Day 34 Good Morning!

Conservation of energy

The total amount of energy you start with must equal the total amount of energy you end up with.

Two general categories of energy

⇒ Kinetic energy ⇒ energy of motion (KE)

⇒ Potential energy ⇒ stored energy

gravitational PE ⇒ pot. energy due to gravity

$KE_i + PE_i = KE_f + PE_f + W$

i ↳ initial, f ↳ final, W ↳ other kinds of energy

gravitational PE

(g) more gravity ⇒ more PE

(h) more height ⇒ more PE

(m) more mass ⇒ more PE

$PE \propto mgh$

from expt. ⇒ $\boxed{PE = mgh}$

eg.

$m = 1\ kg$

$g = 9.8\ m/sec^2$ $(10\ m/sec^2)$

$h = 6\ m$ ⇒ $PE = (1kg)(10\ m/sec^2)(6m) = 60\ J$

↳ Joules

(2) $m = 1\,kg$, $g = 10\ m/s^2$, $h = 6\,m$

↳ initial conditions

eg. What will the KE be after falling 1 m? Assume no energy is given off as heat, light, etc.. Initially at rest.

$W = 0$

$KE_i = 0$

$PE_i = (1\,kg)(10\ m/s^2)(6\,m)$
$= 60\,J$

$KE_f = ?$

$PE_f = (1\,kg)(10\ m/s^2)(5\,m)$
$= 50\,J$

h

5m

$KE_i + PE_i = KE_f + PE_f + W$

$0 + 60J = KE_f + 50J + 0$

$60J = KE_f + 50J$

$KE_f = 60J - 50J = \boxed{10J}$

Same initial conditions $m = 1kg$, $g = 10\ m/s^2$, $h = 6\,m$

When dropped from rest what is the KE after falling 2 m? Assume $W = 0$

$KE_i + PE_i = KE_f + PE_f + W$

$PE_f = (1\,kg)(10\ m/s^2)(4m)$
$= 40\,J$

h=4m $0 + 60J = KE_f + 40J + 0$

$\Rightarrow \boxed{KE_f = 20J}$

After falling 3 m? $W = 0$

$KE_i + PE_i = KE_f + PE_f + W$

$PE_f = (1kg)(10\ m/s^2)(3m)$
$= 30\,J$

h=3m $0 + 60J = KE_f + 30J + 0$

$\Rightarrow KE_f = 30J$

(3) $m = 1\,kg$, $g = 10\,m/s^2$, $h_i = 6\,m$ $PE_i = (1kg)(10\,m/s^2)(6\,m) = mgh_i$

When the ball is dropped from rest, what will the KE be after falling 4 m? Assume $W = 0$ $\Rightarrow h_f = 6m - 4m = 2m$

$KE_i + PE_i = KE_f + PE_f + W$ $\quad PE_f = mgh_f$

$h = 2m$ $\quad 0 + 60J = KE_f + 20J + 0$ $\quad = (1kg)(10\,m/s^2)(2m)$

$KE_f = 60J - 20J = \boxed{40J}$ $\quad = 20J$

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same init., falls 4m, but for every 1m that the ball falls the is 1J of heat created.

$\Rightarrow$ falling 4m $\Rightarrow 4J = W$

$KE_i + PE_i = KE_f + PE_f + W$

$0 + 60J = KE_f + 20J + 4J$

$\Rightarrow KE_f = 60J - 20J - 4J = \boxed{36J = KE_f}$

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same, falls 5 m, 1J for every 1m

$\hookrightarrow h_f = 1m$, $PE_f = (1kg)(10\,m/s^2)(1m) = 10J$

$KE_i + PE_i = KE_f + PE_f + W$ $\quad$ dropped 5m

$0 + 60J = KE_f + 10J + 5J$ $\quad \Rightarrow W = 5J$

$KE_f = 60J - 10J - 5J = \boxed{45J}$ $\quad \begin{array}{r} 60 \\ 15 \\ \hline 45 \end{array}$

#1 $m = 3\,kg$, $g = 10\,m/s^2$, $h_i = 5m$; $PE = mgh$

$KE_i + PE_i = KE_f + PE_f + W$ $\quad h_f = 3m$

$\Rightarrow PE_f = (3kg)(10\,m/s^2)(3m)$

$= 90J$