REVISION TEST-06 (NEET) ANS KEY Dt. 28-06-2024

PHYSICS	
Q. NO.	[ANS]
1	A
2	D
3	A
4	C
5	B
6	D
7	A
8	B
9	C
10	A
11	D
12	B
13	A
14	A
15	D
16	C
17	BONUS
18	B
19	A
20	C
21	D
22	B
23	B
24	C
25	C
26	B
27	D
28	A
29	B
30	C
31	C
32	D
33	B
34	A
35	B
36	B
37	C
38	B
39	A
40	B
41	B
42	B
43	B
44	C
45	B

Single Correct Answer Type

1 **(a)**

$v = \sqrt{2gR} \ \therefore \frac{v_1}{v_2} = \sqrt{\frac{g_1}{g_2} \times \frac{R_1}{R_2}} = \sqrt{g \times K} = (Kg)^{1/2}$

2 **(d)**

Gravitational potential energy is given as

$$U = -\frac{GMm}{r}$$

$$U_1 = -\frac{GMm}{r_1}, U_2 = -\frac{GMm}{r_2}$$

As $r_2 > r_1$, hence,

$$U_1 - U_2 = GMm\left[\frac{r_2 - r_1}{r_1 r_2}\right] \text{ is positie}$$

ie, $U_1 > U_2$

or $U_2 < U_1$

ie, gravitational potential energy increases.

3 **(a)**

$g = \frac{4}{3}\pi G\rho R \Rightarrow g \propto \rho R \Rightarrow \frac{g_e}{g_m} = \frac{\rho_e}{\rho_m} \times \frac{R_e}{R_m}$

$\Rightarrow \frac{6}{1} = \frac{5}{3} \times \frac{R_e}{R_m} \Rightarrow R_m = \frac{5}{18}R_e$

4 **(c)**

$H = \frac{u^2}{2g} \Rightarrow H \propto \frac{1}{g} \Rightarrow \frac{H_B}{H_A} = \frac{g_A}{g_B}$

Now $g_B = \frac{g_A}{12}$ as $g \propto \rho R$

$\therefore \frac{H_B}{H_A} = \frac{g_A}{g_B} = 12$

$\Rightarrow H_B = 12 \times H_A = 12 \times 1.5 = 18m$

5 **(b)**

Gravitational force provides the required centripetal force *ie*,

$$m\omega^2 R = \frac{GMm}{R^{\frac{5}{2}}}$$

$$\Rightarrow \quad \frac{m4\pi^2}{T^2} = \frac{GMm}{R^{\frac{7}{2}}}$$

$$\Rightarrow \quad T^2 \propto R^{7/2}$$

6 **(d)**

$v_0 = \sqrt{\frac{GM}{r}} = \sqrt{\frac{gR^2}{R+h}}$

7 **(a)**

8 **(b)**

$\frac{T^2}{r^3}$ = constant $\Rightarrow T^2 r^{-3}$ = constant

9 **(c)**

$\frac{T_{\text{mercury}}}{T_{\text{earth}}} = \left(\frac{r_{\text{mercury}}}{r_{\text{earth}}}\right)^{3/2} = \left(\frac{6 \times 10^{10}}{1.5 \times 10^{11}}\right)^{3/2} = \frac{1}{4}$

(approx.)

$\therefore T_{\text{mercury}} = \frac{1}{4}\text{year}$

10 **(a)**

As in case of elliptic orbit of a satellite mechanical energy

$E = -(GMm/2a)$ remains constant, at any position of satellite in the orbit,

$\text{KE} + \text{PE} = -\frac{GMm}{2a}$ ...(i)

Now, if at position r, v is the orbital speed of satellite

$\text{KE} = \frac{1}{2}mv^2$ and $\text{PE} = -\frac{GMm}{r}$ ...(ii)

So, from Eqs. (i) and (ii), we have

$$\frac{1}{2}mv^2 - \frac{GMm}{r} = -\frac{GMm}{2a}, ie, v^2 = GM\left[\frac{2}{r} - \frac{1}{a}\right]$$

11 **(d)**

$$\frac{K_A}{K_B} = \frac{r_B}{r_A} = \left(\frac{R+h_B}{R+h_A}\right) = \left(\frac{R+2R}{R+R}\right) = \frac{3}{2}$$

