P11 - 6.2 - Kinetic Potential Conservation Energy Notes

Kinetic Energy, E_k: Energy due to an objects Motion.

$v = 25\frac{m}{s}$

15 →

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

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

$E_k = \frac{1}{2}(15)(25)^2$

$E_k = 4687.5\ J$

Potential Energy, E_p: Energy due to an objects Height (Stored Energy)

15

10m

$E_p = mgh$

$E_p = mgh$

$E_p = 15 \times 9.8 \times 10$

$E_p = 1470\ J$

Law of Conservation of Energy : cannot be created or destroyed, must be conserved!

Ball Drop

	Total	Kinetic	Potential
1.02	$E_t = 100\ J$	$E_k = 0\ J$, *at rest*	$E_p = mgh$ $E_p = (1.02)(9.8)(10)$ $E_p = 100\ J$
Top			$E_k = 0\ J$
5m	$E_t = E_k + E_p$		
	$E_t = 100\ J$	$E_k = \frac{1}{2}mv^2$ $v = \sqrt{\frac{2E_k}{m}}$ $v = \sqrt{\frac{2(50)}{1.02}}$ $v = 9.9\frac{m}{s}$	$E_p = mgh$ $E_p = (1.02)(9.8)(5)$ $E_p = 50\ J$
Middle			$E_k = 50\ J$
5m			
	$E_t = 100\ J$	$E_k = \frac{1}{2}mv^2$ $v = \sqrt{\frac{2E_k}{m}}$ $v = \sqrt{\frac{2(100)}{1.02}}$ $v = 14\frac{m}{s}$	$E_p = mgh$ $E_p = (1.02)(9.8)(0.001)$ $E_p = 0.01\ J$
Bottom*			$E_k = 100\ J$

$v_f^2 = v_i^2 + 2ad$ "a" Energy – Kinematics Link

$v_f = \sqrt{2ad}$

$v_f = \sqrt{(2)(-9.8)(-10)}$

$v_f = 14\frac{m}{s}$

Total Initial Energy = Total Final Energy

$E_i = E_f$

$E_{ki} + E_{pi} = E_{kf} + E_{pf}$

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

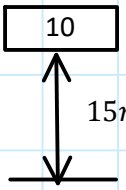
$\Delta E_p + \Delta E_k = 0$

$\Delta E_p = -\Delta E_k$

Total Energy Change equals zero

P11 - 6.2 - Total Energy Notes

Find the Potential, Kinetic and Total Energy of $10\ kg$ *object at a height of* $15\ m$?

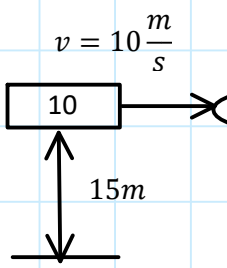


$E_p = mgh$
$E_p = 10(9.8)(15)$
$E_p = 1470\ J$

$E_k = \frac{1}{2}mv^2$
$E_k = \frac{1}{2}(10)(0)^2$
$E_k = 0\ J$

$E_t = E_g + E_k$
$E_t = 1470 + 0$
$E_t = 1470\ J$

Find the E_p, E_k, E_t *of* $10\ kg$ *object at a height of* $15\ m$ *at* $v = 10\frac{m}{s}$?

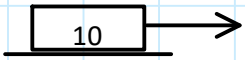


$E_p = mgh$
$E_p = 10(9.8)(15)$
$E_p = 1470\ J$

$E_k = \frac{1}{2}mv^2$
$E_k = \frac{1}{2}(10)(10)^2$
$E_k = 500\ J$

$E_t = E_g + E_k$
$E_t = 1470 + 500$
$E_t = 1970\ J$

What is the Potential, Kinetic and Total Energy of $10\ kg$ *object at a* $h = 0\ m$ *at at* $v = 10\frac{m}{s}$?

