EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2008/2009

SECOND SEMESTER (PROPER/REPEAT)

(Sep/Oct 2010)

PH 206 WAVES AND VIBRATION

Time: 01 hour.

Answer ALL Questions

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1. An object of mass m is placed on a frictionless plane and connected with the end of a spring with spring constant k. The other end of the spring is fixed firmly on a wall.

a) Show that the motion of the object is simple harmonic motion.

b) Hence, show that the displacement of the object at any time t is given by: $x = A\sin(\omega_o t + \theta)$, where the symbols have their usual meaning.

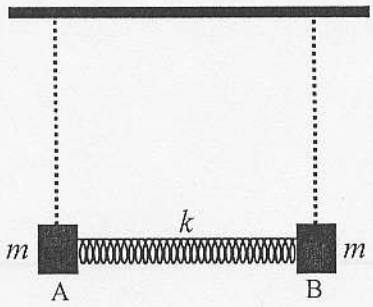
c) Show that the maximum kinetic energy and potential energy of the object in the above case is: $\frac{1}{2}kA^2$.

d) Hence, show that the total energy of the system is constant.

e) Sketch the variations of the potential energy and the kinetic energy of the object against the displacement in one graph.

f) Show that at a displacement $\frac{A}{\sqrt{2}}$ the potential and kinetic energies of the object are equal.

2. Two blocks with masses (m) are coupled by a spring to make a coup pendulum as shown in the figure below. Write down the equation motion of the masses A and B for their small horizontal oscillation alo the axis of the coupling spring of spring constant k.



a) Show that we may choose the normal coordinates,

$X = x + y$, with a normal mode frequency $\omega_1 = \omega_o$ and

$Y = x - y$, with a normal mode frequency $\omega_2^2 = \omega_o^2 + 2\omega_c^2$

b) If the system is set in motion with the initial condition $x = A, y =$ $\dot{x} = \dot{y} = 0$ at $t = 0$, show that the normal mode amplitude $X_o = Y_o =$ to yield; $x = \frac{A}{2}(\cos\omega_1 t + \cos\omega_2 t)$ and $y = \frac{A}{2}(\cos\omega_1 t - \cos\omega_2 t)$