Metropolitan University
PHY 111: Physics I
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MID ASSIGNMENT

CSE 54

(1) We know that,

$$K = \frac{mg}{x}$$

$$= \frac{3.04 \times 9.8}{0.157}$$

$$= 245.9 \ Nm^{-1}$$

Given,

$M = 3.04 kg$

$x = 15.7 cm$

$= 0.157 m$

$m = 0.520 kg$

The period of oscillation $T = 2\pi\sqrt{\frac{m}{K}}$

$$= 2\pi\sqrt{\frac{0.520}{245.9}}$$

$$= 0.29s$$

∴ The period of oscillation is 0.29s.

(2.a) Motion is repeated in every 0.484s, therefore the period of oscillation will be,

$T = 0.484s$

(2.b) we know that,

$$f = \frac{1}{T}$$

$$= \frac{1}{0.484}$$

$$= 2.07 \text{ Hz}$$

Given,

$T = 0.484s$

∴ Frequency of the oscillation would be 2.07 Hz.

(2.c) We know that,

$\omega = 2\pi f$

$= 2 \times 3.14 \times 2.07$

$= 12.9996 \text{ rad/s}$.

Get the value from 2.b

$f = 2.07 \text{ Hz}$

∴ Angular frequency of the oscillation would be

$\omega = 13.0 \text{ rad/s}$

(2.d) we know that,

$K = m\omega^2$

~~$= 512 \times (13.0 \text{ rad/s})^2$~~

~~$= 6$~~

$= (512 \times 10^{-3} \text{ kg})(13.0 \text{ rad})^2$

~~$(86.5 \text{ kg}^2)(1 \text{ N}/1)$~~

$= 86.5 \text{ N/m}$.

Given,

$m = 512 \text{ g} = 512 \times 10^{-3} \text{ kg}$

$\omega = 13.0 \text{ rad/s}$.

∴ The constant force K

$= 86.5 \text{ N/m}$

(2.e) We know that,

$V_m = \omega x_m$

$= 13.0 \times 34.7\,cm$

$= 13.0 \times 34.7\,cm \times 10^{-2}\,m$

$= 4.51\,m/s$

Given,

$x_m = 34.7\,cm$

$\omega = 13.0\,rad/s$

∴ Maximum Speed $V_m = 4.51\,m/s$.

(2.f) We know that,

$F_m = m\omega^2 x_m$

$= (512g \times 10^{-3}\,kg/1g)$

$(13.0\,rad)^2$

$(34.7cm \times 10^{-2}\,m/1cm)$

$= 30.0\,N$

Given,

$m = 512\,g = 512g \times 10^{-3}\,kg/1g$

$\omega = 13.0\,rad/s$

$x_m = 34.7\,cm =$

$= 34.7cm \times 10^{-2}\,m/cm$

∴ Maximum Force $F_m = 30.0\,N$.

(3.a) We know that,

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

$$K = \frac{4\pi^2 m}{T^2}$$

$$= \frac{4\pi^2 \times 5.22}{0.645}$$

$$= 495.3\,Nm^{-1}$$

Given,

$m = 5.22\,kg$

$T = 645\,ms$

$= 0.645\,s$

∴ The force constant of the spring $K = 495.3\,Nm^{-1}$

(3.b) We know that,

~~$V_{max} = \pm\sqrt{\frac{K}{m}} x_m^2$~~

$$x_m = \frac{V_{max}}{\sqrt{\frac{K}{m}}}$$

$$= \frac{0.153}{\sqrt{\frac{495.3}{5.22}}}$$

$$= 1.57\,cm$$

Given,

$V_{max} = 15.3\,cms^{-1}$

$= 0.153\,m$

$m = 5.22\,kg$

$K = 495.3\,Nm^{-1}$

(3.c) we know that,

$$f = \frac{1}{T}$$

$$= \frac{1}{0.645}$$

$$= 1.55\ Hz$$

Given,

$T = 645\ ms$

$= 0.645\ s$

(4.d) We know that,

Given,

$\omega = 8.38 \text{ rad/s}$

$$T = \frac{2\pi}{\omega}$$

$$\frac{1}{\nu} = \frac{2\pi}{\omega}$$

$$\nu = \frac{\omega}{2\pi}$$

$$= \frac{8.38}{2\pi}$$

$$= 1.33 s^{-1}$$

(4.e) We know that,

$$T = \frac{1}{\nu}$$

$$= \frac{1}{1.33\,s^{-1}}$$

$$= 0.751$$

Given,

$\nu = 1.33\,s^{-1}$