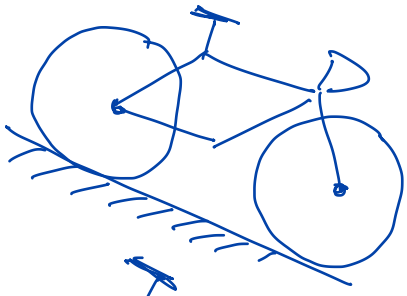
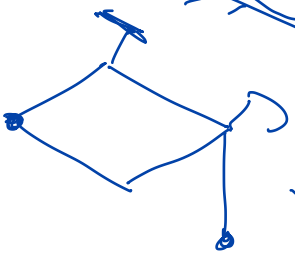
A bicycle is coasting downhill at 15 km/hr. The mass of the frame is 10 kg, and each wheel has a mass of 3 kg and a radius of 0.35 m. What is the total kinetic energy of the bicycle? Assume the wheels can be approximated as thin rings, and that they do not slip with respect to the ground.

Find KE

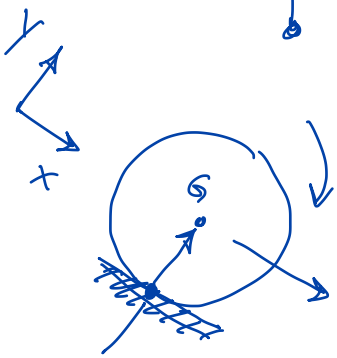


$\vec{v} = 15\ km/hr$



$v = 15\ km/hr$

$= 4.17\ m/s$



$v_G = 4.17\ m/s$

$KE_{TOT} = KE_{frame} + 2\,KE_{wheel}$

$= \frac{1}{2} m_f v_G^2 + 2\left(\frac{1}{2} m_w v_G^2 + \frac{1}{2} I_G \omega^2\right)$

$= \frac{1}{2} m_f v_G^2 + 2\left(\frac{1}{2} m_w v_G^2 + \frac{1}{2} m_w r^2 \omega^2\right)$

$r^2\omega^2 = v_G^2$

$= \frac{1}{2} m_f v_G^2 + 2\left(m_w v_G^2\right)$

$= \left(\frac{1}{2} m_f + 2 m_w\right) v_G^2$

$= \left(\frac{1}{2}(10\,kg) + 2(3\,kg)\right)(4.17\,m/s)^2$

$\boxed{KE_{TOT} = 191.3\ J}$

$\vec{v}_G = \vec{\omega} \times \vec{r}_{G/IC}$

$v_G \hat{i} = -\omega \hat{k} \times r \hat{j}$

$v_G \hat{i} = \omega r \hat{i}$

$v_G = \omega r$ *

$\omega = \frac{v_G}{r} = \frac{4.17\ m/s}{0.35 m}$

$= 11.91\ rad/s$

$I_G = m_w r^2$