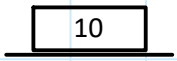


$E_p = mgh$
$E_p = 10(9.8)(0)$
$E_p = 0\ J$

$E_k = \frac{1}{2}mv^2$
$E_k = \frac{1}{2}(10)(10)^2$
$E_k = 500\ J$

$E_t = E_g + E_k$
$E_t = 500 + 0$
$E_t = 500\ J$

What is the Potential, Kinetic and Total Energy of $10\ kg$ *object at a height of* $0\ m$?

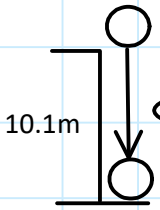


$E_p = mgh$
$E_p = 10(9.8)(0)$
$E_p = 0\ J$

$E_k = \frac{1}{2}mv^2$
$E_k = \frac{1}{2}(10)(0)^2$
$E_k = 0\ J$

$E_t = E_g + E_k$
$E_t = 0 + 0$
$E_t = 0\ J$

What is the Final Velocity, and Time in Flight, of $5\ kg$ *ball if dropped from a* $10.1\ m$?



$t = ? = 1.22s$

$v_f = ? = 14.1\frac{m}{s}$

$E_{ki} + E_{pi} = E_{kf} + E_{pf}$

$\cancel{E_{ki}} + E_{pi} = E_{kf} + \cancel{E_{pf}}$

$mgh = \frac{1}{2}mv_f^2$ *Mass is Irrelevant!*

$v_f = \sqrt{2gh}$

$v_f = \sqrt{(2)(-9.8)(10.1)}$

$v_f = 14.1\frac{m}{s}$

$v_i = 0$	$h_f = 0$
$\frac{1}{2}mv^2 = 0$	$mgh = 0$

$v_f = v_i + at$

$t = \frac{v_f}{a}$

$t = \frac{14.1}{9.8}$

$t = 1.44\ s$

$\Delta d = v_i t + \frac{1}{2}at^2$

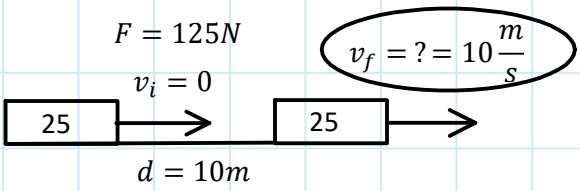
$t = \sqrt{\frac{2d}{a}}$ *Kinematics −Work Link*

$t = \sqrt{\frac{2(10.1)}{9.8}}$

$t = 1.44s$

P11 - 6.2 - Energy Work Mom. Dyn. Kin Link Notes

Find v_f of a car of $m =$ 25 kg, initially at rest, with a Force of 125 N over a $d = 10m$?



$\Delta E = W$

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

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

$v = \sqrt{\frac{2(125)(10)}{25}}$

$v = 10\frac{m}{s}$

$\Delta E = E_f - E_i$

$\Delta E = E_f - 0$

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

$W = Fd$

How much Work was done on the Object?

$W = Fd$

$W = 125(10)$

$W = 1250\ J$

What was the Objects Acceleration?

$v_f^2 = v_i^2 + 2ad$

$a = \frac{v_f^2}{2d}$ $\quad v_i = 0$

$a = \frac{10^2}{2(10)}$

$a = 5\frac{m}{s^2}$

OR

$v_f = v_i + at$

$a = \frac{v_f}{t}$

$a = \frac{10}{2}$

$a = 5\frac{m}{s^2}$

Check your Answer!

$F = ma$

$125 = 25(5)$

$125N = 125\ N$

How long did it take?

$\Delta d = v_i t + \frac{1}{2}at^2$

$t = \sqrt{\frac{2d}{a}}$

$t = \sqrt{\frac{(2)(10)}{5}}$

$t = 2\ s$

What is the Final Momentum of the Box?

$p = mv$

$p = (25)(10)$

$p = 250\frac{kgm}{s}$

And Around And Around We Go!