Physics 112
Monday May 13th.

Springs & Elastics

Hooke's Law $F = kx$

Elastic Potential energy $E_e = \frac{1}{2}kx^2$

Change in elastic potential energy $\Delta E_e = E_{e_2} - E_{e_1}$

F = force in Newtons (N)

k = spring constant
strength of the spring or elastic

↑ k value, stronger it is.

x = How much the spring or elastic stretehs or compresses (in meters)

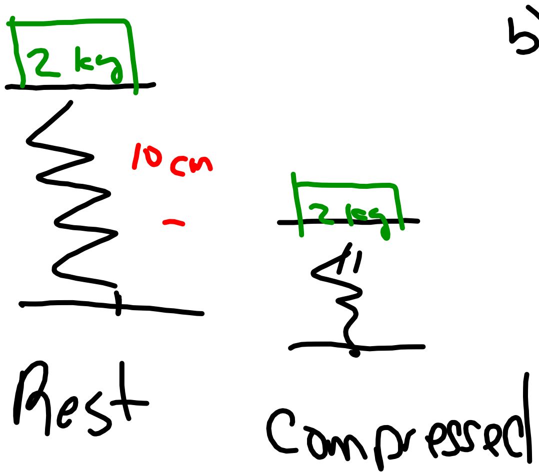
Ee → Spiing potential Energy.

Now that we have looked at springs and their involvement and association with energy, we must now take E_e into account when working with total energy problems. Same concept, the TE remains constant at two points in the system.

When released determine

a) Speed block leaves spring.

b) Maximum height the block will travel



k = 100 N/m

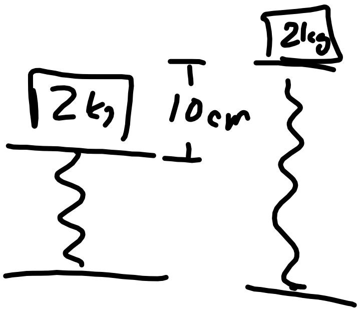
At compressed position

$$E_e = \frac{1}{2} k x^2$$

$$= \frac{1}{2}(100\ N/m)(0.10\ m)^2$$

$$E_e = 0.5 \text{ Joules}$$

This is the total energy at this point and for any other point



TE = 0.5 J

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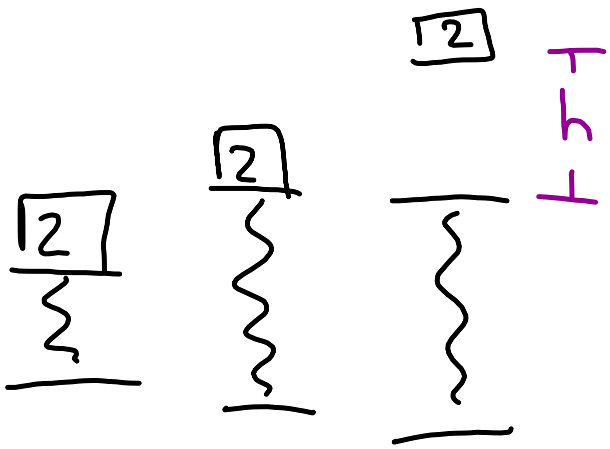
At this position, all energy is kinetic and must equal 0.5 J.

$$KE = \frac{1}{2} m v^2$$

$$0.5 = \frac{1}{2}(2) v^2$$

$$0.5 = v^2$$

$$0.7 \text{ m/s} = v$$



At the highest point (max height) we know that the only energy present is PE, and this must equal the total.

PE = 0.5 J

$PE = mgh$

$0.5 = 2(9.81)h$

$0.025\ m = h$

$2.5\ cm = h_{max}$

Green text.

p 329 (24, 25)

p 298 (15, 17)

From last week p 258 (35, 36, 37)

261 (38, 39. 40)

p 276-277 (30-35)

24. $m = 50.0 g$
$= 0.050 kg$
$k = 1200 N/m$
$x = 0.50 cm$
$= 0.005 m$

$E_e = \frac{1}{2} kx^2$
$= \frac{1}{2} (1200)(0.005)^2$
$E_e = 0.015 J$
$TE = 0.015 J$
$\therefore KE = 0.015 J$ at release
$\frac{1}{2}(0.050)v^2 = 0.015$
$v = 0.78 m/s$

$PE = 0.015 J$ at h_{max}
$mgh = 0.015$
$(0.05)9.81(h) = 0.015$
$h = 0.03 m \rightarrow 3.0 cm$

25. $k = 950$ N/m
$x = 0.20$ m
$m = 1.5$ kg

$E_e = KE$

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

$kx^2 = mv^2$

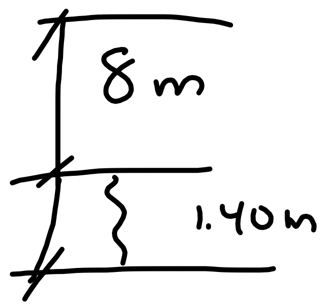
$\sqrt{\frac{kx^2}{m}} = v = 5.0$ m/s

P 298

15. $m = 70.0\ kg$

$x = 1.40\ m$

$k = ?$



$PE = Ee$

$mgh = \frac{1}{2}kx^2$

$70(9.81)(9.4) = \frac{1}{2}k(1.40)^2$

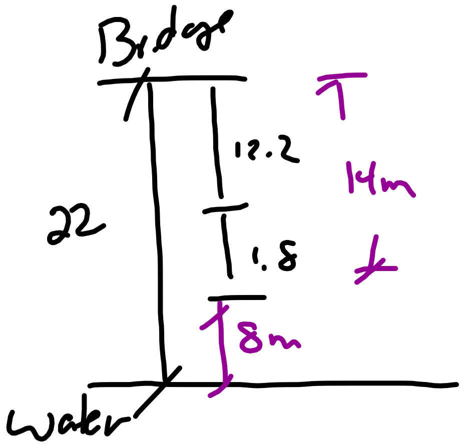
$k = 6.59 \times 10^3\ N/m$

17. $d = 22\,m$ (bridge above water)

Cord = 12.2 m

jumper = 1.8 m

mass = 60 kg



$PE_{Top} = E_{e\,Bott}$

$mgh = \frac{1}{2}kx^2$

$(60)(9.81)(22) = \frac{1}{2}k(8)^2$

$405\ N/m = k$