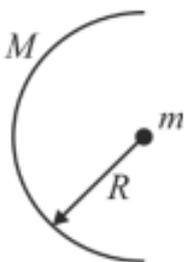


Prayas JEE (2025)

Physics Gravitation

DPP: 2

Q1 A particle of mass m is placed on centre of curvature of fixed, uniform semi-circular ring of radius R and mass M as shown in figure. Calculate interaction force between the ring and the particle.



- (A) $F = \frac{2GM}{\pi R^2}$
- (B) $F = \frac{2GMm}{\pi R}$
- (C) $F = \frac{2GMm^2}{\pi R^2}$
- (D) $F = \frac{2GMm}{\pi R^2}$

Q2 Two planets have the same average density but their radii are R_1 and R_2 . If acceleration due to gravity on these planets be g_1 and g_2 respectively, then

- (A) $\frac{g_1}{g_2} = \frac{R_1}{R_2}$
- (B) $\frac{g_1}{g_2} = \frac{R_2}{R_1}$
- (C) $\frac{g_1}{g_2} = \frac{R_1^2}{R_2^2}$
- (D) $\frac{g_1}{g_2} = \frac{R_1^3}{R_2^3}$

Q3 What will be the acceleration due to gravity at height h if $h \gg R$. Where R is radius of

earth and g is acceleration due to gravity on the surface of earth

- (A) $\frac{g}{(1+\frac{h}{R})^2}$
- (B) $g(1 - \frac{2h}{R})$
- (C) $\frac{g}{(1-\frac{h}{R})^2}$
- (D) $g(1 - \frac{h}{R})$

Q4 If the change in value of g at a height h above the surface of the earth is same as that at a depth d below it, when both h and d are much smaller than the radius of the earth, then

- (A) $h = d$
- (B) $2h = d$
- (C) $h = 2d$
- (D) $h^2 = d$

Q5 The weight of an object on the surface of the Earth is 40 N. Its weight at a height equal to the radius of the Earth is

- (A) 40 N
- (B) 20 N
- (C) 10 N
- (D) 30 N

Q6 The value of g at a depth h is two third the value that on the earth's surface. The value of h in terms of radius of earth R is

- (A) $\frac{2R}{3}$
- (B) $\frac{R}{3}$
- (C) $\frac{R}{6}$



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(D) $\frac{R}{2}$

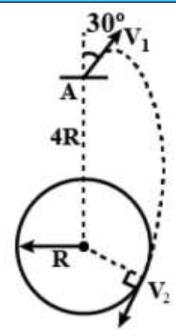
- Q7** In a gravitational field, at a point where the gravitational potential is zero
- (A) The gravitational field is necessarily zero
 - (B) The gravitational field is necessarily not zero
 - (C) Nothing can be said definitely about the gravitational field
 - (D) None of these

- Q8** Find the potential energy of the gravitational interaction of a point mass m and a rod of mass m and length l if they are along a straight line. Point mass is at a distance of a from the end of the rod.



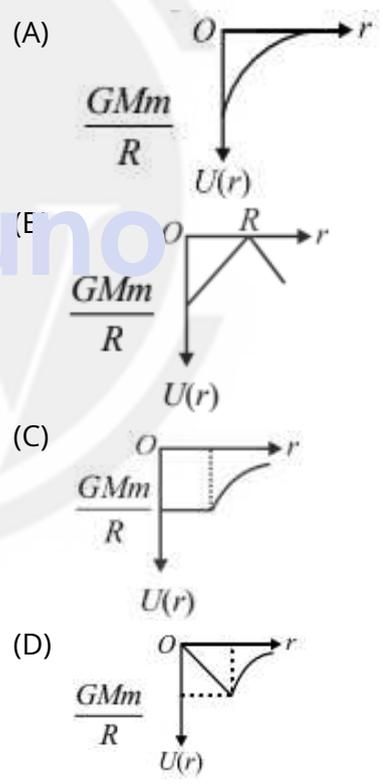
- (A) $-\frac{Gm^2}{l} \ln\left(\frac{l+a}{l}\right)$
- (B) $-\frac{Gm^2}{l} \ln\left(\frac{l+a}{a}\right)$
- (C) $-\frac{Gm^2}{l} \ln\left(\frac{l-a}{l}\right)$
- (D) $-\frac{Gm^2}{l} \ln\left(\frac{l-a}{a}\right)$

- Q9** A particle is projected from point A , that is at a distance $4R$ from the centre of the Earth, with speed v_1 in a direction making an angle of 30° with the line joining the centre of the Earth and point A , as shown. Find the speed v_2 of particle (in m/s) if particle passes grazing the surface of the earth. Consider gravitational interaction only between these two. (use $\frac{GM}{R} = 6.4 \times 10^7 \text{ m}^2/\text{s}^2$)



- (A) $\frac{8000}{\sqrt{2}}$
- (B) 800
- (C) $800\sqrt{2}$
- (D) None of these

- Q10** A shell of mass M and radius R has a point mass m placed at a distance r from its centre. The gravitational potential energy $U(r)$ vs r will be



- Q11** The gravitational potential energy of a system of three particles of mass m each kept at the vertices of equilateral triangle of side x will be
- (A) $-\frac{Gm^2}{x}$
 - (B) $-\frac{Gm^2}{3x}$

(C) $\frac{3Gm^2}{x}$

(D) $\frac{3Gm^2}{x^2}$

Q12 A particle is projected vertically upwards from the surface of the earth (radius R_e) with a speed equal to one fourth of escape velocity. What is the maximum height attained by it from the surface of the earth?

(A) $\frac{16}{15}R_e$

(B) $\frac{R_e}{15}$

(C) $\frac{4}{15}R_e$

(D) None of these



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Answer Key

Q1 D
Q2 A
Q3 A
Q4 B
Q5 C
Q6 B

Q7 C
Q8 B
Q9 D
Q10 C
Q11 C
Q12 B



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