Physics 112

Wednesday Nov 22nd

So far,

momentum → $P = mv$

Conservation of momentum → Before momentum = After momentum

W → $W = Fd$ $W = \Delta KE$

Power → $P = \frac{W}{t}$

KE → $KE = \frac{1}{2}mv^2$

PE → $PE = mgh$

Energy

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

Energy due to an object moving.

$PE = mgh$

Energy due to an object's height.

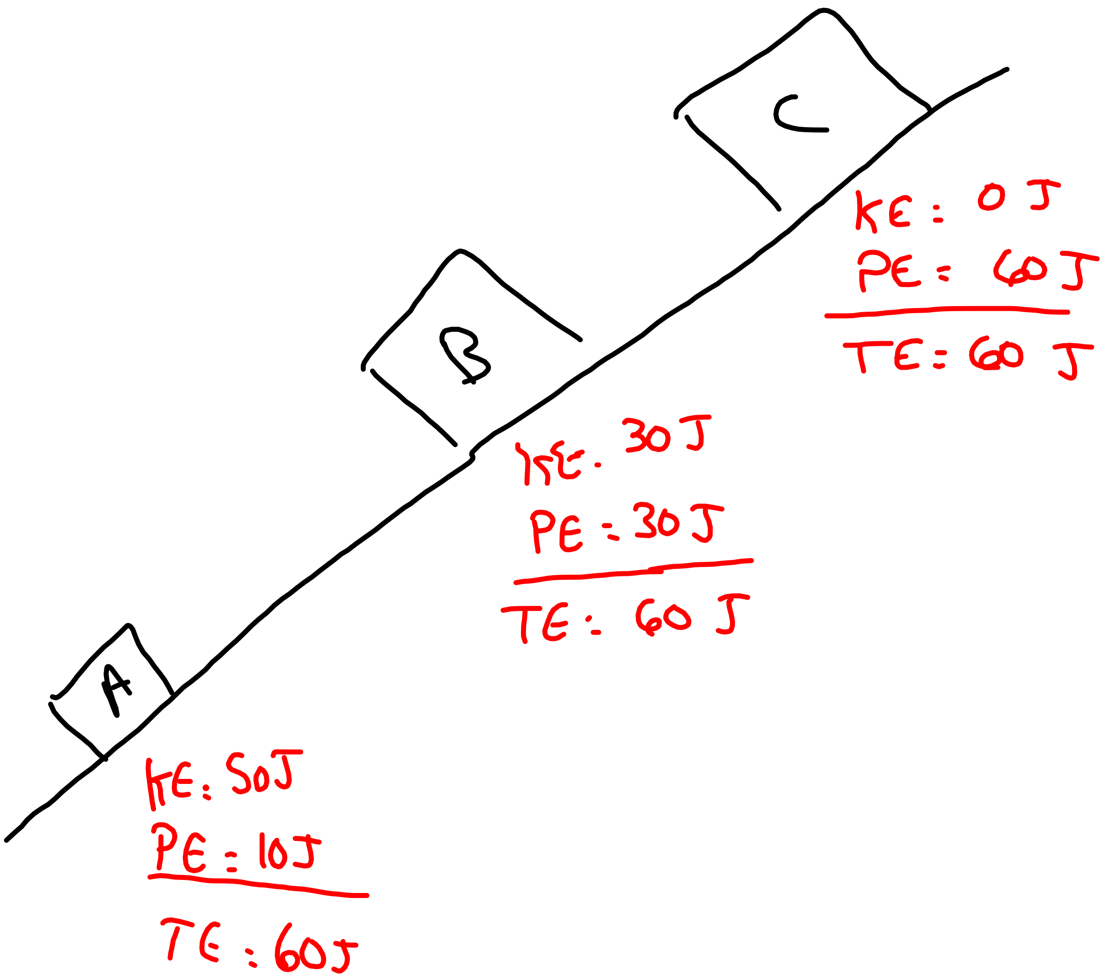
- Stored energy.

