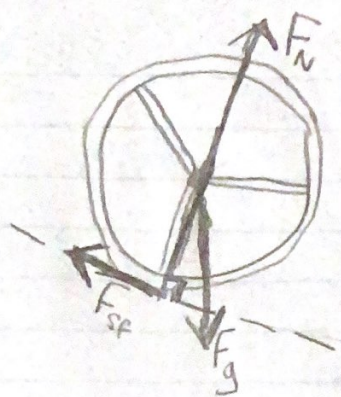


a. i.



ii. Since $\alpha = \frac{\Delta \omega}{\Delta t}$ and $\therefore \Delta \omega = \alpha \Delta t$, ω , angular velocity, is changed by α , angular acceleration and since $\Sigma \tau = I \alpha$, $\alpha = \Sigma \tau / I$, and $\tau = r F \sin \theta$, $\Delta \omega = \frac{\Sigma (r F \sin \theta) \Delta t}{I}$. Δt and I are constants for each force over a period of time. since $r = 0$ for F_g and $\theta = \pi$ rad for F_N and $\sin \pi = 0$, τ_N and τ_g both $= 0$. Since $r \neq 0$ for F_{fr} and $\theta = \pi/2$ for F_{fr} , $\tau_{fr} \neq 0$.

The force of static friction, F_{fr} causes a change in angular velocity, $\Delta \omega$, with respect to its center of mass.

~~Since the force of static friction, F_{fr} , acts at the point of contact, it creates a torque about the center of mass. This torque causes the wheel to rotate. The torque is given by $\tau = r F_{fr} \sin \theta$, where r is the radius of the wheel, F_{fr} is the force of static friction, and θ is the angle between the force vector and the line connecting the center of mass to the point of contact. Since $\theta = \pi/2$, $\sin \theta = 1$, and the torque is $\tau = r F_{fr}$. The angular acceleration is $\alpha = \tau / I$, where I is the moment of inertia of the wheel. The change in angular velocity is $\Delta \omega = \alpha \Delta t$.~~

b. Since $\Sigma F = Ma = F_g \text{ component} - F_{fr} = Mg \sin \theta - 0.4 Mg \sin \theta = 0.6 Mg \sin \theta$
 $a = 0.6 g \sin \theta$

c. i. Since the block of ice has negligible friction, it's final speed, $\|v_f\|$ will be the greatest. Since $\Sigma F = Ma = F_g - F_{fr}$, with $< F_{fr}$, $> a$
X Block

ii. Since the block is not rotating and both start with the same PE, more of the block's KE is linear since none is rotational, causing there to be a greater linear speed, $\|v_f\|$ since $KE = \frac{1}{2} M v^2$.