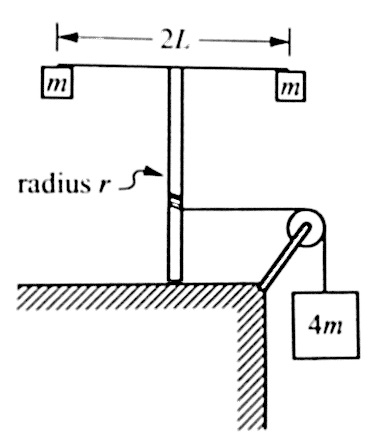
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**AP Physics 1: Rotation AP Practice**



1. A light string that is attached to a large block of mass *4m* passes over a pulley with negligible rotational inertia and is wrapped around a vertical pole of radius *r*, as shown in Experiment A above. The system is released from rest, and as the block descends the string unwinds and the vertical pole with its attached apparatus rotates. The apparatus consists of a horizontal rod of length *2L*, with a small block of mass *m* attached at each end. The rotational inertia of the apparatus is assumed to be *2mL2*.
2. If the downward acceleration of the large block is measured to be *a*, determine the tension *T* in the string, in terms of the acceleration of the falling block.
3. Determine the torque exerted on the rotating pole by the string, in terms of the mass of the blocks and the acceleration.
4. When the large block has descended a distance *D*, how does the instantaneous rotational kinetic energy of the apparatus compare with the value *4mgD*? Check the appropriate space below and justify your answer.

\_\_\_\_\_ Greater than *4mgD* \_\_\_\_\_ Equal to *4mgD* \_\_\_\_\_ Less than *4mgD*

Now consider the experiment again, this time including the rotational inertia of the small pulley.

1. If the rotational inertia of the pulley were large enough to have an effect on the experiment, would you predict your answers to be different? Explain your response.
2. How will the angular velocity of the rotating apparatus and linear velocity of the falling mass compare now with their values calculated in parts (a), (b), and (c)?
3. Discuss how the torque exerted by the string on the rotating apparatus changes the angular momentum of the apparatus.



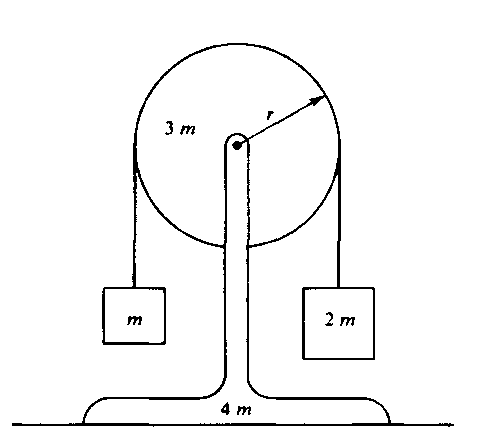
1. A box of uniform density weighing 100 N moves in a straight line with constant speed along a horizontal surface. The coefficient of sliding friction is 0.4 and a rope exerts a force F in the direction of motion as shown above.
   1. On the diagram below, draw and identify all the forces on the box.



* 1. Calculate the force F exerted by the rope that keeps the box moving with constant speed.



* 1. A horizontal force F', applied at a height 5/3 meters above the surface as shown in the diagram above, is just sufficient to cause the box to begin to tip forward about an axis through point P. The box is 1 meter wide and 2 meters high. Calculate the force F’.

