CONSERVATION OF ENERGY WITH ROTATION

● For problems between 2 points where speed/height/spring compression changes → Conservation of Energy equation!

- The only difference is that now Kinetic Energy can be K_L, K_R, or _____ (_____) !

- Most important thing: We will re-write ____ and ____ in terms of each other (so we reduce two variables into one).

EXAMPLE: A solid disc is free to rotate around a fixed, perpendicular axis through its center. The disc has mass M = 5 kg, radius R = 6 m, and is initially at rest. A long, light cable is wrapped several times around the cylinder. You pull on the cable with a constant 10 N, in such a way that the cable unwinds horizontally at the top of the disc unwind without slipping. Ignore any frictional forces. Use Conservation of Energy to find the angular speed of the pulley after you've pulled the rope for 8 m.

EXAMPLE: WORK TO ACCELERATE CYLINDER

EXAMPLE**:** A solid cylinder of mass 10 kg and radius 2 m is mounted and free to rotate on a perpendicular axis through its center. If the cylinder is initially at rest, how much work is needed to accelerate the cylinder to 120 RPM? Ignore any friction**.**

PRACTICE: WORK TO STOP SPHERE

PRACTICE**:** How much work is needed to stop a hollow sphere of mass 2 kg and radius 3 m that spins at 40 rad/s around an axis through its center**?**

EXAMPLE: CONSERVATION OF ENERGY / SHAPES RACE DOWN

EXAMPLE**:** Three objects of equal mass and radius, but different shapes, are all released from rest, at the same time, from the top of an inclined plane. They all roll without slipping. Which of the following shapes will reach the bottom first**?** Why**?**

(1) solid cylinder
(2) hollow cylinder
(3) solid sphere

EXAMPLE: CYLINDERS ON A HILL / SLIDDING VS. ROLLING

EXAMPLE**:** Two cylinders of equal mass and radius are released from rest from the top of two hills having the same height**.** Cylinder A rolls down without slipping, and B slides down without rolling. Which will reach the bottom with greater speed**?**

PRACTICE: CONSERVATION OF ENERGY / SHAPES RACE UP

PRACTICE**:** Two solid cylinders of same mass and radius roll on a horizontal surface just before going up an inclined plane. Cylinder A rolls without slipping, but cylinder B moves along a slippery path, so it moves without rotating at all times. At the bottom of the incline, both have the same speed at their center of mass. Which will go higher on the inclined plane**?** (Why?)