401. The ratio of gravitational mass and inertial mass is

(a) 2 : 1 (b) 1 : 1 (c) 1 : 2 (d) 3 : 1

402. The height of the point vertically above the earth's surface at which the acceleration due to gravity becomes 1% of its value at the surface is (*R* is the radius of the earth)

(a) 8 R (b) 9 R (c) 10 R (d) 20 R

403. Four particles each of mass *m*, are placed at the vertices of square and are moving along a circle of radius *r* under the influence of mutual gravitational attraction. The speed of each particle will be

(a) $\sqrt{\frac{Gm}{r}\frac{(2\sqrt{2}+1)}{4}}$ (b) $\sqrt{\frac{Gm}{r}}$ (c) $\sqrt{\frac{Gm}{r}(2\sqrt{2}+1)}$ (d) $\sqrt{\frac{2\sqrt{2}GM}{r}}$

404. A bomb blasts on the moon. Its sound will be heard on earth after

(a) sound will never be heard (b) 138 minutes

(c) 10 minutes (d) 3.7 minutes

405. To determine time, an astronaut in earth satellite should use

(a) either a spring watch or a pendulum clock

(b) a spring watch

(c) neither a spring watch nor a pendulum clock

(d) a pendulum clock

406 A tunnel is dug along one of the diameters of the earth. The force on a particle of mass *m* distant *x* from the centre in this tunnel will be

(a) $\frac{GM_e m}{R^2 x}$ (b) $\frac{GM_e m R^3}{x}$ (c) $\frac{GM_e m x}{R^2}$ (d) $\frac{GM_e m x}{R^3}$

407. A satellite has to revolve round the earth in a circular orbit of radius 8×10^3 km. The velocity of projection of satellite in this orbit will be

(a) 16 kms^{-1} (b) 7.08 kms^{-1} (c) 3 kms^{-1} (d) 8 kms^{-1}

408. The length of the day from today when the sun is directly overhead till tomorrow again when the sun is directly overhead can be determined by the

(a) rotation of the earth about its one axis

(b) revolution of the earth around the sun

(c) inclination of axis of rotation of the earth from the plane of revolution

(d) rotation of the earth about its own axis as well as its revolution around the sun

409. The orbital velocity of Jupiter is

(a) less than the orbital velocity of earth (b) more than the orbital velocity of earth
(c) zero (d) equal to the orbital velocity of earth

410. Two metallic spheres each of mass *m* are suspended by two strings each of length *l*. The distance between the sphere is *l*. The angle which the string made with the vertical due to mutual attraction of the spheres is (acceleration due to earth gravity is *g*)

(a) $\tan^{-1}\frac{Gm}{gl^2}$ (b) $\tan^{-1}\frac{Gm}{2gl^2}$ (c) $\tan^{-1}\frac{2Gm}{gl^2}$ (d) $\tan^{-1}\frac{2Gm}{gl}$

411. The value of acceleration due to gravity at height *h* from each surface will half its value on the surface if (*R* = radius of earth)

(a) $h = (\sqrt{2}+1)R$ (b) $h = 2R$ (c) $h = (\sqrt{2}-1)R$ (d) $h = R$

412. The velocity of a satellite in a parking orbit is

(a) 3.1 kms^{-1} (b) zero (c) 2.35 kms^{-1} (d) 8 kms^{-1}

413. A satellite of mass *m* is revolving at height *h* from earth's surface. Its orbital velocity will be

(a) $\sqrt{\frac{gR_e^2}{R_e+h}}$ (b) $\sqrt{gR_e}$ (c) $\sqrt{\frac{gR_e}{R_e+h}}$ (d) $\frac{gR_e}{R_e+h}$

414. The number of communication satellites necessary for intercontinental telecast will be

(a) 6 (b) 4 (c) 5 (d) 3

415. A gravitational force of 75 newton acts on a body of mass 2.5 kg at a centre point. The intensity of gravitation field at this point will be

(a) 40 N kg^{-1} (b) 13 N kg^{-1} (c) 20 N kg^{-1} (d) 30 N kg^{-1}

416. The earth revolves round the Sun in one year. If the distance between them becomes double, the new period of revolution will be

(a) 1/ 2 year (b) $2\sqrt{2}$ years (c) 4 years (d) 8 years

417. Two small bodies initially both at rest and to move from a distance of 1m from each other are subject to only their gravitational force of attraction. They approach each other and collide and do not separate. In respect of this collision which of the following statement is true?

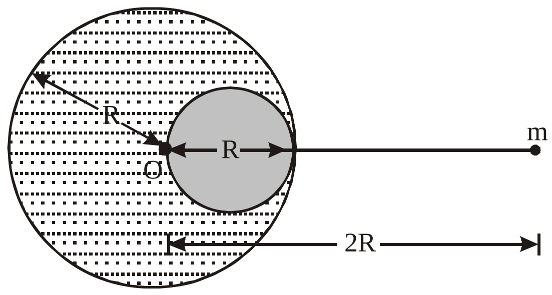
(a) the total gravitational P.E. of the two masses has increased during collision

(b) the total gravitational P.E. of the two masses has decreased during collision

(c) the law of conservation of energy holds good.

