ZAKON ODRŽANJA MEHANIČKE ENERGIJE

ZADACI – PRVI DEO

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ZAKON ODRŽANJA MEHANIČKE ENERGIJE
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1. Odredi, pomoću Zakona održanja energije, brzinu koju dobije telo pri slobodnom padanju sa visine 20m.

$h = 20m$

$g = 10\frac{m}{s^2}$

$$E_u = E_u$$

$$m \cdot g \cdot h_{max} = \frac{m \cdot {v_{max}}^2}{2}$$

$$g \cdot h_{max} = \frac{{v_{max}}^2}{2}$$

$$2 \cdot g \cdot h_{max} = {v_{max}}^2$$

$${v_{max}}^2 = 2 \cdot g \cdot h_{max}$$

$${v_{max}}^2 = 2 \cdot g \cdot h_{max}$$

$${v_{max}}^2 = 2 \cdot 10\frac{m}{s^2} \cdot 20m$$

$${v_{max}}^2 = 400\frac{m^2}{s^2}$$

$$v_{max} = \sqrt{400\frac{m^2}{s^2}}$$

$$v_{max} = 20\frac{m}{s}$$

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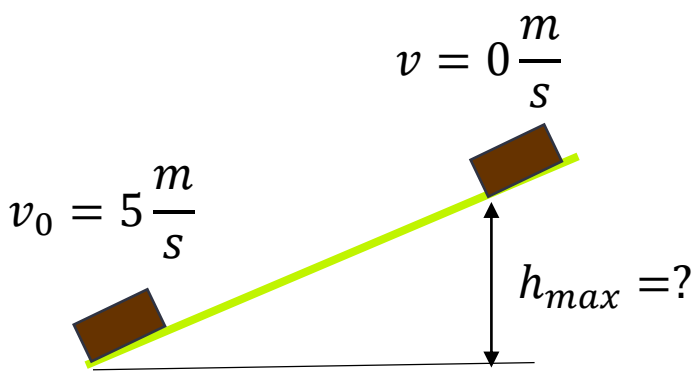
2. Kvadar se gurne brzinom 5 $\frac{m}{s}$ uz glatku kosu ravan kao na slici. Do koje maksimalne visine (h) će stići?



$v_0 = 5\frac{m}{s}$

$g = 10\frac{m}{s^2}$

$h_{max} = ?$

$$E_u = E_u$$

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

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

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

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

$$h_{max} = \frac{(5\frac{m}{s})^2}{2 \cdot 10\frac{m}{s^2}}$$

$$h_{max} = \frac{25\frac{m^2}{s^2}}{20\frac{m}{s^2}}$$

$$h_{max} = 1{,}25m$$

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3. Jabuka mase 250g slobodno pada sa visine 5m. Odredi njenu potencijalnu i kinetičku energiju na visini 2m.

$$m = 250g = 0{,}25kg$$

$h_1 = 5m$

$v_1 = 0\,\frac{m}{s}$

$$E_{k1} = \frac{m \cdot {v_1}^2}{2} = 0J$$

$$E_{p1} = m \cdot g \cdot h_1 = 0{,}25kg \cdot 10\,\frac{N}{kg} \cdot 5m = 12{,}5\text{J}$$

$$E_u = E_{k1} + E_{p1} = E_{p1} = 12{,}5J$$

$h_2 = 2m$

$v_2 > 0\,\frac{m}{s}$

$$E_{k2} = \frac{m \cdot {v_2}^2}{2}$$

$$E_{p2} = m \cdot g \cdot h_2 = 0{,}25kg \cdot 10\,\frac{N}{kg} \cdot 2m = 5\text{J}$$

$$E_u = E_{k2} + E_{p2}$$

$$E_{k2} = E_u - E_{p2}$$

$$E_{k2} = 12{,}5J - 5\text{J}$$

$$E_{k2} = 7{,}5J$$

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4. Lopta je bačena vertikalno naviše početnom brzinom $20\frac{m}{s}$. Koliku brzinu će imati na visini 10m? Zadatak radi pomoću Zakona o održanju energije.

$h_2 = 10m$

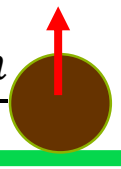
$v_2 = ?$

$$E_{k2} = \frac{m \cdot {v_2}^2}{2}$$

$$E_{p2} = m \cdot g \cdot h_2 = m \cdot 10\frac{m}{s^2} \cdot 10m = m \cdot 100\frac{m^2}{s^2}$$

$h_1 = 0m$

$v_1 = 20\frac{m}{s}$



$$E_{k1} = \frac{m \cdot {v_1}^2}{2} = \frac{m \cdot (20\frac{m}{s})^2}{2} = \frac{m \cdot 400\frac{m^2}{s^2}}{2} = m \cdot 200\frac{m^2}{s^2}$$

$$E_{p1} = 0\text{J}$$

$$E_{u1} = E_{u2}$$

$$E_{p1} + E_{k1} = E_{p2} + E_{k2}$$

$$m \cdot 200\frac{m^2}{s^2} = m \cdot 100\frac{m^2}{s^2} + \frac{m \cdot {v_2}^2}{2} \quad / \frac{1}{m}$$

$$200\frac{m^2}{s^2} = 100\frac{m^2}{s^2} + \frac{{v_2}^2}{2}$$

$$\frac{{v_2}^2}{2} = 200\frac{m^2}{s^2} - 100\frac{m^2}{s^2} = 100\frac{m^2}{s^2}$$

$${v_2}^2 = 2 \cdot 100\frac{m^2}{s^2} = 200\frac{m^2}{s^2}$$

$$v_2 = \sqrt{200\frac{m^2}{s^2}} \approx 14{,}14\frac{m}{s}$$

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5. Lopta je bačena vertikalno naviše početnom brzinom $20\frac{m}{s}$. Na kojoj visini će njena potencijalna energija biti jednaka kinetičkoj?