Conservation of Energy

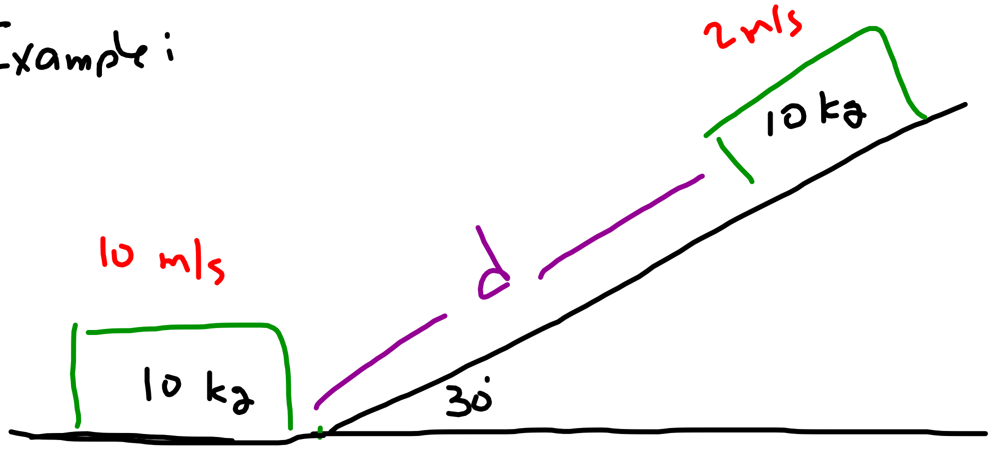
As an object moves the combination of its KE and PE remain constant.

TE = KE + PE

If you can calculate both the KE and the PE at any point along an object's path, the addition of these two is the TE at that position. This value for TE will remain constant along its path.


C
KE: 0 J
PE: 60 J
TE: 60 J
B
KE: 30 J
PE: 30 J
TE: 60 J
A
KE: 50J
PE: 10J
TE: 60J

Example:



