Ch. 12 Assigned Homework

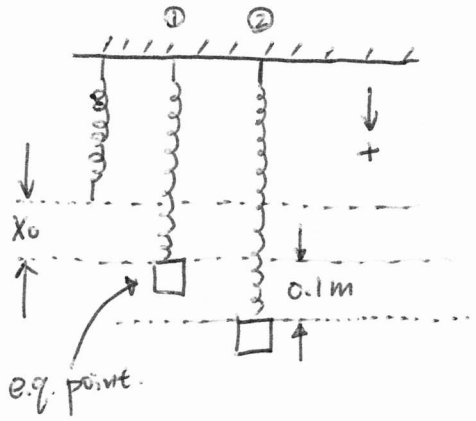
2014 Spring
PHYS 1Cb

2. $x = 4\cos(6\pi t) \Rightarrow \omega = 6\pi$ (rad/s) $\therefore T = \frac{2\pi}{\omega} = \frac{2\pi}{6\pi} = \frac{1}{3}$ (s) //

3. Total energy = $E_{total} = \frac{1}{2}kA^2$ is independent of mass (m).

$\therefore$ the energy of the system is still 12 J.

5.



① at equilibrium point, $mg = kx_0 \Rightarrow x_0 = \frac{mg}{k} = \frac{0.4\times10}{8}$

$\Rightarrow x_0 = 0.5$ (m) (let $g = 10\ m/s^2$)

② when it is at its maximum displacement of 0.1 m,

spring force $= -k\cdot(x_0+0.1) = -8\times(0.6) = -4.8$ N (↑)

gravitational force $= m\cdot g = 0.4\times10 = 4$ N (↓)

$\therefore$ net force $= -4.8+4 = -0.8$ N (↑)

$\therefore |a| = \left|\frac{F}{m}\right| = \left|\frac{-0.8}{0.4}\right| = 2\ m/s^2$ //

6. $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} \propto \frac{1}{\sqrt{m}}$ $\therefore$ frequency changes by the factor of $\frac{1}{\sqrt{9}} = \frac{1}{3}$ //

7. $f = \frac{1}{2\pi}\sqrt{\frac{g}{L}} \propto \frac{1}{\sqrt{L}}$ $\therefore$ frequency becomes $\frac{1}{\sqrt{2}}$ times as large. //

8. $K = 2U_s$. $E_{total} = K + U_s = \frac{1}{2}kA^2 \Rightarrow 2U_s + U_s = 3U_s = \frac{1}{2}kA^2$

$\therefore$ elastic potential energy $U_s = \frac{1}{3}\cdot\frac{1}{2}\cdot kA^2$

$\Rightarrow \frac{1}{3}\cdot\frac{1}{2}\cdot k\cdot A^2 = \frac{1}{2}\cdot k\cdot x^2$ $\therefore x = \frac{1}{\sqrt{3}}A$ //

9. (i) c (ii) c (iii) e

10. (i) c (ii) a (iii) a

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

(a) $T_a = 2\pi\sqrt{\frac{0.1}{10}}$

(b) $T_b = 2\pi\sqrt{\frac{0.1}{10}}$

(c) $T_c = 2\pi\sqrt{\frac{0.2}{10}}$ $\therefore$ (c) > (a) = (b) = (e) > (d)

(d) $T_d = 2\pi\sqrt{\frac{0.1}{20}}$

(e) $T_e = 2\pi\sqrt{\frac{0.1}{10}}$

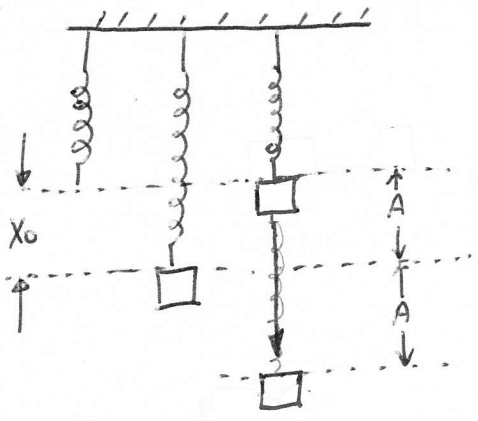
12. (a) yes (b) yes (c) no

13. $T = 2\pi\sqrt{\frac{L}{g}}$ (i) $T \propto \sqrt{L}$ $\Rightarrow$ T becomes $\sqrt{4} = 2$ times large

$\Rightarrow 2.5 \times 2 = 5$ (s) ✓

(ii) T doesn't depend on the mass. $\therefore$ T is still 2.5 (s) ✓

14.



$X_0 = 15$ cm

$\therefore$ maximum distance $= 2A = 2X_0 = 30$ cm ✓