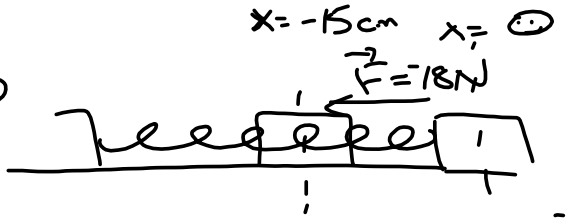
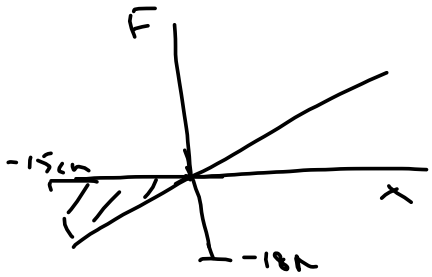
40





$F = kx$

$-18N = k(-0.15m)$

$k = 120 N/m$

$PE = \frac{1}{2}kx^2 = \frac{1}{2}(120 N/m)(0.15m)^2$

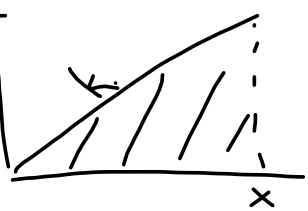
$= 1.35 J$

$PE = \frac{1}{2}Fx = Area$

$= \frac{1}{2}(18N)(0.15m)$

$= 1.35 J$

$kx = F$



$PE = W = \frac{1}{2}(x)(kx)$

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

Quiz

1) [3 marks] A pool ball (m=300 g) travelling at 4.0 m/s collides with another ball (m=200 g) initially at rest. The 200 g ball is then measured to be moving 3.0 m/s after the collision. What is the final speed of the 300 g ball?

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$

$(300g)(+4) = 300v_1' + 200(+3)$

$+1200 - 600 = 300v_1'$

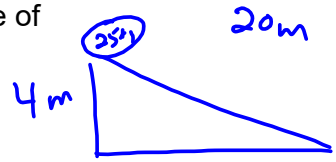
$v_1' = +2\frac{m}{s}$

2) [6 marks] A rock (m=25 kg) is at the top of a hill 4.0 m high and 20 m long. It rolls down the hill, experiencing a force of friction of 25 N.

(a) What is it's potential energy at the top?

(b) How much energy does it lose on the way down?

(c) What is the final velocity at the bottom of the hill?



$PE = mgh = 4(9.8)(25)$

$= 980J$

$W_f = fd = (25N)(20m)$

$= 500J$

$KE = 980J - 500J$

$= 480J = \frac{1}{2}mv^2$

$480J = \frac{1}{2}(25)v^2$

$v = 6.2\frac{m}{s}$

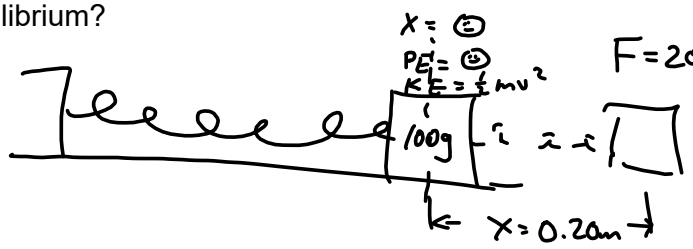
Answers:

1. 2.0 m/s in original direction

2. a) 981 J
   b) 500 J
   c) 6.2 m/s

Springs

Example: A spring requires a force of 20 N to stretch it 0.10 m. If the spring is stretched 20 cm with a mass of 100 g mass attached to it,
a) What is the PE in the spring?
b) When it is released, what is the maximum speed of the mass?
c) What is the speed of the mass when it is 0.05 m away from equilibrium?



$F = 20N \rightarrow 0.10m = x$

$k = \frac{F}{x} = \frac{20N}{0.10m} = 200 N/m$

a) $PE_s = \frac{1}{2}kx^2 = \frac{1}{2}(200\frac{N}{m})(0.20m)^2$

$= 4.0J$

(b) At equilibrium PE = ☺

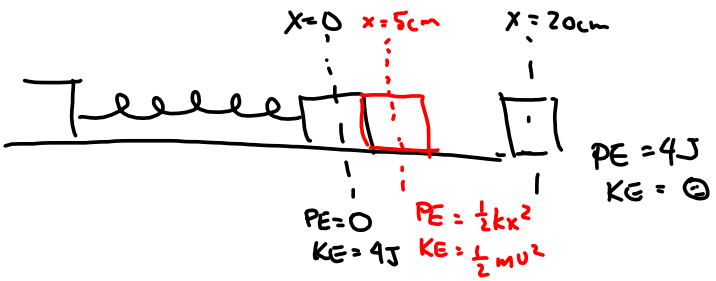
so KE = 4.0J

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

$4.0J = \frac{1}{2}(0.100kg)v^2$

$80 = v^2$

$v = 8.94\frac{m}{s}$



At x = 5cm

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

$= \frac{1}{2}(200)(0.05)^2$

$= 0.25J$

$KE = E - PE$

$= 4 - 0.25 = 3.75J = \frac{1}{2}mv^2$

$3.75 = \frac{1}{2}(0.1)v^2$

$75 = v^2$

$v = 8.7\frac{m}{s}$

Homework: p. 258 # 37,
p. 261 #39
Sheet # 19

Lab due tomorrow.