**Angular Rolling and Energy Noteguide**

Handy Substitutions:

Γ = Iα

Γ = rF

so **F = Γ/r = Iα/r**

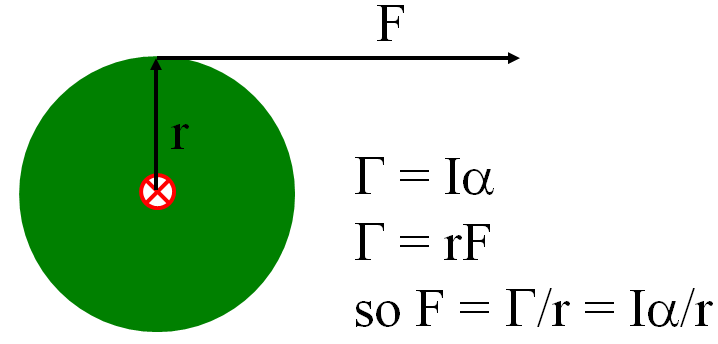
s = θr, so θ = s/r

v = ωr, so ω = v/r

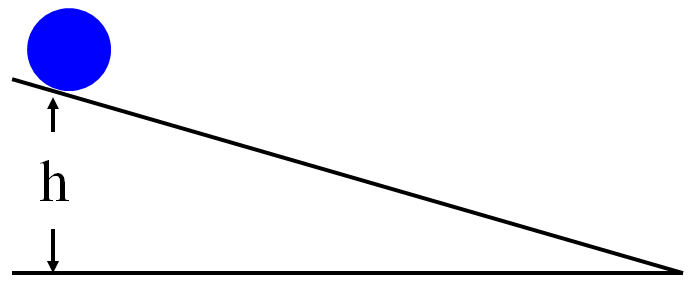
a = αr, so **α = a/r**

and I = 1/2mr2 or 2/5mr2 etc.

**Rolling objects accelerate linearly and angularly:**



So F = ma turns into: **F = ma + Iα/r** into which we will substitute for I, and α

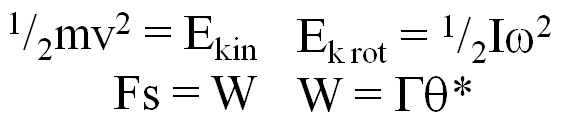


**Inclined plane problem:**

**An 11.0 g, 0.0130 m radius cylinder rolls down an incline that is 2.90 m long, and loses 0.340 m of elevation. What is its acceleration down the plane, and its velocity at the bottom of the plane?**

|  |  |
| --- | --- |
| Using Dynamics | Using Conservation of energy: |

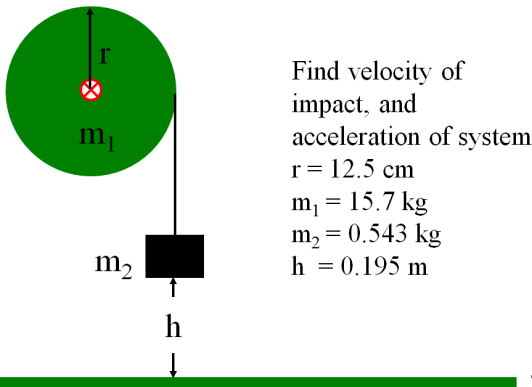
**Rotational Kinetic Energy:**



Example: A 23.7 kg 45 cm radius cylinder is rolling at 13.5 m/s at the bottom of a hill.

What is its translational kinetic energy? What is its rotational kinetic energy?

What is the total kinetic energy? What was the height of the hill?



In General: I tend to solve all rotational dynamics problems using energy.

1. Set up the energy equation
2. (Make up a height)
3. Substitute linear for angular:
   * ω = v/r
   * I = ?mr2
4. Solve for v
5. Go back and solve for accelerations