Oscillations + Waves #3

p 727 C 14, 19
p 729 P 24, 37, 43, 45
online - Energy Harmonics

p727 - Concept

14) Pendulum clock running too fast.
How fix?

$T = 2\pi\sqrt{\frac{l}{g}}$ ↑T ↑L

- move bob further from pivot

19) - pendulum
- block on spring) adjust ~~1 vibration~~ 1 vib per sec

- go to Moon, which affected? Why?

$T_s = 2\pi\sqrt{\frac{m}{k}}$ $T_p = 2\pi\sqrt{\frac{l}{g}}$

a) only T_p

b) - k + m the same on moon
- g on moon is smaller

p 729 - Problems

24) $m = 2.0\,kg$ cart on spring
$k = 18\,N/m$

a) what determine? ✓T oscillation
✓ frequency

b) $T_s = ?$ $T_s = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{2.0\,kg}{18\,N/m}}$

(1)

$T_s = 2.1\,s$

c) $f = ?$ $f = \frac{1}{T} = \frac{1}{2.1\,s} = .48\,Hz$

d) second 18 N/m spring attached, new $T_s = ?$

doubles k $T_s = 2\pi\sqrt{\frac{m}{k}} = \frac{T_s}{\sqrt{2}}$

$T_{s\,new} = 1.6\,s$

37) pendulum
$A = .020m$
$T = 2.0s$
$V_{max} = ?$

$V_{max} = A\omega = A(2\pi f)$

$= A\left(\frac{2\pi}{T}\right)$

$= .020m\left(\frac{2\pi}{2.0s}\right)$

$= .063\ m/s$

43) $l = 1.3m$
$g = 1.62\ m/s^2$

$T_p = 2\pi\sqrt{\frac{l}{g}} = 2\pi\sqrt{\frac{1.3m}{1.62\ m/s^2}}$

$= 5.6s$

45) $m = 1.2kg$
$v_0 = 6\ m/s$
$x = .10m$

block on frictionless collides w/spring

a) $K = ?$

$\mathcal{E}_0 = \mathcal{E}_f$

$K = U_s$

$\cancel{\frac{1}{2}}mv_0^2 = \cancel{\frac{1}{2}}kx^2$

$k = \frac{mv_0^2}{x^2} = \frac{(1.2kg)(6m/s)^2}{(.10m)^2} = 4320\ N/m$

b) $f = ?$

$T = 2\pi\sqrt{\frac{m}{k}}$

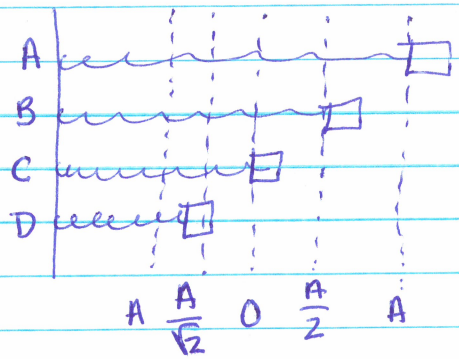
$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{4320\ N/m}{1.2kg}}$

$f = 9.5\ Hz$

c) $T = ?$

$T = 1/f = 1/9.5\ Hz = .11s$

Online - Energy of Harmonic Oscillators



A) max potential?

A (max stretch)

B) ~~max~~ min kinetic?

(no v, max x)

A ~~B~~ ~~(max v, no x)~~

c) if K is <u>increasing</u> block <u>must</u>

· be moving to equilibrium

d) max kinetic? C (max v, no x)

(2)

e) min potential? C (no x)

f) when is K = U? D

K = U when $K = \frac{1}{2} U_{max} = \frac{1}{2}(k)A^2$

@ $A\frac{2}{\sqrt{2}}$ b/c A^2 in eqn

g) $K_B = ?$

$$K_B = U_{max} - U_B$$
$$= \frac{1}{2}kA^2 - \frac{1}{2}k\left(\frac{A}{2}\right)^2$$
$$= \frac{1}{2}kA^2 - \frac{1}{8}kA^2$$
$$K_B = \frac{3}{8}kA^2$$