Torque and Newton’s laws

Take a solid frictionless pulley with mass M and radius R and have a mass m hanging from a string wrapped around the pulley suspended in the air as shown below. I = ½ MR2



ΣFblock = ma = mg – T

Στpulley = Iα = T R = ½ MR2(atan/R) = TR

 ½ M (a) = T

 ma = mg – T

 ( ½ M + m) a = mg

 a = mg/[ ½ M + m]

Say M = 4 kg R = 0.1 m and m = 1 kg

a = 9.8/(2 +1) = 3.27 m/s/s α = a/R = 32.7 rad/s/s

if R = 0.2 m a still = 3.27 m/s/s α = 3.27/ 0.2 = 16.33 rad/s/s

 

ΣF1 = m1a = m1g– T1

ΣF2 = m2a= T2

Στ = I α = T1R – T2R = (T1 – T2)R; ½ MR2 (a/R) = (T1 – T2)R

m1a = m1g– T1

m2a = T2­

½ M a = (T1 – T2)

( ½ M + m2 + m1) a = m1g a = m1g/( ½ M + m2 + m1)