DPP

DAILY PRACTICE PROBLEMS

CLASS : XITH | **Solutions** | **SUBJECT : PHYSICS**

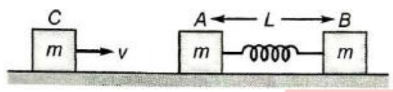
DATE : | | **DPP NO. : 4**

Topic :- OSCILLATIONS

1 **(a)**

When block (C) strikes the block (A), then it begins to oscillate, whose time period

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



Compression $x = vT = v \times 2\pi\sqrt{\frac{m}{2k}}$

$\therefore \quad x \propto v\sqrt{\frac{m}{2k}}$

2 **(d)**

Spring is cut into two equal halves so spring constant of each part $= 2k$

These parts are in parallel so $K_{eq} = 2K + 2K = 4K$

Extension force $(i.e.\ W)$ is same hence by using $F = kx$

$\Rightarrow 4k \times x' = kx \Rightarrow x' = \frac{x}{4}$

3 **(a)**

On the inclined plane, the effective acceleration due to gravity

$g' = g \cos 30°$

$= g \times \sqrt{3}/2$

$\therefore \quad T = 2\pi\sqrt{\frac{l}{g'}} = 2\pi\sqrt{\frac{2l}{\sqrt{3}g}}$

4 **(d)**

Standard equation of S.H.M. $\frac{d^2y}{dt^2} = -\omega^2 y$, is not satisfied by $y = a\tan\omega t$

5 **(c)**

$v = \omega\sqrt{(a^2 - y^2)} = 2\sqrt{60^2 - 20^2} = 113 mm/s$

6 **(d)**

Let the distance of vertical disc c of block be pushed in liquid, when block is floating, then Buoyancy force

$= abxx_\omega, g = abxg$

The mass of piece of wood $= abcd$

So acceleration $= -abxg/abcd = -\left(\frac{g}{cd}\right)x$

Hence, time period, $T = 2\pi\sqrt{\frac{dc}{g}}$

7 **(d)**

When the bob is immersed in water its effective weight

$$= \left(mg - \frac{m}{\rho}g\right) = mg\left(\frac{\rho - 1}{\rho}\right)$$

$$\therefore g_{eff} = g\left(\frac{\rho - 1}{\rho}\right)$$

$$\frac{T'}{T} = \sqrt{\frac{g}{g_{eff}}} \Rightarrow T' = T\sqrt{\frac{\rho}{(\rho - 1)}}$$

8 **(d)**

$$y = A\sin\omega t = \frac{A\sin 2\pi}{T}t \Rightarrow \frac{A}{2} = A\sin\frac{2\pi t}{T} \Rightarrow t = \frac{T}{12}$$

9 **(d)**

Time period of harmonic oscillator is independent of the amplitude of oscillation. Energy of oscillation is

$$E = \frac{1}{2}m\omega^2a^2 \ \ ie, E \propto a^2$$

So if a is double, E becomes four times.

10 **(a)**

On a planet, if a body dropped initial velocity $(u = 0)$ from a height h and takes time t to reach the ground then $h = \frac{1}{2}g_Pt^2 \Rightarrow g_P = \frac{2h}{t^2} = \frac{2 \times 8}{4} = 4\ m/s^2$

Using $T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T = 2\pi\sqrt{\frac{1}{4}} = \pi = 3.14\ sec$

11 **(a)**

$$y = kt^2$$

$$\frac{d^2y}{dt^2} = 2k$$

or $a_y = 2\ \text{ms}^{-2}$ (as $k = 1\ \text{ms}^{-2}$)

$$T_1 = 2\pi\sqrt{\frac{l}{g}}$$

and $T_2 = 2\pi\sqrt{\frac{l}{g + a_y}}$

$$\therefore \quad \frac{T_1^2}{T_2^2} = \frac{g + a_y}{g} = \frac{10 + 2}{10} = \frac{6}{5}$$

12 **(b)**

$$v_x = A(1 - \cos px)$$

$$F = -\frac{dv}{dx} = -Ap\sin px$$

For small (x)

$$F = -Ap^2x$$

$a = -\frac{Ap^2}{m}x$

$a = \omega^2 x$

$\omega = \sqrt{\frac{Ap^2}{m}}$

$\therefore \quad T = 2\pi\sqrt{\frac{m}{Ap^2}}$

13 **(c)**

$v_{\max} = a\omega = a\frac{2\pi}{T}$

$\Rightarrow a = \frac{v_{\max}T}{2\pi} = \frac{15 \times 628 \times 10^{-3}}{2 \times 3.14} = 1.5\ cm$

14 **(b)**

The time period of a pendulum of length l, is

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$\Rightarrow \quad l = g\frac{T^2}{4\pi^2}$

Since, $\quad T = 2\ s \quad$ (for second's pendulum)

$\therefore \quad l_1 = \frac{g_1(2)^2}{4\pi^2} = \frac{g_1}{\pi^2}; l_2 = \frac{g_2(2)^2}{4\pi^2} = \frac{g_2}{\pi^2}$

Since, length is decreased, g_2 is less than g_1

$\therefore \quad l_1 - l_2 = \frac{g_1 - g_2}{\pi^2}$

$\Rightarrow \quad (l_1 - l_2)\pi^2 = g_1 - g_2$

$0.3 \times 10 = g_1 - g_2$

$\therefore \quad g_2 = 981 - 3 = 978\ cms^{-2}$

15 **(d)**

In S.H.M. at mean position velocity is maximum

So $v = a\omega$ (maximum)

16 **(a)**

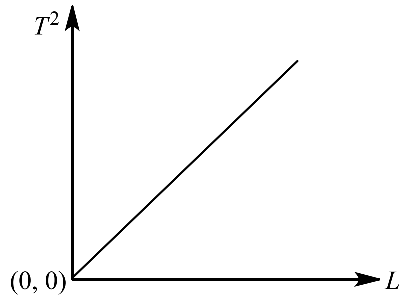
As the girl stands up, the effective length of pendulum decreases due to the reason that the centre of gravity rises up. Hence, according to

$$T = 2\pi\sqrt{\frac{l}{g}}$$

T will decrease.

17 **(a)**

$T = 2\pi\sqrt{\frac{L}{g}}$



or $T \propto \sqrt{L}$ or $T^2 \propto L$

It is linear relation between T^2 and l hence the graph between T^2 and L is a straight line passing through the origin.

18 **(c)**

The motion of a planet around the sun is a periodic motion but not a simple harmonic motion. All other given motions are the examples of simple harmonic motion

20 **(a)**

Fig. (i) alone represents damped SHM

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	D	A	D	C	D	D	D	D	A
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	B	C	B	D	A	A	C	C	A