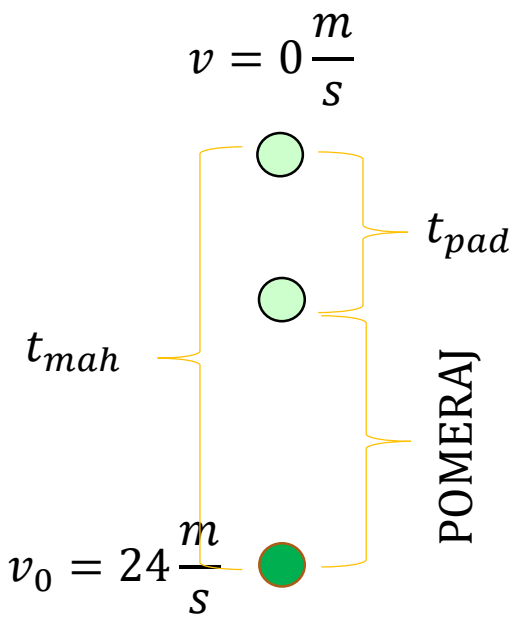
$h = v_0 \cdot t - \frac{g \cdot t^2}{2}$

$h = 24\frac{m}{s} \cdot 4s - \frac{10\frac{m}{s^2} \cdot (4s)^2}{2}$

$h = 96m - \frac{10\frac{m}{s^2} \cdot 16\,s^2}{2}$

$h = 96m - 80\,m$

$h = 16\,m$



$h_{mah} = \frac{v_0^2}{2 \cdot g} = \frac{\left(24\frac{m}{s}\right)^2}{2 \cdot 10\frac{m}{s^2}} = \frac{576\frac{m^2}{s^2}}{20\frac{m}{s^2}} = 28{,}8m$

$h_{pad} = \frac{g \cdot t_{pad}^2}{2} = \frac{10\frac{m}{s^2} \cdot (1{,}6s)^2}{2} = \frac{10\frac{m}{s^2} \cdot 2{,}56\,s^2}{2} = 12{,}8\,m$

$h = h_{mah} + h_{pad} = 28{,}8m + 12{,}8\,m = 41{,}6m$

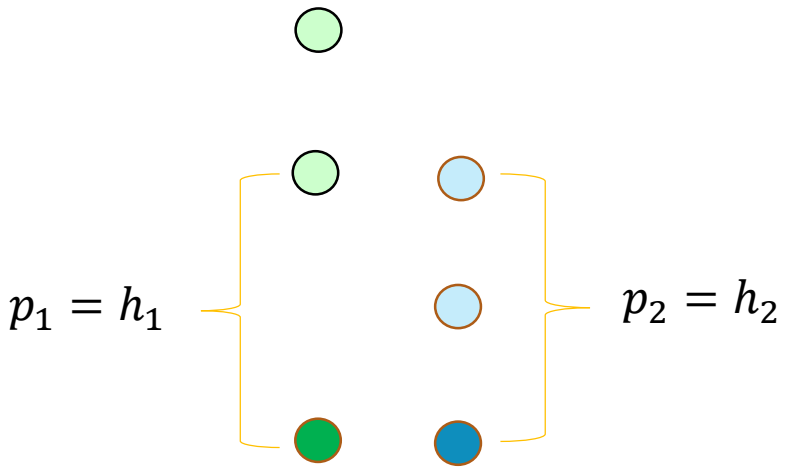
POMERAJ

4. U razmaku 3 s, bačena su vertikalno uvis sa istog mesta dva tela sa istom početnom brzinom 20 m/s. Posle koliko vremena od bacanja drugog tela će se susresti?