12 **(b)**

From Kepler's third law of planetary motion

$$T^2 \propto R^3$$

Given, $T_1 = 1, T_2 = 8, R_1 = R$

$$\therefore \quad \frac{T_1^2}{T_2^2} = \frac{R_1^3}{R_2^3}$$

$$R_2^3 = R_1^3 \frac{T_2^2}{T_1^2}$$

$$R_2^3 = R_1^3 \times (8)^2$$

$$R_2^3 = R^3 \times (2^3)^2$$

$$\Rightarrow \quad R_2 = R \times 4 = 4R$$

13 **(a)**

$g' = \frac{GM}{(R+h)^2}$, acceleration due to gravity at height h

$$\Longrightarrow \quad \frac{g}{9} = \frac{GM}{R^2} \cdot \frac{R^2}{(R+h)^2}$$

$$= g\left(\frac{R}{R+h}\right)^2$$

$$\Longrightarrow \quad \frac{1}{9} = \left(\frac{R}{R+h}\right)^2$$

$$\Longrightarrow \quad \frac{R}{R+h} = \frac{1}{3}$$

$$\Longrightarrow \quad 3R = R + h$$

$$\Longrightarrow \quad 2R = h$$

14 **(a)**

Since the gravitational field is conservative field, hence, the work done in taking a particle from one point to another in a gravitational field is path independent

15 **(d)**

At height $h', \frac{g'}{g} = 1 - \frac{2h}{R} = \frac{90}{100}$

or $\frac{2h}{R} = 1 - \frac{90}{100} = \frac{10}{100} = \frac{1}{10}$

or $R = 20h = 20 \times 320 = 6400\ km$

At dept $d, \frac{g'}{g} = 1 - \frac{d}{R} = \frac{95}{100}$

or $\frac{d}{R} = 1 - \frac{95}{100} = \frac{5}{100} = \frac{1}{20}$

or $d = \frac{R}{20} = \frac{6400}{20} = 320\ \text{km}$

16 **(c)**

$$T = 2\pi\sqrt{\frac{r^3}{GM}} \Rightarrow T^2 = \frac{4\pi^2}{GM}(R+h)^3$$

$$\Rightarrow R + h = \left[\frac{GMT^2}{4\pi^2}\right]^{1/3} \Rightarrow h = \left[\frac{GMT^2}{4\pi^2}\right]^{\frac{1}{3}} - R$$

17 **(bonus)**

From Kepler's third law of planetary motion also known as law of periods

18 **(b)**

$v_e = \sqrt{2}\, v_o, i.e.$ if the orbital velocity of moon is increased by factor of $\sqrt{2}$ then it will escape out from the gravitational field of earth

20 **(c)**

Force on the body $= \frac{GMm}{x^2}$

To move it by a small distance dx,

Work done $= F\,dx = \frac{GMm}{x^2}dx$

Total work done $= GMm \int_R^{R+h} \frac{dx}{x^2} = \left[\frac{-GMm}{x}\right]_R^{R+h}$

$$= GMm\left[\frac{1}{R} - \frac{1}{R+h}\right]$$

$$= \left[\frac{(R+h) - R}{R(R+h)}\right] = \frac{GMmh}{R(R+h)}$$

$$\frac{GM}{R^3} \times \frac{mhR}{R+h} = \frac{gmhR}{R+h} = \frac{PRh}{R+h}$$

21 **(d)**

$$T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T \propto \frac{1}{\sqrt{g}} \Rightarrow \frac{T_P}{T_e} = \sqrt{\frac{g_e}{g_P}} = \sqrt{\frac{2}{1}} \Rightarrow T_P = \sqrt{2}T_e$$

22 **(b)**

$\frac{d^2x}{dt^2} = -\alpha x$ ...(i)

We know,

$a = \frac{d^2y}{dt^2} = -\omega^2 x$ ...(ii)

From Eqs.(i) and (ii), we have

$\omega^2 = \alpha$

$\omega = \sqrt{\alpha}$

or $\frac{2\pi}{T} = \sqrt{\alpha}$

∴ $T = \frac{2\pi}{\sqrt{\alpha}}$

23 **(b)**

Motion given here is SHM starting from rest

24 **(c)**

The average acceleration of a particle performing SHM over one complete oscillation is zero.

