DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
Date :

Solutions

SUBJECT : PHYSICS
DPP No. : 3

Topic :- GRAVITATION

1 **(c)**

For $r \leq R$:

$$\frac{mv^2}{r} = \frac{Gmm'}{r^2}$$

Here, $m' = \left(\frac{4}{3}\pi r^3\right)\rho_0$

Substituting in Eq. (i) we get

$$v \propto r$$

ie, v–r graph is a straight line passing through orgine.

For $r > R$:

$$\frac{mv^2}{r} = \frac{G\,m\left(\frac{4}{3}\pi R^3\right)\rho_0}{r^2}$$

or $v \propto \frac{1}{\sqrt{r}}$

The corresponding v–r graph will be as shown in option (c).

2 **(c)**

$$g = \frac{GM}{R^2} = \frac{GM_0}{(D_0/2)^2} = \frac{4GM_0}{D_0^2}$$

3 **(c)**

If x is the distance of point on the line joining the two masses from mass m_2' where gravitational field intensity is zero, then

$$\frac{Gm}{(r - x)^2} = \frac{Gm_2}{x^2} \text{ or } \frac{2}{(9 - x)^2} = \frac{8}{x^2}$$

or $\frac{1}{9 - x} = \frac{2}{x}$

On solving, $x = 6$

5 **(a)**

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

6 **(b)**

As $T^2 \propto r^3$,

so, $\frac{T_A^2}{T_B^2} = \frac{r_A^3}{r_B^3}$

or $\frac{r_A}{r_B} = \left(\frac{T_A}{T_B}\right)^{2/3} = (8)^{2/3} = 4$

or $r_A = 4r_B$;

so $r_A - r_B = 4r_B - r_B = 3r_B$

7 **(c)**

Weight of the body at equator $= \frac{3}{5}$ of initial weight

$\therefore g' = \frac{3}{5}g$ (because mass remains constant)

$g' = g - \omega^2 R \cos^2 \lambda \Rightarrow \frac{3}{5}g = g - \omega^2 R \cos^2(0^\circ)$

$\Rightarrow \omega^2 = \frac{2g}{5R} \Rightarrow \omega = \sqrt{\frac{2g}{5R}} = \sqrt{\frac{2 \times 10}{5 \times 6400 \times 10^3}}$

$= 7.8 \times 10^{-4} \frac{rad}{sec}$

8 **(c)**

$\frac{T_1}{T_2} = \left(\frac{R_1}{R_2}\right)^{3/2} = \left(\frac{R}{4R}\right)^{3/2} \Rightarrow T_2 = 8T_1$

9 **(a)**

Escape velocity of a body from the surface of earth is 11.2 kms^{-1} which is independent of the angle of project

11 **(b)**

$v = \sqrt{\frac{GM}{R}} = G^{1/2}M^{1/2}R^{-1/2}$

12 **(d)**

Since, velocity of projection $(v)$is greater than the escape velocity (v_e),therefore at infinite distance the body moves with a velocity

$$v' = \sqrt{v^2 - v_e^2}$$

$$\therefore \quad v' = \sqrt{(\sqrt{5}v_e)^2 - v_e^2} = 2v_e$$

13 **(c)**

Gravitational field inside hollow sphere will be zero

14 **(d)**

When $r < R$, Gravitational field intensity,

$I = \frac{GM}{R^3} r = \frac{Gr}{R^3}\left(\frac{4}{3}\pi R^3 \rho\right) = \frac{4\pi G \rho r}{3}$

15 **(a)**

Escape velocity $v = \sqrt{2gR}$

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

16 **(b)**

Orbital speed, $v_0 = \sqrt{\frac{GM}{r}}$; so speed of satellite decreases with the increase in the radius of its orbit. We need more than one satellite for global communication. For stable orbit it must pass through the centre of earth. So, only (b) is correct

17 **(c)**

$$g = \frac{GM}{R^2} \therefore g \propto \frac{M}{R^2}$$

According to problem $M_p = \frac{M_e}{2}$ and $R_p = \frac{R_e}{2}$

$$\therefore \frac{g_p}{g_e} = \left(\frac{M_p}{M_e}\right)\left(\frac{R_e}{R_p}\right)^2 = \left(\frac{1}{2}\right) \times (2)^2 = 2$$

$$\Rightarrow g_p = 2g_e = 2 \times 9.8 = 19.6\ m/s^2$$

18 **(c)**

The escape velocity of a particle

$$v_e = \sqrt{2gR}$$

Hence, the escape velocity is independent of mass of the particle.

19 **(b)**

Gravity, $g = \frac{GM}{R^2}$

$$\therefore \frac{g_{earth}}{g_{planet}} = \frac{M_e}{M_p} \times \frac{R_p^2}{R_e^2}$$

$$\Rightarrow \frac{g_e}{g_p} = \frac{2}{1}$$

Also, $T \propto \frac{1}{\sqrt{g}} \Rightarrow \frac{T_e}{T_p} = \sqrt{\frac{g_p}{g_e}}$

$$\Rightarrow \frac{2}{T_p} = \sqrt{\frac{1}{2}} \Rightarrow T_p = 2\sqrt{2}s$$

20 **(c)**

From Kepler's second law of planetary motion, the linear speed of a planet is maximum, when its distance from the sun is least, *ie*, at point A.

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