(d) the force of gravitational attraction vanishes when the bodies come in contact.

418. A uniform sphere of mass M and radius R exerts a force F on a small mass m situated at a distance of $2R$ from the centre O of the sphere. A spherical portion of diameter R is cut from the sphere as shown in figure. The force of attraction between the remaining part of the sphere and the mass m will be



(a) $\frac{7F}{9}$ (b) $\frac{2F}{3}$ (c) $\frac{4F}{9}$ (d) $\frac{F}{3}$

419. For a satellite orbiting in circular path around earth kinetic, potential and total energies are K, V and E respectively. Which of the following relation is not true

(a) E = – K (b) U = –2 K (c) U = 2E (d) K = –2E

420. Consider earth to be a uniform solid sphere of mass M and radius R. V_s and V_C be gravitational potential due to earth on its surface and centre respectively. Which of the following is true

(a) $V_s = -\frac{GM}{R}$ and $V_C = \infty$ (b) $V_s = \frac{GM}{R}$ and $V_s = -\frac{GM}{R}$

(c) $V_s = V_c = -\frac{GM}{R}$ (d) $V_s = -\frac{GM}{R}$ and $V_c = -\frac{3}{2}V_s$

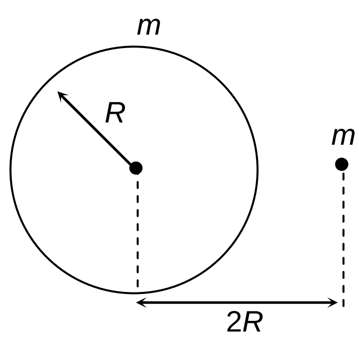
421. A solid sphere of radius r and mass 2m is placed inside a thin spherical shell having radius $4r$ and mass m such that their surfaces are in contact. Work done to bring unit mass from infinity to the centre of spherical shell will be

(a) $-\frac{11}{12}\frac{Gm}{r}$ (b) $-\frac{3}{2}\frac{Gm}{r}$ (c) $-\frac{Gm}{r}$ (d) $-\frac{3}{4}\frac{Gm}{r}$

422. Two solid spheres each of mass M and radius R is released from rest from large distance apart. Due to mutual gravitational attraction they accelerate towards each other and collide. Velocity of each sphere at the moment they collide equals to

(a) $\sqrt{\frac{GM}{R}}$ (b) $\sqrt{\frac{2GM}{R}}$ (c) $\sqrt{\frac{GM}{2R}}$ (d) $M\sqrt{\frac{G}{2R}}$

423. A point mass m is placed at a distance of $2R$ from the centre of thin spherical shell of mass m and radius R. Which of the following statements is true



(a) Resultant gravitational potential at the centre of the spherical shell is $-\frac{Gm}{2R}$

(b) Resultant gravitational field at the centre of the spherical shell is zero.

(c) resultant gravitational potential at the centre of the spherical shell is zero

(d) resultant gravitational field at the centre of the spherical shell is $\frac{Gm}{4R^2}$

424. A missile of mass m is fired vertically upward from the surface of earth at such an initial speed that it attains a maximum height (above the surface) equal to R, R being the radius of earth. What is the mechanical energy of the missile when it is at height $h = \frac{R}{3}$.

(a) $\frac{2}{3}mgR$ (b) $-mgR$ (c) $-\frac{mgR}{2}$ (d) $-\frac{5}{6}mgR$

425. Imagine that earth is rotating at such an angular speed that a body becomes weightless at the equator. If weight of the same body at north pole is 100 kg wt, its weight at a placed of latitude 60^0 will be

(a) 75 kg wt (b) 100 kg wt (c) zero (d) 67.5 kwt

426. Gravitational field in a region is given by $\left(3\hat{i} + 2\hat{j}\right)$ N kg^{-1}. Find the work done by the gravitational field when a particle of mass m moves from one point (x_1, y_1) to another (x_2, y_2) on the line $2y + 3x = 5$

(a) zero (b) $9(x_2 - x_1) + 4(y_2 - y_1)$

(c) $9m(x_1 - x_2) + 4m(y_1 - y_2)$ (d) none

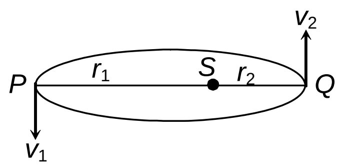
427. The work done to take a particle of mass m from surface of the earth to a height equal to $2R$ is where R is radius of earth.