26 **(b)**

$x = A\cos(\omega t + \theta);$

Velocity, $v = \frac{dx}{dt} = -A\omega\sin(\omega t + \theta)$

$= -A\omega\sqrt{1 - \cos^2(\omega t + \theta)}$

$= -A\omega\sqrt{1 - x^2/A^2} = -\omega\sqrt{A^2 - x^2}$

Here, $v = \pi \text{ cms}^{-1}, x = 1 \text{ cm}, \omega = \pi\text{s}^{-1}$

So $\pi = -\pi\sqrt{A^2 - 1^2}$

or $(-1)^2 = A^2 - 1 \;\; or \;\; A^2 = 2$

or $A = \sqrt{2}\,\text{cm}$

27 **(d)**

For simple harmonic motion, $y = a\sin\ \omega t$

$\therefore \quad y = a\sin\ \left(\frac{2\pi}{T}\right)t$ (at t=2 s)

$y_1 = a\sin\ \left[\left(\frac{2\pi}{16}\right) \times 2\right]$

$= a\sin\left(\frac{\pi}{4}\right) = \frac{a}{\sqrt{2}}$ ...(i)

At t=4 s or after 2 s from mean position.

$y_1 = \frac{a}{\sqrt{2}}$, velocity=4 ms^{-1}

$\therefore$ Velocity = $\omega\sqrt{a^2 - y_1^2}$

or $4 = \left(\frac{2\pi}{16}\right)\sqrt{a^2 - \frac{a^2}{2}}$ [From Eq. (i)]

or $4 = \frac{\pi}{8} \times \frac{a}{\sqrt{2}}$

or $a = \frac{32\sqrt{2}}{\pi}$ m

28 **(a)**

The given equation is written as,

$y = 3\sin\left(100\,t + \frac{\pi}{6}\right)$ ...(i)

The general equation of simple harmonic motion is written as

$y = a\sin(\omega t + \emptyset)$ ...(ii)

Equating Eqs. (i) and (ii), we get

$a = 3, \omega = 100$

Maximum velocity, $v = a\omega$

$= 3 \times 100 = 300 \text{ ms}^{-1}$

29 **(b)**

Length of the line = Distance between extreme positions of oscillation $= 4\,cm$

So, Amplitude $a = 2\,cm$

also $v_{\max} = 12\,cm/s$

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

$\Rightarrow T = \frac{2\pi a}{v_{\max}} = \frac{2 \times 3.14 \times 2}{12} = 1.047\,s$

30 **(c)**

When $t = \frac{T}{12}$, then $x = A\sin\frac{2\pi}{T} \times \frac{T}{12} = \frac{A}{2}$

$\text{KE} = \frac{1}{2}\,mv^2 = \frac{1}{2}\,m\omega^2(r^2 - x^2)$

$= \frac{1}{2}\,m\omega^2\left(A^2 - \frac{A^2}{4}\right)$

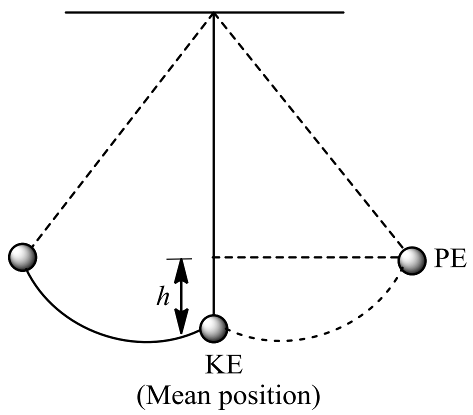
$= \frac{3}{4}\left(\frac{1}{2}\,m\omega^2 A^2\right)$

$\text{PE} = \frac{1}{2}\,m\omega^2 x^2 = \frac{1}{4}\left(\frac{1}{2}\,m\omega^2 A^2\right)$

$\frac{\text{KE}}{\text{PE}} = \frac{3}{1}$

31 **(c)**

The bob possess kinetic energy at its mean position which gets converted to potential energy at height h. But the total energy remains converted.



Hence, we have

KE=PE

Let velocity of the bob at mean position be v and m be its mass, then we have

$$\frac{1}{2}mv^2 = mgh$$

$\Rightarrow$ $v = \sqrt{2gh}$

Putting $g = 9.8\ \text{ms}^{-2}, h = 0.1\ \text{m}$

$\therefore$ $v = \sqrt{2 \times 9.8 \times 0.1} = 1.4\ \text{ms}^{-1}$

32 **(d)**

$y = a\sin\omega t; v = \dfrac{dy}{dt} = a\omega\cos\omega t$

$= a\omega\sin(\omega t + \pi/2)$

Acceleration $A = \frac{dv}{dt} = -\omega^2 a\sin\omega t$

$= \omega^2 a\sin(\omega t + \pi)$

33 **(b)**

Maximum acceleration = Maximum velocity$\times\pi$

$ie,$ $\omega^2 A = \pi\omega A$

where A is amplitude and ω is angular velocity.

