Spring Simple harmonic motion
Class Work

Spring Energy and Hook's Law

1. A 10 kg block is hung on a spring (k = ~~2~~ 20 N/m),

   $F = -Kx$ $\quad F_w = m \cdot g$ $\quad F_w = F_s = 10 \cdot 10 = 100$

   $\frac{100}{20} = 5m$

   a. How far down will the spring hang from the equilibrium point.

   b. How much energy is the spring storing? $U_s = \frac{1}{2}Kx^2$

   $\frac{1}{2}(20)(5)^2 = 250N$

2. A 5kg mass is placed on a spring, causing it to drop = 2cm ↳ (0.02m)

   a. What is the spring constant?

   $F_w = F_s = m \cdot g$ $\quad F = -Kx$

   $5 \cdot 10 = 50N$ $\quad \frac{50}{.02} = 2500 N/m$

   b. How much energy is the spring storing?

   $U_s = \frac{1}{2}Kx^2$ $\quad \frac{1}{2}(2500)(.02)^2 = 0.5J$

3. A 50g (0.05kg) weight is placed on a spring. It is pulled down and released. It oscillates up and down making a complete loop in 3 seconds.

   a. What is the period of the springs motion?

   3sec

   b. What is the frequency of the springs motion?

   $\frac{1}{3}$ or 0.33 cycles/sec

   c. What is the spring constant of the spring?

   $T_s = 2\pi\sqrt{\frac{m}{K}}$ $\quad 3 = 2\pi\sqrt{\frac{.05}{K}}$ $\quad \left(\frac{3}{2\pi}\right)^2 = \frac{.05}{K}$ $\quad K = 0.224 N/m$

   d. If this experiment were taking place on the moon, how might the period of the spring oscillation change? (Bigger, smaller, (equal))

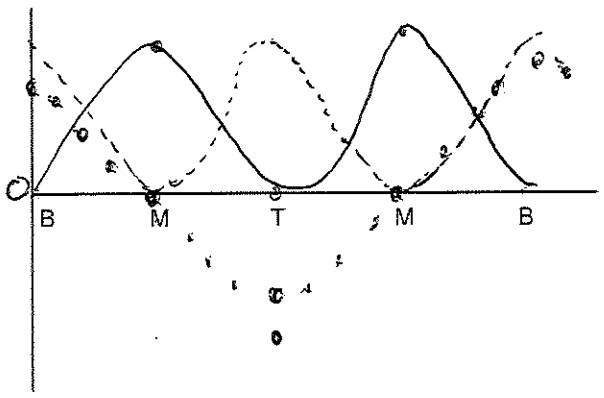
   e. If the mass of the block were increased and the experiment were repeated, how might the period of oscillation change? ((Bigger), smaller, equal)

   ✱ Not Linear

   f. In the graph, sketch out KE, PE and acceleration. (Label each)

   g. How much time does the graph track?

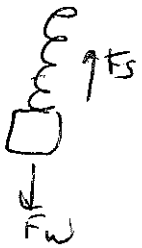
   3sec



--- PE
—— Energy (KE)
... a

Spring Simple harmonic motion
Student Work

Spring Energy and Hook's Law $F = -kx$



1. A 15 kg block is hung on a spring (k = 5Nm),
   a. How far down will the spring hang from the equilibrium point.

$F_S = F_W$ $15 \cdot 10 = 150\ N$ $150 = x \quad \frac{150}{5} = 30m$

$m \cdot g = kx$

   b. How much energy is the spring storing?

$U_s = \frac{1}{2}kx^2 \quad \frac{1}{2}(5)\,30^2 = 2250J$

2. A 15kg mass is hung on a spring, causing it to drop 20cm. ← .20m
   a. What is the spring constant?

$F_W = F_S = -kx$

$150 \cdot 10 = 150 = \frac{F_S}{x} = k \quad \frac{150}{.2} = 750\ N/m$

   b. How much energy is the spring storing?

$U_s = \frac{1}{2}kx^2 \quad \frac{1}{2}(750)(.2)^2 = 15J$

3. A 50g (0.05kg) weight is placed on a spring is placed on spring with a spring constant of 0.5Nm.
   a. What is the period of the springs motion?

$T_S = 2\pi\sqrt{\frac{m}{k}} \quad 2\pi\left(\sqrt{\frac{.05}{5}}\right) = 1.98\ sec$

   b. What is the frequency of the springs motion?

$1/1.98 = .5\ cycles/sec$

   c. How would the period of the spring change if the mass was a 25g weight? (Bigger, smaller, same)

$T = 2\pi\sqrt{\frac{m}{k}}$ ← $\sqrt{2}$ Less Numerator Proportional

   d. At the bottom, what is the U_{spring}? $U_s = \frac{1}{2}kx^2 \quad \frac{1}{2}(.05)(1)^2 = .025N$

What is x $F_W = F = -kx$ $\frac{N}{k} = x \quad \frac{.5}{.5} = 1M$

$.05 \cdot 10 = .5N$

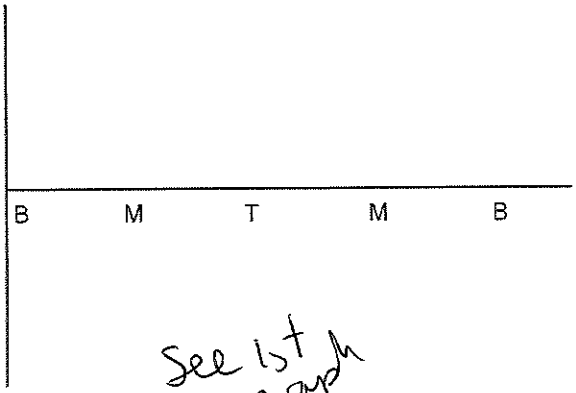
   e. At the middle what is the force of the spring?

$x = 0 \qquad 0$

   f. How far can the spring stretch?

1M

   g. In the graph, sketch out KE, PE and acceleration. (Label each)



See 1st graph