DPP
DAILY PRACTICE PROBLEMS

Class : XIth
Date :

Solutions

SUBJECT : PHYSICS
DPP No. : 2

TOPIC :- GRAVITATION

1 **(b)**

For a moving satellite kinetic energy $=\frac{GMm}{2r}$

Potential energy $=\frac{-GMm}{r} \Rightarrow \therefore \frac{\text{Kinetic energy}}{\text{Potential energy}}=\frac{1}{2}$

2 **(b)**

$I=\frac{-dV}{dr}$. If $I=0$ then $V=$ constant

3 **(b)**

$$v=\sqrt{2gR} \Rightarrow \frac{v_A}{v_B}=\sqrt{\frac{g_A}{g_B}\times\frac{R_A}{R_B}}=\sqrt{k_1\times k_2}=\sqrt{k_1k_2}$$

4 **(d)**

Orbital radius of satellites $r_1=R+R=2R$

$r_2=R+7R=8R$

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

$K_1=\frac{GMm}{2r_1}$ and $K_2=\frac{GMm}{2r_2}$

$E_1=\frac{GMm}{2r_1}$ and $E_2=\frac{GMm}{2r_2}$

$$\therefore \frac{U_1}{U_2}=\frac{K_1}{K_2}=\frac{E_1}{E_2}=4$$

6 **(c)**

If no external torque acts on a system, then angular momentum of the system does not change.

ie, If $\tau=0$

$$\Rightarrow \frac{dL}{dt}=0$$

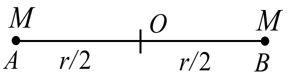
$\therefore$ $L=$ constant

Hence, $mv_{\max}r_{\min}=mv_{\min}r_{\max}$

$$\Rightarrow r_{\min}=\frac{v_{\min}\times r_{\max}}{v_{\max}}$$

$$= \frac{1 \times 10^3 \times 4 \times 10^4}{3 \times 10^4} = \frac{4}{3} \times 10^3 \text{km}$$

7 **(d)**



Gravitational potential of A at $O = -\frac{GM}{r/2} = -\frac{2GM}{r}$

For B, potential at $O = -\frac{GM}{r/2} = -\frac{2GM}{r}$

$\therefore$ Total potential $= -\frac{4GM}{r}$

8 **(b)**

Orbital radius of Jupiter > Orbital radius of Earth

$\frac{v_J}{v_e} = \frac{r_e}{r_J}$. As $r_J > r_e$ therefore $v_J < v_e$

9 **(d)**

% change in $T = \frac{3}{2}$ (% change in R) $= \frac{3}{2} \times (2)\% = 3\%$

11 **(b)**

From Kepler's third law of planetary motion

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

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

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

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

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

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

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

12 **(c)**

$$g = \frac{4}{3} G\pi R\rho \Rightarrow \frac{g_1}{g_2} = \frac{\rho_1 R_1}{\rho_2 R_2} = \frac{1}{2} \times \frac{4}{1} = \frac{2}{1}$$

13 **(b)**

Gravitational acceleration is given by

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

where G = gravitational constant

$$\therefore \quad \frac{g}{G} = \frac{M}{R^2}$$

15 **(c)**

Let x be the distance of point from the smaller body where gravitational intensity is zero.

$$\therefore \frac{Gm_1}{(1-x)^2} = \frac{Gm_2}{x^2}$$

or $\frac{x}{1-x} = \sqrt{\frac{m_2}{m_1}} = \sqrt{\frac{1000}{100{,}000}} = \frac{1}{10}$

or $10x = -x$

or $x = (1/11)\text{m}$

17 **(b)**

From kepler's third law of planetary motion:

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

Given, $T_p = 27T_{e'}$

$$\frac{T_e^2}{T_p^2} = \frac{R_e^3}{R_p^3}$$

$$\frac{T_e^2}{(27T_e)^2} = \frac{R_e^3}{R_p^3}$$

$$\frac{R_p}{R_e} = (27)^{1/2}$$

$$\frac{R_p}{R_e} = 3^2$$

$$R_p = 9R_e$$

18 **(a)**

$$g' = g\left(\frac{R}{R+h}\right)^2 = g\left(\frac{R}{R+\frac{R}{2}}\right)^2 = \frac{4}{9}g$$

$$\therefore W' = \frac{4}{9} \times W = \frac{4}{9} \times 72 = 32N$$

19 **(b)**

The acceleration due to gravity

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

At a height h above the earth's surface, the acceleration due to gravity is

$$g' = \frac{GM}{(R+h)^2}$$

$$\therefore \quad \frac{g}{g'} = \left(1+\frac{\text{h}}{R}\right)^{-2} = \left(1+\frac{\text{h}}{R}\right)^2$$

$$\frac{g'}{g} = \left(1+\frac{\text{h}}{R}\right)^{-2} = \left(1-\frac{2h}{R}\right)$$

but $g' = \frac{g}{2}$ (given)

$$\therefore \quad \frac{g/2}{g} = 1 - \frac{2h}{R}$$

$$\frac{2h}{R} = \frac{1}{2}$$

$$h = \frac{R}{4}$$

20 **(b)**

Since, gravitation provides centripetal force

$\frac{mv^2}{r} = \frac{k}{r^{5/2}}$ $ie, v^2 = \frac{k}{mr^{3/2}}$

So that $T = \frac{2\pi r}{v} = \sqrt{\frac{mr^{3/2}}{k}}$ $ie, T^2 = \frac{4\pi^2 m}{k} r^{7/2}$

$\therefore T^2 \propto r^{7/2}$

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