41. If two particles of masses 3 kg and 6 kg which are at rest are separated by a distance of 15 m. The two particles are moving towards each other under a mutual force of attraction. Then the ratio of distances travelled by the particles before collision is

(1) 2 : 1 (2) 1 : 2

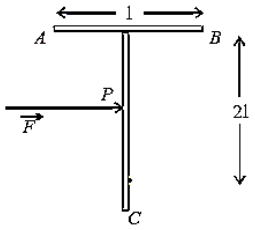
(3) 1 : 3 (4) 3 : 1

42. A circular disc of radius R is removed from a bigger circular disc of radius 2R such that the circumferences of the discs coincide. The centre of mass of the new disc is α/R from the centre of the bigger disc. The value of α is

(1) $\frac{1}{4}$ (2) $\frac{1}{3}$

(3) $\frac{1}{2}$ (4) $\frac{1}{6}$

43. A 'T' shaped object with dimensions shown in the figure, is lying on a smooth floor. A force $\vec{F}$ is applied at thepoint P parallel to AB, such that the object has only the translational motion without rotation. Find the location of P with respect to C.



(1) $\frac{3}{2}l$ (2) $\frac{2}{3}l$

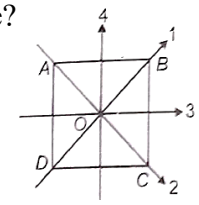
(3) l (4) $\frac{4}{3}l$

44. Four particle of masses m, 2m, 3m and 4m are arranged at the corners of a parallelogram with each side equal to a and one of the angle between two adjacent sides is 60°. The parallelogram lies in the x-y plane with mass m at the origin and 4m on the x-axis. The centre of mass of the arrangement will be located at

(1) $\left(\frac{\sqrt{3}}{2}a, 0.95a\right)$ (2) $\left(0.95a, \frac{\sqrt{3}}{4}a\right)$

(3) $\left(\frac{3a}{4}, \frac{a}{2}\right)$ (4) $\left(\frac{a}{2}, \frac{3a}{4}\right)$

45. The moment of inertia of a thin square plate ABCD of uniform thickness about an axis passing through the centre O and perpendicular to the plane of the plate is I. Which of the following is false?



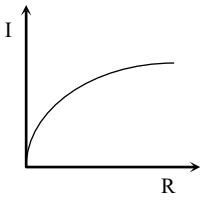
(1) $I = I_1 + I_2$

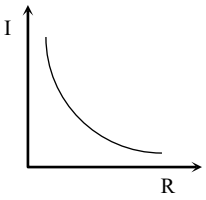
(2) $I = I_1 + I_3$

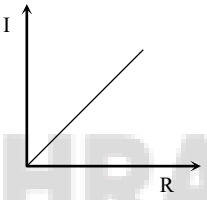
(3) $I = I_4 + I_2$

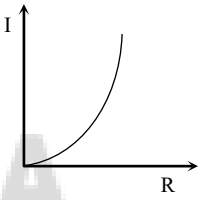
(4) $I = I_1 + I_2 + I_3 + I_4$

46. Moment of inertia of a sphere of mass M and radius R is I. Keeping M constant if a graph is plotted between I and R, then its form would be

(1) 

(2) 

(3) 

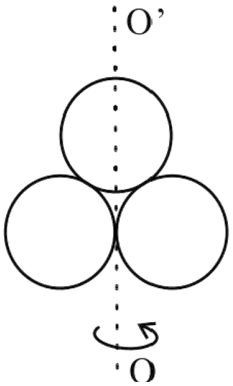
(4) 

47. Moment of inertia of a uniform circular disc about a diameter is I. Its moment of inertia about an axis perpendicular to its plane and passing through a point on its rim will be

(1) 5I (2) 3I

(3) 6I (4) 4I

48. Three rings each of mass m and radius r are so placed that they touch each other as shown in the figure. The moment of inertia of the system about the axis OO′ is



(1) $5mr^2$

(2) $\frac{5}{7}mr^2$

(3) $7mr^2$

(4) $\frac{7}{2}mr^2$

49. What is the moment of inertia of Earth about its diameter, taking it to be a sphere of radius 6400 km and mass 6×10^{24} kg?

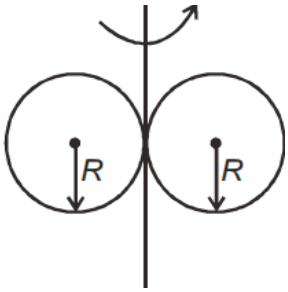
(1) 11.6×10^{26} kg m^2

(2) 6×10^{34} kg m^2

(3) 9.83×10^{37} kg m^2

(4) 8.63×10^{26} kg m^2

50. Moment of inertia of combination of two discs of same mass M and same radius R kept in contact about the tangent passing through point of contact and in the plane of discs, as shown is



(1) $\frac{MR^2}{4}$

(2) $\frac{5}{4}MR^2$

(3) $\frac{MR^2}{2}$

(4) $\frac{5}{2}MR^2$