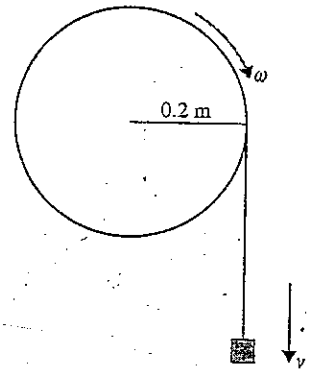
Conservation of mechanical energy

Example 1 A uniform rod, AB, of length a and mass m, is free to rotate in a vertical plane about a horizontal axis through A. The rod is gently displaced from rest with B vertically above A.

a) Find the angular velocity of the rod when B reaches a point vertically below A.

Example 2 A constant tangential force of magnitude 12 N is applied to the rim of a stationary, uniform, circular flywheel of mass 100 kg and radius 0.5 m. Find the speed at which the flywheel is rotating after it has completed 25 revolutions.

Example 3 A uniform cylinder can rotate freely about its axis, which is horizontal. The cylinder has radius 20 cm and mass 5 kg. A particle of mass 2 kg is attached by means of a light, inextensible string to a point on the cylinder and the string is wound onto the cylinder. The particle is held below the cylinder with the string vertical and taut, and is released from rest. Find the speed at which the particle is travelling after the cylinder has made two complete revolutions. (Assume the string is still partially wound on the cylinder at this stage.)



Example 4 A uniform disc of mass M and radius a can rotate about a horizontal axis which is tangential to the disc. The disc is held in a horizontal position and released from rest. Find the angular velocity of the disc when it reaches a vertical position.

EXAMPLES 5

1) A uniform circular disc of mass m, radius r and centre O is free to turn in its own plane about a smooth horizontal axis passing through a point A on the rim of the disc. The disc is released from rest in the position in which OA is horizontal and the disc is vertical. Find the angular velocity of the disc when OA first becomes vertical.