DPP 02

Q.1 A satellite is moving in a low nearly circular orbit around the earth. Its radius is roughly equal to that of the earth's radius R_e. By firing rockets attached to it, its speed is instantaneously increased in the direction of its motion so that it become $\sqrt{\frac{3}{2}}$ times larger. Due to this, the farthest distance from the centre of the earth that the satellite reaches is R. Value of R is

(A) $4R_e$ (B) $2.5R_e$ (C) $3R_e$ (D) $2R_e$

Q.2 A body is moving in a low circular orbit about a planet of mass M and radius R. The radius of the orbit can be taken to be R itself. Then the ratio of the speed of this body in the orbit to the escape velocity from the planet is

(A) $\sqrt{2}$ (B) 2 (C) $\frac{1}{\sqrt{2}}$ (D) 1

Q.3 Planet A has mass M and radius R. Planet B has half the mass and half the radius of planet A. If the escape velocities from the planets A and B are v_A and v_B, respectively, then $\frac{v_A}{v_B} = \frac{n}{4}$. The value of n is

(A) 3 (B) 4 (C) 1 (D) 2

Q.4 A spaceship orbits around a planet at a height of 20 km from its surface. Assuming that only gravitational field of the planet acts on the spaceship, what will be the number of complete revolutions made by the spaceship in 24 hours around the planet?

[Given: Mass of planet $= 8 \times 10^{22}$ kg, Radius of planet $= 2 \times 10^6$ m, Gravitational constant $G = 6.67 \times 10^{-11}\ \text{N m}^2/\text{kg}^2$]

(A) 13 (B) 9 (C) 17 (D) 11

Q.5 The time period of a satellite of earth is 5hour. If the separation between the earth and the satellite is increased to 4 times the previous value, the new time period will become

(A) 10 hour (B) 80 hour (C) 40 hour (D) 20 hour

Q.6 If suddenly the gravitational force of attraction between Earth and a satellite revolving around it becomes zero, then the satellite will

(A) continue to move in its orbit with same velocity

(B) move tangentially to the original orbit in the same velocity

(C) become stationary in its orbit

(D) move towards the earth.

Q.7 Three identical point masses, each of mass 1 kg lie in the $x - y$ plane at points (0,0), (0,0.2m) and (0.2m, 0). The net gravitational force on the mass at the origin is

(A) $1.67 \times 10^{-9}(\hat{i} + \hat{j})N$ (B) $3.34 \times 10^{-10}(\hat{i} + \hat{j})N$

(C) $1.67 \times 10^{-9}(\hat{i} - \hat{j})N$ (D) $3.34 \times 10^{-10}(\hat{i} + \hat{j})N$

Q.8 As observed from the earth, the sun appears to move in an approximate circular orbit. For the motion of another planet like mercury as observed from the earth, this would

(A) be similarly true

(B) not be true because the force between the earth and mercury is not inverse square law

(C) not be true because the major gravitational force on mercury is due to the sun

(D) not be true because mercury is influenced by forces other than gravitational forces

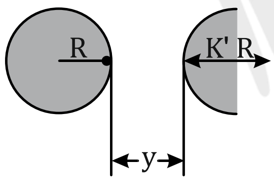
Q.9 Two particles of equal mass m go round a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is

(A) $\frac{1}{2R}\sqrt{\frac{1}{Gm}}$ (B) $\sqrt{\frac{Gm}{2R}}$ (C) $\frac{1}{2}\sqrt{\frac{Gm}{R}}$ (D) $\sqrt{\frac{4Gm}{R}}$

Q.10 A small body of superdense material, whose mass is twice the mass of the earth but whose size is very small compared to the size of the earth, starts from rest at a height $H << R$ above the earth's surface, and reaches the earth's surface in time t. Then t is equal to

(A) $\sqrt{2H/g}$ (B) $\sqrt{H/g}$ (C) $\sqrt{2H/3g}$ (D) $\sqrt{4H/3g}$

Q.11 In a cosmic event, suppose a planet heavier than the earth with mass $KM(K > 1)$ and radius $K'R(K' > 1)$ passes through a path near the earth (M and R are the mass and radius of earth). At what closest distance from surface of planet, we are in danger of being thrown into space?



(A) $\left[\frac{2KGM}{g}\right]^{1/2} - \frac{1}{2}K'R$ (B) $\left[\frac{KGM}{2g}\right]^{1/2} - \frac{1}{2}K'R$

(C) $\left[\frac{KGM}{g}\right]^{1/2} - \frac{1}{2}K'R$ (D) $\left[\frac{KGM}{g}\right]^{1/2} - K'R$

Q.12 The mass of a satellite is M/81 and radius is R/4 where M and R are the mass and radius of the planet. The distance between the surfaces of planet and its satellite will be at least greater than

(A) 1.25R (B) 12.5R (C) 10.5R (D) 5R

ANSWER KEY

1.	(C)	**2.**	(C)	**3.**	(B)	**4.**	(D)	**5.**	(C)	**6.**	(B)	**7.**	(A)
8.	(C)	**9.**	(C)	**10.**	(C)	**11.**	(D)	**12.**	(A)				