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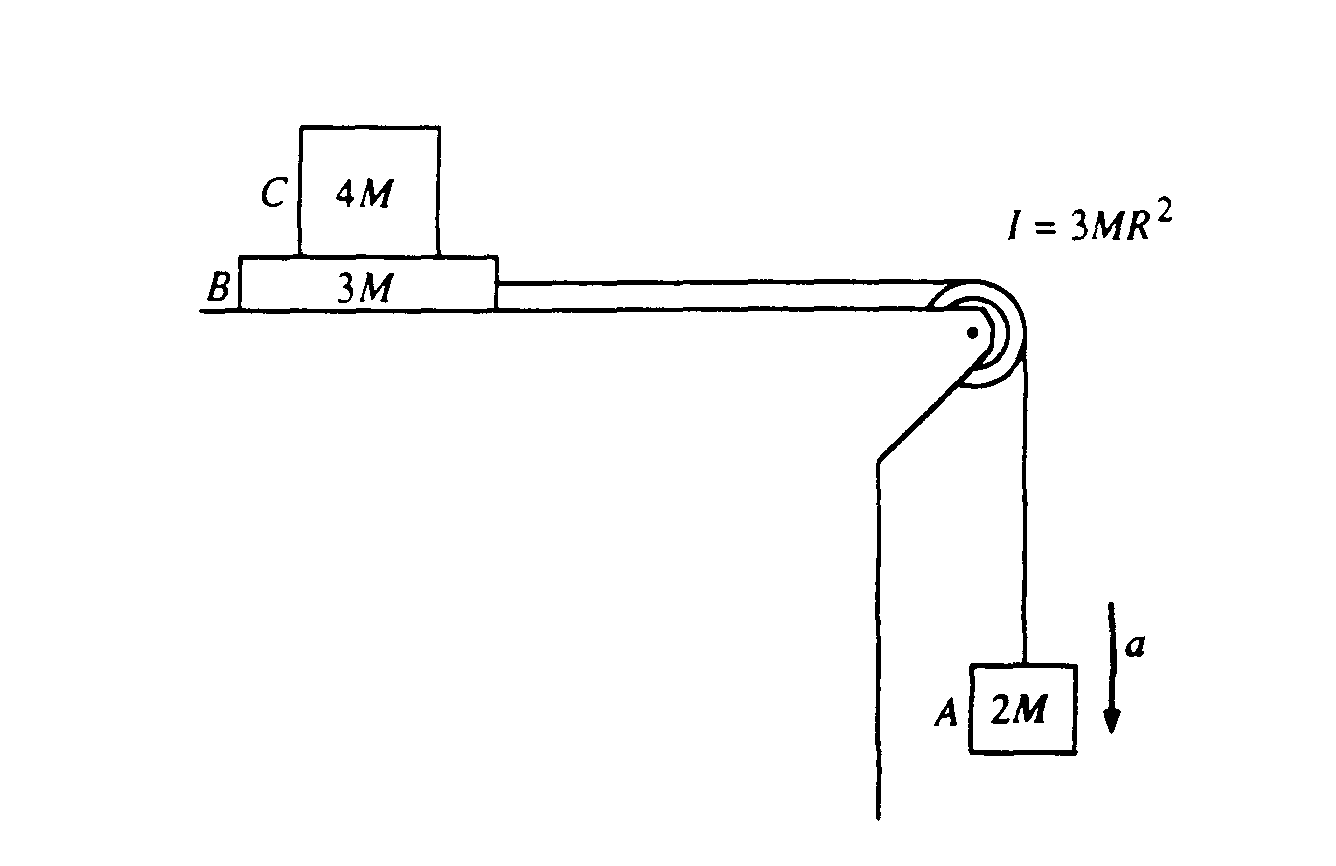
1. A pulley of mass 3m and radius r is mounted on frictionless bearings and supported by a stand of mass 4m at rest on a table as shown above. The moment of inertia of this pulley about its axis is 1.5mr2.

Passing over the pulley is a massless cord supporting a block of mass m on the left and a block of mass 2m on the right. The cord does not slip on the pulley, so after the block‑pulley system is released from rest, the pulley begins to rotate.

1. On the diagrams below, draw and label all the forces acting on each block.



1. Use the symbols identified in part a. to write each of the following.
2. The equations of translational motion (Newton's second law) for each of the two blocks
3. The analogous equation for the rotational motion of the pulley
4. Solve the equations in part b. for the acceleration of the two blocks.
5. Determine the tension in the segment of the cord attached to the block of mass m.
6. Determine the normal force exerted on the apparatus by the table while the blocks are in motion.



1. Block A of mass 2M hangs from a cord that passes over a pulley and is connected to block B of mass 3M that is free to move on a frictionless horizontal surface, as shown above. The pulley is a disk with frictionless bearings, having a radius R and moment of inertia 3MR2. Block C of mass 4M is on top of block B. The surface between blocks B and C is NOT frictionless. Shortly after the system is released from rest, block A moves with a downward acceleration a, and the two blocks on the table move relative to each other.

In terms of M, g, and a, determine the

* 1. tension Tv in the vertical section of the cord
  2. tension Th in the horizontal section of the cord

If a = 2 meters per second squared, determine the

1. coefficient of kinetic friction between blocks B and C
2. acceleration of block C