Chapter 11

Gravitation

Exercise

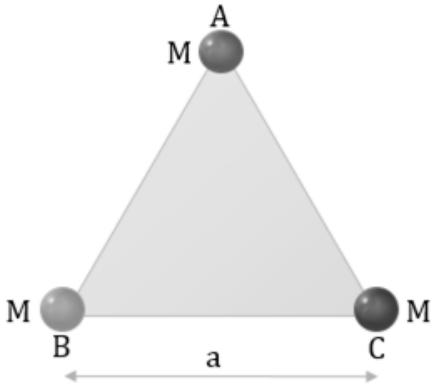
Q.1 If the mass of the moon is$M/81$, where Mthe mass of the earth is, find the distance of the point where the gravitational field due to earth and moon cancel each other, from the center of the moon. Given that the distance between the centers of the earth and moon is 60 R where R the radius of earth is.

(A) 4 R **(B)** 8 R **(C)** 12 R **(D)** 6 R

Q.2 A thin rod of length L is bent to form a circle. Its mass isM. What force will act on the mass m placed at the centre of the circle?

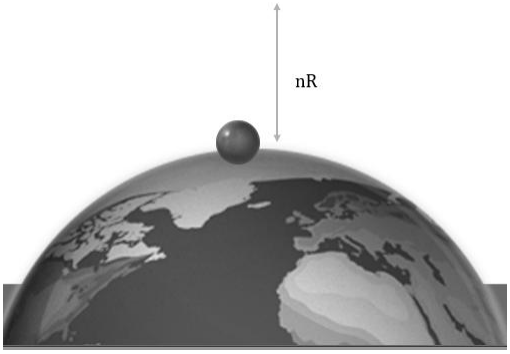
(A) $\frac{4\pi^2 GMm}{L^2}$ **(B)** $\frac{GMm}{4\pi^2 L^2}$ **(C)** $\frac{2\pi GMm}{L^2}$ **(D)** zero

Q.3 If three particles, each of mass M, are placed at the three corners of an equilateral triangle of side a, the forces exerted by this system on another particle of mass M placed (i) at the midpoint of a side and (ii) at the centre of the triangle are respectively,



(A) $0, \frac{4GM^2}{3a^2}$ **(B)** $\frac{4GM^2}{3a^2}, 0$ **(C)** $\frac{3GM^2}{a^2}, \frac{GM^2}{a^2}$ **(D)** 0,0

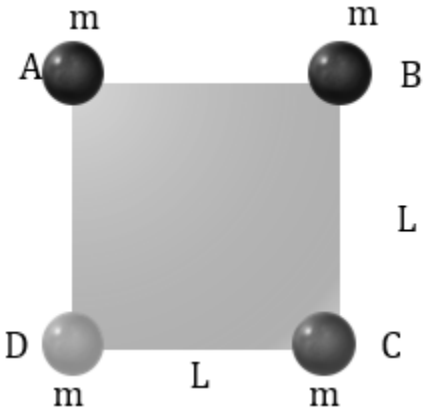
Q.4 The change in potential energy when a body of mass m is raised to height nR from the earth's surface is (R is radius of earth)



(A) $\Delta U = \left(\frac{n+1}{n}\right)\frac{GMm}{R}$ **(B)** $\frac{GMm}{R}$

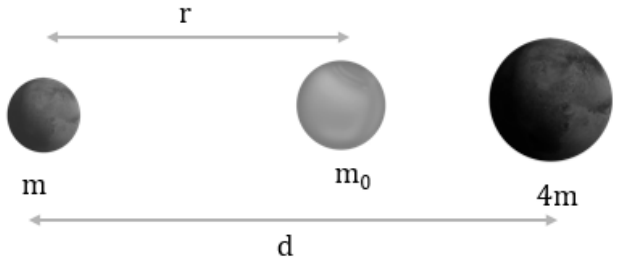
(C) $\Delta U = \left(\frac{n}{n+1}\right)\frac{GMm}{R}$ **(D)** $\Delta U = -\left(\frac{n}{n+1}\right)\frac{GMm}{R}$

Q.5 Four particlesA,B,C and D each of mass m are kept at the corners of a square of side L. Now the particle D is taken to infinity by an external agent keeping the other particles fixed at their respective positions. The work done by the gravitational force acting on the particle D during its movement is