$h_2 = ?$

$$E_{k2} = \frac{m \cdot {v_2}^2}{2}$$

$$E_{p2} = m \cdot g \cdot h_2$$

$$E_{k2} = E_{p2}$$

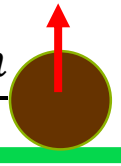
$$E_{u2} = E_{p2} + E_{k2}$$

$$E_{u2} = E_{p2} + E_{p2}$$

$$E_{u2} = 2E_{p2}$$

$h_1 = 0m$

$v_1 = 20\frac{m}{s}$



$$E_{k1} = \frac{m \cdot {v_1}^2}{2} = \frac{m \cdot (20\frac{m}{s})^2}{2} = \frac{m \cdot 400\frac{m^2}{s^2}}{2} = m \cdot 200\frac{m^2}{s^2}$$

$E_{p1} = 0\text{J}$

$$E_{u1} = E_{u2}$$

$$E_{p1} + E_{k1} = 2E_{p2}$$

$$m \cdot 200\frac{m^2}{s^2} = 2 \cdot m \cdot g \cdot h_2$$

$$200\frac{m^2}{s^2} = 2 \cdot 10\frac{m}{s^2} \cdot h_2$$

$$200\frac{m^2}{s^2} = 20\frac{m}{s^2} \cdot h_2$$

$$h_2 = \frac{200\frac{m^2}{s^2}}{20\frac{m}{s^2}} = 10m$$

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6. Lopta je bačena vertikalno naviše početnom brzinom $20\frac{m}{s}$. Koliku brzinu ima lopta u trenutku kada je potencijalna energija jednaka kinetičkoj enertiji?

$v_2 = ?$

$$E_{k2} = \frac{m \cdot {v_2}^2}{2}$$

$$E_{p2} = m \cdot g \cdot h_2$$

$$E_{k2} = E_{p2}$$

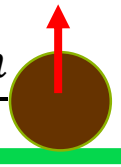
$$E_{u2} = E_{p2} + E_{k2}$$

$$E_{u2} = E_{k2} + E_{k2}$$

$$E_{u2} = 2E_{k2}$$

$h_1 = 0m$

$v_1 = 20\frac{m}{s}$



$$E_{k1} = \frac{m \cdot {v_1}^2}{2} = \frac{m \cdot (20\frac{m}{s})^2}{2} = \frac{m \cdot 400\frac{m^2}{s^2}}{2} = m \cdot 200\frac{m^2}{s^2}$$

$E_{p1} = 0\text{J}$

$$E_{u1} = E_{u2}$$

$$E_{p1} + E_{k1} = 2E_{K2}$$

$$m \cdot 200\frac{m^2}{s^2} = 2 \cdot \frac{m \cdot {v_2}^2}{2}$$

$$200\frac{m^2}{s^2} = {v_2}^2$$

$${v_2}^2 = 200\frac{m^2}{s^2}$$

$$v_2 = \sqrt{200\frac{m^2}{s^2}} \approx 14{,}14\frac{m}{s}$$

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7. Lopta je bačena vertikalno naviše početnom brzinom $20\frac{m}{s}$. Do koje masimalne visine će stići lopta? Zadatak radi pomoću Zakona o održanju energije.

$h_2 = ?$

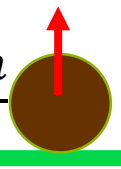
$v_2 = 0\,\frac{m}{s}$

$E_{k2} = 0J$

$E_{p2} = m \cdot g \cdot h_2 = m \cdot 10\,\frac{m}{s^2} \cdot h_2$

$h_1 = 0m$

$v_1 = 20\,\frac{m}{s}$



$E_{k1} = \frac{m \cdot {v_1}^2}{2} = \frac{m \cdot (20\,\frac{m}{s})^2}{2} = \frac{m \cdot 400\,\frac{m^2}{s^2}}{2} = m \cdot 200\,\frac{m^2}{s^2}$

$E_{p1} = 0\text{J}$

$$E_{u1} = E_{u2}$$

$$E_{p1} + E_{k1} = E_{p2} + E_{k2}$$

$$E_{k1} = E_{p2}$$

$$m \cdot 200\,\frac{m^2}{s^2} = m \cdot 10\,\frac{m}{s^2} \cdot h_2$$

$$200\,\frac{m^2}{s^2} = 10\,\frac{m}{s^2} \cdot h_2$$

$$h_2 = \frac{200\,\frac{m^2}{s^2}}{10\,\frac{m}{s^2}} = 20m$$