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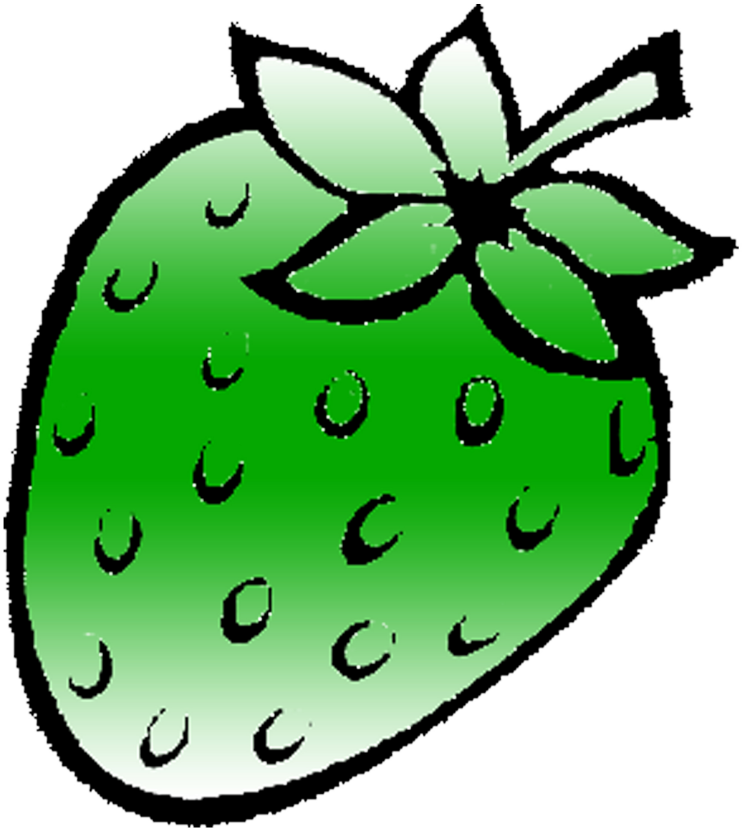

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KINETICS OF RIGID BODIES

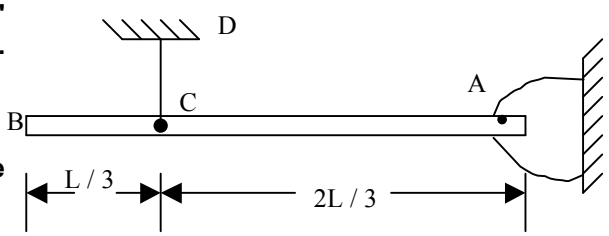
1. **A uniform bar AB of mass 'm' and length 'L' is supported by wire CD as shown in figure. Determine :**

(i) The angular acceleration of bar AB.

(ii) The linear acceleration of free end B

(iii) The reaction at the hinged support A at the instant the wire is cut suddenly.

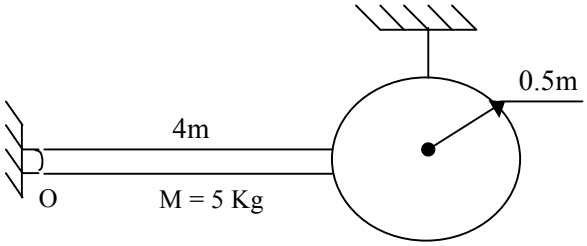
Take m = 8 kg, L = 6m, g = 9.81 m/s^2.



Ans. : (i) α = 2.4525 r/s^2 (↺)

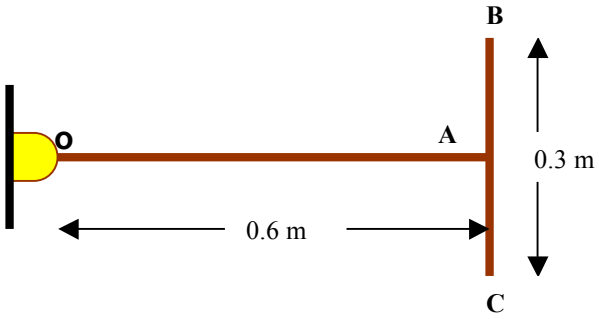
(ii) a_B = 14.715 m/s^2 (↓), (iii) R_A = 19.62 N (↑).