(A) $\frac{Gm^2}{L}$ **(B)** $\frac{2Gm^2}{L}$ **(C)** $\frac{Gm^2}{L}\left(\frac{2\sqrt{2}+1}{\sqrt{2}}\right)$ **(D)** $-\frac{Gm^2}{L}\left(\frac{2\sqrt{2}+1}{\sqrt{2}}\right)$

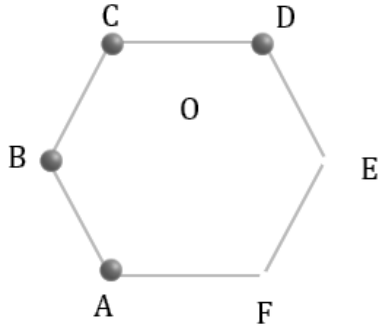
Q.6 Two point masses m and $4m$ are separated by a distance d on a straight line as shown in figure. A third point mass mo is to be placed at a point on the line such that the net gravitational force on it is zero.



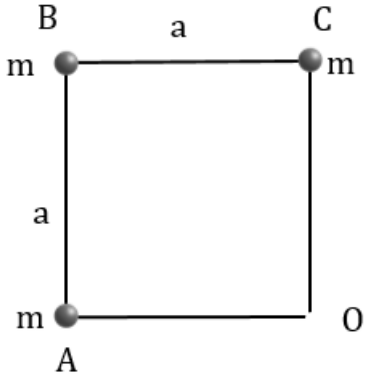
(A) $\frac{d}{2}$ **(B)** $\frac{d}{4}$ **(C)** $\frac{d}{4}$ **(D)** $\frac{d}{5}$

Q.7 Four-point masses each of mass 'm' are placed at four vertices A, B, C and D of a regular hexagon of side 'a' as shown in figure. Find the gravitational field strength at the centre O of the hexagon.

(A) $\frac{\sqrt{3}Gm}{a^2}$ **(B)** $\frac{\sqrt{2}Gm}{a^2}$ **(C)** $\frac{\sqrt{3}Gm}{2a^2}$ **(D)** $\frac{Gm}{a^2}$



Q.8 Three-point masses each of mass ′m′ are kept at three vertices of a square of side ′a′ as shown in figure. Find gravitational field strength at point O.



(A) $\sqrt{2}\frac{Gm}{a^2}$, towards B **(B)** $\left(\sqrt{2}+\frac{1}{2}\right)\frac{Gm}{a^2}$, towards O

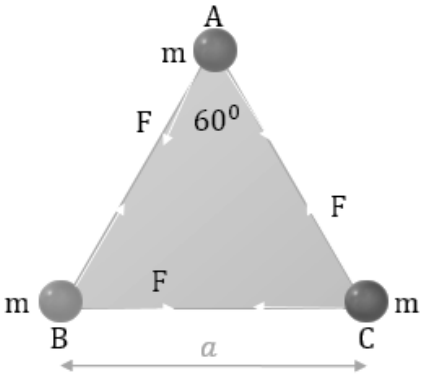
(C) $\left(\sqrt{2}+\frac{1}{2}\right)\frac{Gm}{a^2}$, towards B **(D)** None of the above

Q.9 The gravitational field due to a disc of mass M and radius R at a point located x distance away from the centre of disc along the axis of disc is given by

(A) $\frac{2GMx}{R^2}\left[\frac{1}{x}-\frac{1}{\sqrt{R^2+x^2}}\right]$ **(B)** $\frac{2GMx}{R^2}\left[\frac{1}{\sqrt{R^2+x^2}}\right]$

(C) $\frac{GMx}{R^2}\left[\frac{1}{\sqrt{R^2+x^2}}\right]$ **(D)** $\frac{GMx}{R^2}\left[\frac{1}{x}-\frac{1}{\sqrt{R^2+x^2}}\right]$

Q.10 Three identical masses m are kept at the vertices of the equilateral triangle of side a. Find the force on A due to B and C.



(A) $\frac{\sqrt{3}GM^2}{a^2}\hat{j}$ **(B)** $\frac{\sqrt{2}GM^2}{a^2}-\hat{j}$ **(C)** $\frac{\sqrt{3}GM^2}{a^2}-\hat{j}$ **(D)** None of these

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(D)	(D)	(B)	(C)	(D)	(C)	(A)	(C)	(A)	(C)