Start

$h = 0\,m$

$PE = mgh$

$= 10(9.81)0$

$= 0\ J$

$v = 10\ m/s$

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

$= \frac{1}{2}10(10)^2$

$= 500\ J$

$TE = PE + KE$

$= 0 + 500\ J$

$TE = 500\ J$

Top

$TE = 500\ J$

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

$= \frac{1}{2}(10)(2)^2$

$= 20\ J$

$TE = PE + KE$

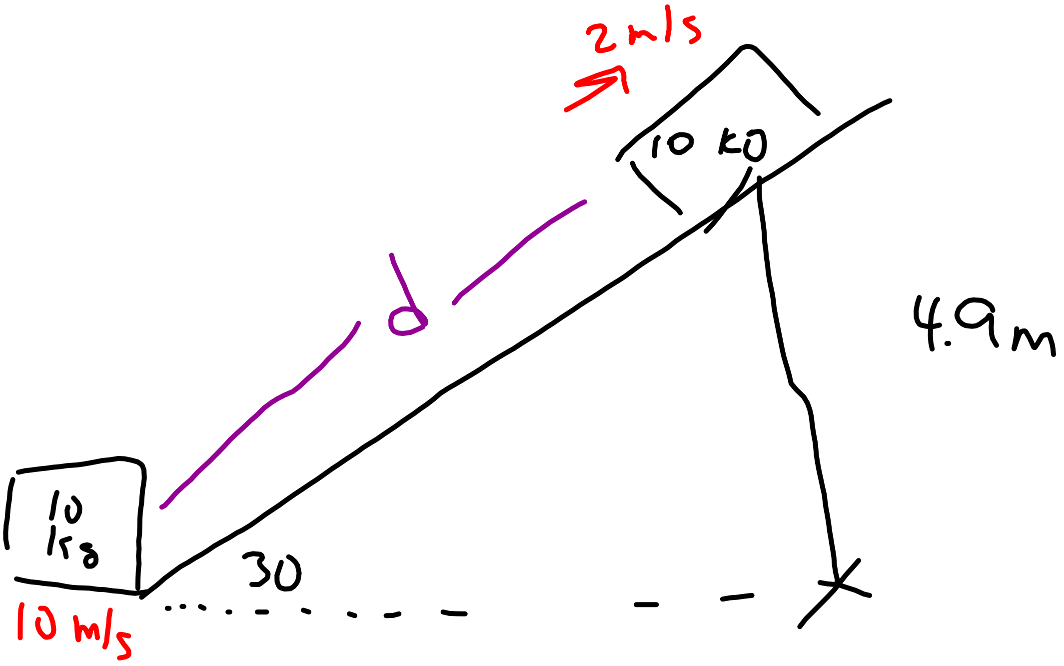
$TE - KE = PE$

$500\ J - 20\ J = 480\ J = PE$

$PE = mgh$

$480 = 10(9.81)h$

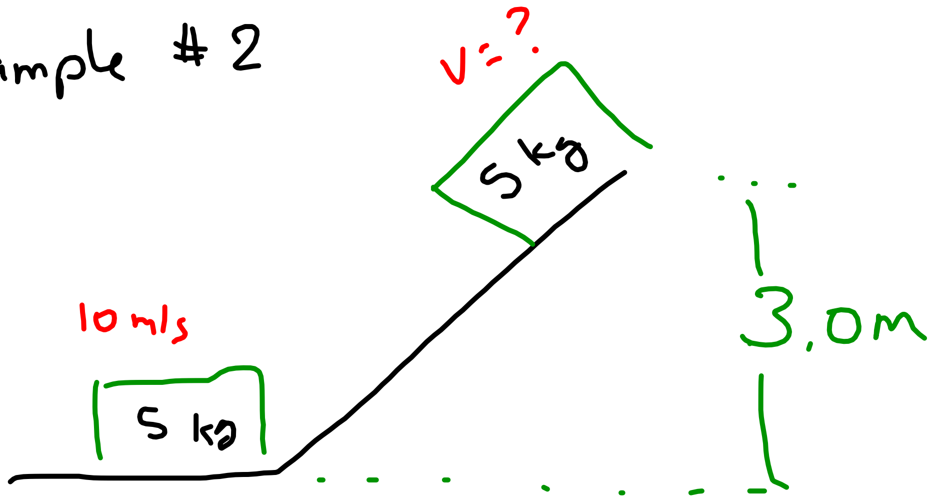
$4.9\ m = h$



$$\sin 30 = \frac{4.9}{d}$$

$$d = \frac{4.9}{\sin 30} = 9.8\,m$$

Example # 2



Start

$h = 0\ m$

$PE = mgh$

$= 5(9.81)(0)$

$= 0\ J$

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

$= \frac{1}{2}(5)(10)^2$

$= 250 J$

$TE = PE + KE$

$= 0 + 250\ J$

$TE = 250 J$

End

$TE = 250\ J$

$PE = mgh$

$= 5(9.81)(3)$

$= 147\ J$

$TE = KE + PE$

$250 = KE + 147\ J$

$103\ J = KE$

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

$103 = \frac{1}{2}(5)v^2$

$206 = 5v^2$

$41.2 = v^2$

$6.4\ m/s = v$

How can we identify a problem as a total energy (TE) problem?

Ans: Look to see if there are both differences in:

(a) height

(b) velocity.

→ Try Model problem p 285
from the green text.

→ p 287 (1, 2, 3)
use m = 95 kg

1. **Start**

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

$= \frac{1}{2}(95)(4)^2$

$= 760 J$

$PE = mgh$

$= 95(9.81)(12)$

$= 11183$

$TE = KE + PE$

$= 760 + 11183$

$= 11943.4$

A

$PE = mgh$

$= 95(9.81)4$

$= 3727.8 J$

$TE = 11943.4 J$

$-$

$KE = TE - PE$

$= 11943.4 - 3727.8$

$= 8215.6 J$

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

$8215.6 = \frac{1}{2}(95)v^2$

$173 = v^2$

$13.2 \text{ m/s} = v$