$\Delta t = 3s$

$v_0 = 20\frac{m}{s}$

$t_1 = t_2 + \Delta t$



$$h_1 = h_2$$

$$v_0 \cdot (t_2 + \Delta t) - \frac{g \cdot (t_2 + \Delta t)^2}{2} = v_0 \cdot t_2 - \frac{g \cdot {t_2}^2}{2} \quad / \cdot 2$$

$$2 \cdot v_0 \cdot (t_2 + \Delta t) - \frac{2 \cdot g \cdot (t_2 + \Delta t)^2}{2} = 2 \cdot v_0 \cdot t_2 - \frac{2 \cdot g \cdot {t_2}^2}{2}$$

$$2 \cdot v_0 \cdot (t_2 + \Delta t) - g \cdot (t_2 + \Delta t)^2 = 2 \cdot v_0 \cdot t_2 - g \cdot {t_2}^2$$

$$2 \cdot v_0 \cdot t_2 + 2 \cdot v_0 \cdot \Delta t - g \cdot ({t_2}^2 + 2 \cdot t_2 \cdot \Delta t + \Delta t^2) = 2 \cdot v_0 \cdot t_2 - g \cdot {t_2}^2$$

$$2 \cdot v_0 \cdot t_2 + 2 \cdot v_0 \cdot \Delta t - g \cdot {t_2}^2 - g \cdot 2 \cdot t_2 \cdot \Delta t - g \cdot \Delta t^2 = 2 \cdot v_0 \cdot t_2 - g \cdot {t_2}^2$$

$$2 \cdot v_0 \cdot t_2 - g \cdot {t_2}^2 - g \cdot 2 \cdot t_2 \cdot \Delta t - 2 \cdot v_0 \cdot t_2 + g \cdot {t_2}^2 = g \cdot \Delta t^2 - 2 \cdot v_0 \cdot \Delta t$$

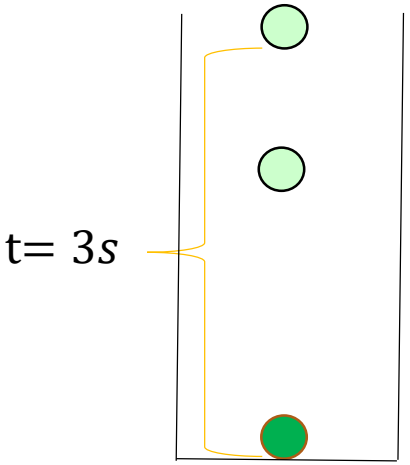
$$-g \cdot 2 \cdot t_2 \cdot \Delta t = g \cdot \Delta t^2 - 2 \cdot v_0 \cdot \Delta t \quad / \cdot (-1)$$

$$g \cdot 2 \cdot t_2 \cdot \Delta t = -g \cdot \Delta t^2 + 2 \cdot v_0 \cdot \Delta t$$

$$t_2 = \frac{-g \cdot \Delta t^2 + 2 \cdot v_0 \cdot \Delta t}{g \cdot 2 \cdot \Delta t} = \frac{-10\frac{m}{s^2} \cdot 9s^2 + 2 \cdot 20\frac{m}{s} \cdot 3s}{10\frac{m}{s^2} \cdot 2 \cdot 3s} = \frac{-90m + 120m}{60\frac{m}{s}} = 0{,}5s$$

5. Dečak baci u prazan bunar kamen, brzinom 2 m/s (hitac naniže) i on padne na dno za 3 s. Ako je brzina zvuka 10,5 puta veća od brzine kojom je kamen udario u dno bunara, naći vreme kretanja zvuka do dečaka.

$$v_0 = 2\frac{m}{s}$$
$$t = 3s$$
$$v_Z = 10{,}5 \cdot v$$



$$v = v_0 + g \cdot t$$
$$v = 2\frac{m}{s} + 10\frac{m}{s^2} \cdot 3s$$
$$v = 2\frac{m}{s} + 30\frac{m}{s}$$
$$v = 32\frac{m}{s}$$
$$v_Z = 10{,}5 \cdot 32\frac{m}{s}$$
$$v_Z = 336\frac{m}{s}$$

$$h = v_0 \cdot t + \frac{g \cdot t^2}{2}$$
$$h = 2\frac{m}{s} \cdot 3s + \frac{10\frac{m}{s^2} \cdot (3s)^2}{2}$$
$$h = 6m + \frac{10\frac{m}{s^2} \cdot 9\,s^2}{2}$$
$$h = 6m + 45\,m$$
$$h = 51m$$

$$t_Z = \frac{h}{v_Z} = \frac{51m}{336\frac{m}{s}} = 0{,}15s$$