$\Rightarrow$ $\omega = \pi$

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

$\Rightarrow$ $T = 2$ s

34 **(a)**

At the time $t = \frac{T}{4} = \frac{4}{4} = 1\ \text{sec}$ after passing from mean position, the body reaches at it's extreme position. At extreme, position velocity of body becomes zero

35 **(b)**

$y = 4\cos^2\left(\dfrac{t}{2}\right)\sin 1000\,t$

$\Rightarrow y = 2(1 + \cos t)\sin 1000\,t$

$\Rightarrow y = 2\sin 1000\,t + 2\cos t\sin 1000\,t$

$\Rightarrow y = 2\sin 1000\,t + \sin 999\,t + \sin 1001\,t$

It is a sum of three S.H.M.

36 **(b)**

PE varies from zero to maximum. It is always positive sinusoidal function

37 **(c)**

$y = A\sin PT + B\cos PT$

Let $A = r\cos\theta, B = r\sin\theta$

$\Rightarrow y = r\sin(PT + \theta)$ which is the equation of SHM

38 **(b)**

$n = \frac{1}{2\pi}\sqrt{\frac{g}{l}} \Rightarrow n \propto \frac{1}{\sqrt{l}} \Rightarrow \frac{n_1}{n_2} = \sqrt{\frac{l_2}{l_1}} = \sqrt{\frac{L_2}{2L_2}}$

$\Rightarrow \frac{n_1}{n_2} = \frac{1}{\sqrt{2}} \Rightarrow n_2 = \sqrt{2}n_1 \Rightarrow n_2 > n_1$

Energy $E = \frac{1}{2}m\omega^2 a^2 = 2\pi^2 mn^2 a^2$

$\Rightarrow \frac{a_1^2}{a_2^2} = \frac{m_2 n_2^2}{m_1 n_1^2}$ [$\because E$ is same]

Given $n_2 > n_1$ and $m_1 = m_2 \Rightarrow a_1 > a_2$

39 **(a)**

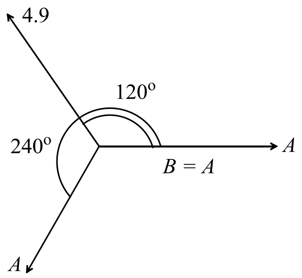
On the inclined plane, the effective acceleration due to gravity

$g' = g\cos 30°$

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

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

40 **(b)**



So $B = A, \phi = 240° = \frac{4\pi}{3}$

Assertion - Reasoning Type

42 **(b)**

Acceleration due to gravity,

$g' = g - R\omega^2\cos^2\lambda$

At equator, $\lambda = 0°$ $i.e.\cos 0° = 1 \therefore g_e = g - R\omega^2$

At poles, $\lambda = 90°$ $i.e.\cos 90° = 0 \therefore g_p = g$

Thus, $g_p = g_e = g - g + R\omega^2 = R\omega^2$

Also, the value of g is maximum at poles and minimum at equators

43 **(b)**

If root mean square velocity of the gas molecules is less than escape velocity from that planet (or satellite) then atmosphere will remain attached with that planet and if $v_{rms} > u_{escape}$ then there will be no atmosphere on the planet. This is the reason for no atmosphere at moon

44 **(c)**

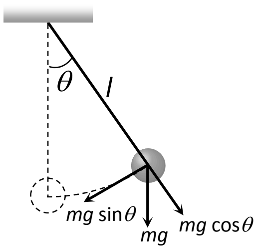
Amplitude of oscillation for a forced, damped oscillator is $A = \frac{F_0/m}{\sqrt{(\omega^2-\omega_0^2)+(b\omega/m)^2}}$, where b is constant related to the strength of the resistive force, $\omega_0 = \sqrt{k/m}$ is natural frequency of undamped oscillator $(b = 0)$

When the frequency of driving force $(\omega) \approx \omega_0$, then amplitude A is very larger.

For $\omega < \omega_0$ or $\omega > \omega_0$, the amplitude decreases

45 **(b)**

In simple pendulum, when bob is in deflection position, the tension in the spring is $T = mg\cos\theta + \frac{mv^2}{l}$. Since the value of θ is different at different positions, hence tension in the string is not constant throughout the oscillation



At end points θ is maximum; the value of $\cos\theta$ is least, hence the value of tension in the string is least. At the mean position, the value of $\theta = 0°$ and $\cos 0° = 1$, so the value of tension is largest

Also velocity is given by $v = \omega\sqrt{a^2 - y^2}$ which is maximum when $y = 0$, at mean position