(a) 2 mgR (b) $\frac{mgR}{2}$ (c) 3 mgR (d) $\frac{2mgR}{3}$

428. Two satellites are revolving around the earth with velocities v_1, v_2 and in radii r_1 and r_2 ($r_1 > r_2$) respectively. Then

(a) $v_1 = v_2$ (b) $v_1 > v_2$ (c) $v_1 < v_2$ (d) $\frac{v_1}{r_1} = \frac{v_2}{r_2}$

429. A planet is moving in an elliptical path around the sun as shown in figure. Speed of planet in positions P and Q are v_1 and v_2 respectively with $SP = r_1$ and $SQ = r_2$ then v_1/v_2 is equal to



(a) $\frac{r_1}{r_2}$ (b) $\frac{r_2}{r_1}$ (c) consonant (d) $\left(\frac{r_1}{r_2}\right)^2$

430. A point P $(R\sqrt{3},0,0)$ lies on the axis of a ring of mass M and radius R. The ring is located in y-z plane with its center at origin O. A small particle of mass m starts from P and reaches O under gravitational attraction only. Its speed at O will be

(a) $\sqrt{\frac{GM}{R}}$ (b) $\sqrt{\frac{Gm}{R}}$ (c) $\sqrt{\frac{GM}{\sqrt{2}R}}$ (d) $\sqrt{\frac{Gm}{\sqrt{2}R}}$

431. Two particles having masses m_1 and m_2 start moving towards each other under mutual gravitational force from the state of rest from infinite separation. Their relative velocity of approach when they are at a separation r will be

(a) $\sqrt{\frac{G(m_1+m_2)}{r}}$ (b) $\sqrt{\frac{2G(m_1+m_2)}{r}}$ (c) $\sqrt{\frac{3G(m_1+m_2)}{r}}$ (d) $\sqrt{\frac{4G(m_1+m_2)}{r}}$

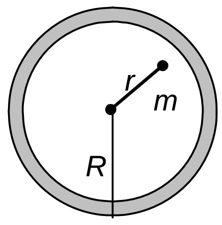
432. The escape velocity for a planet is v_e. A tunnel is dug along a diameter of the planet and a small body is dropped into it at the surface. When the body reaches the centre of the planet, its speed will be

(a) v_e (b) $\frac{v_e}{\sqrt{2}}$ (c) $\frac{v_e}{2}$ (d) zero

433. The distances of two satellites from the surface of the earth are R and $7R$. Their time periods of rotation are in the ratio

(a) 1 : 7 (b) 1 : 8 (c) 1 : 49 (d) 1 : $7^{3/2}$

434. A mass m is placed in the cavity inside a hollow sphere of mass M as shown in the figure. What is the gravitational force on the mass m?



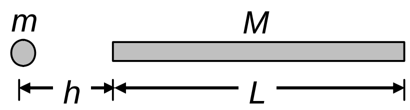
(a) $\frac{GMm}{R^2}$ (b) $\frac{GMm}{r^2}$

(c) $\frac{GMm}{(R-r)^2}$ (d) zero

435. The rotation of the earth having radius R about its axis speeds up to a value such that a man at latitude angle 60° feels weightlessness. The duration of the day in such a case is

(a) $2\pi\sqrt{\frac{R}{g}}$ (b) $\pi\sqrt{\frac{R}{g}}$ (c) $2\pi\sqrt{\frac{g}{R}}$ (d) $4\pi\sqrt{\frac{g}{R}}$

436. A homogeneous bar of length L and mass M is at a distance h from a point mass m as shown. The force on m is F.



(a) $F=\frac{GMm}{(h+L)^2}$ (b) $F=\frac{GMm}{h^2}$

(c) $F=\frac{GMm}{h(h+L)}$ (d) $F=\frac{GMm}{L^2}$

437. Two identical thin rings each of radius R are coaxially placed at a distance R. If the rings have a uniform mass distribution and each has mass m_1 and m_2 respectively, then the work done in moving a mass m from center of one ring to that of the other is

(a) zero (b) $\frac{Gm(m_1-m_2)(\sqrt{2}-1)}{\sqrt{2}R}$

(c) $\frac{Gm\sqrt{2}(m_1+m_2)}{R}$ (d) $\frac{Gmm_1(\sqrt{2}+1)}{m_2R}$

438. A particle is projected vertically upwards from the surface of earth (radius R_e) with a kinetic energy equal to half of the minimum value needed for it to escape. The height to which it rises above the surface of earth is

(a) R_e (b) $2R_e$ (c) $3R_e$ (d) $4R_e$

439. Distance between the centers of two stars is $10a$. The masses of these stars are M and $16M$ and their radii a and $2a$ respectively. A body of mass m is fired straight from the surface of the larger star towards the smaller star. The minimum initial speed for the body to reach the surface of smaller star is

(a) $\frac{3}{2}\sqrt{\frac{GM}{a}}$ (b) $\frac{2}{3}\sqrt{\frac{6GM}{a}}$ (c) $\frac{3}{2}\sqrt{\frac{5GM}{a}}$ (d) $\frac{2}{3}\sqrt{\frac{GM}{a}}$

440. Two satellites S_1 and S_2 revolve round a planet in coplanar circular orbits in the same sense. Their periods of revolution are 1 hour and 8 hour respectively. The radius of the orbit S_1 is 10^4 km. The speed of S_2 relative to S_1 when they are closest (in km h^{-1}) is

(a) $10^4\ \pi$ (b) $2 \times 10^4\pi$ (c) $\frac{1}{4}10^4\ \pi$ (d) $4 \times 10^4\ \pi$