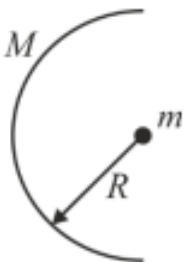


Prayas JEE (2025)

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 = (2GM)/(piR^2)
- (B) F = (2GMm)/(piR)
- (C) F = (2GMm^2)/(piR^2)
- (D) F = (2GMm)/(piR^2)

Q2 Two planets have the same average density but their radii are R1 and R2. If acceleration due to gravity on these planets be g1 and g2 respectively, then

- (A) g1/g2 = R1/R2
- (B) g1/g2 = R2/R1
- (C) g1/g2 = (R1^2)/(R2^2)
- (D) g1/g2 = (R1^3)/(R2^3)

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

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

- (A) g / (1 + h/R)^2
- (B) g (1 - 2h/R)
- (C) g / (1 - h/R)^2
- (D) g (1 - 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) 2R/3
- (B) R/3
- (C) R/6

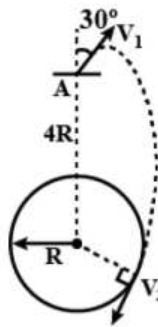


- (D) $\frac{R}{2}$
- Q7** In a gravitational field, at a point where the gravitational potential is zero
- (A) The gravitational field is necessarily zero
- (B) The gravitational field is necessarily not zero
- (C) Nothing can be said definitely about the gravitational field
- (D) None of these

- 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
- (A)
- (B)
- (C)
- (D)
- 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) $-\frac{Gm^2}{3x}$



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(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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