2. **The sphere is connected to the rod rigidly and the assembly is pin connected at O. It is supported in horizontal position by a rope as shown in figure. Find the angular acceleration & reaction at point 'O' at the instant the rope is cut.**



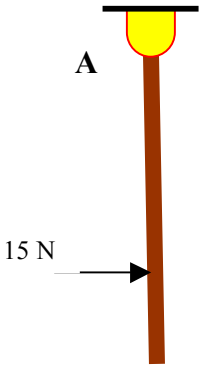
Ans. :α = 2.33 r/s^2 (↻), O_x = 0, O_y = 19.41 N (↑).

3. **A homogeneous rod OA of length 600mm and mass 10kg is rigidly attached to another uniform rod BC of length 300mm and mass 2kg at A as shown in the figure. The system is hinge connected at O and is released from rest in horizontal position. Determine angular acceleration about O just after the release.**

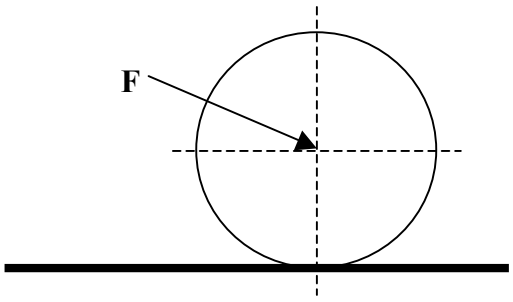


[α = 21.27 r/s^2]

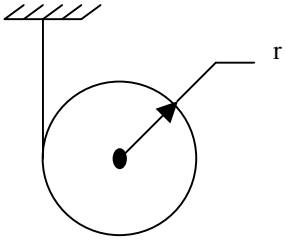
4. **A uniform slender rod of length 900mm and mass 2.5kg hangs freely from a hinge at A in a vertical plane. At what distance, from A, a force of 15N is applied so that the horizontal component of the reaction at A is zero? Find the corresponding angular acceleration of the rod. Use preferably D'Alembert's Principle.**



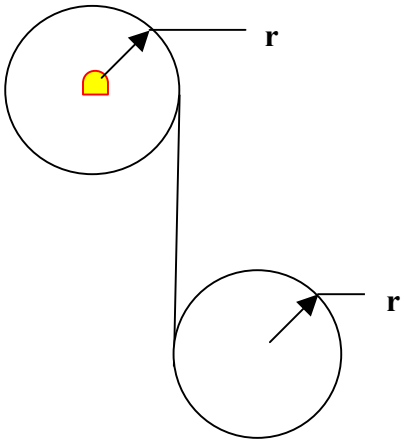
5. **A workman moves a cylindrical lawn roller of weight W = 4500N and radius r = 30cm along a horizontal plane by pushing with a constant force F in the direction AC as shown in the figure. What is the magnitude of this force, if after a horizontal displacement x = 3.6m, the roller has a velocity V = 1.2m/s. Assume that the cylinder rolls without slipping.**



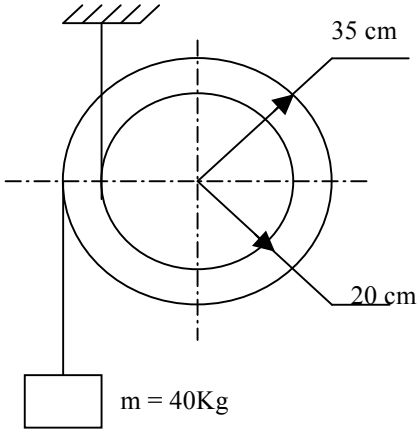
6. **A homogeneous disc of mass 'm' & radius 'r' is allowed to fall as it unwinds as shown in the figure. Find acceleration of thin disc. Also find the tension in the rope.**
Ans. : a = 6.66 m/s^2, T = mg/3.



7. **Two identical thin, right circular, discs are arranged in vertical plane as shown in the figure. Neglecting friction, determine the acceleration of the center C of the falling disc.**
Ans : a_c = 4g/5 m/s^2 ↓



8. **If the system is released find the acceleration of Pulley & block. The compound Pulley has mass 20 kg and radius of gyration 30 cm. Also find the tension in the rope supporting the Pulley.**
Ans. :a_B = 0.85 m/s^2 (↓), a_P = 1.142 m/s^2 (↑), T = 588.55 N



9. **Figure shows a system of bodies A, B and C connected by inextensible cord and mounted on frictionless bearing. The stepped pulley A rolls on inclined the plane without slip. If the system is released from rest, find:**
(i) The velocity of C after it moves through 3.6m
(ii) The tension in the cord connecting A and B.