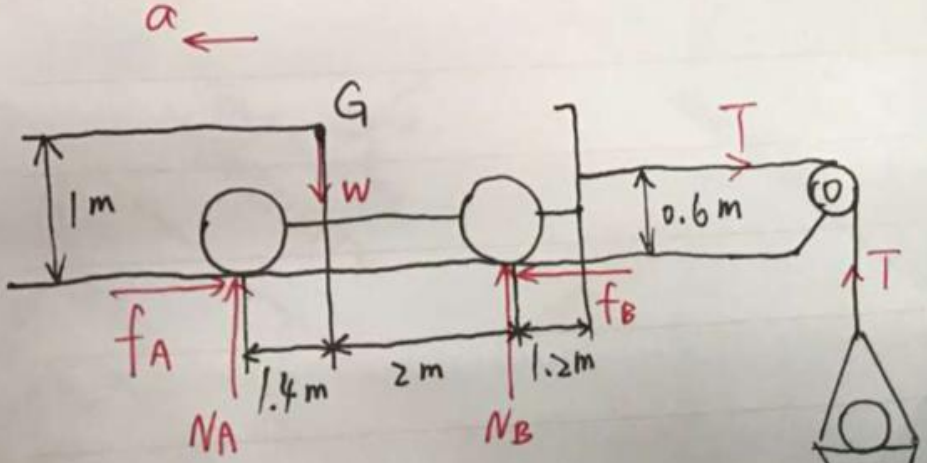
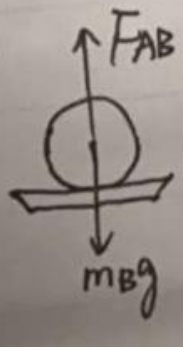


(a) $\begin{cases} x: & f_B - f_A - T = ma \\ y: & N_A + N_B = mg \\ \Sigma M_G = \bar{I}\alpha: & f_A \cdot 1 - f_B \cdot 1 + (1+0.6)T + 2N_B - 1.4N_A = 0 \end{cases}$

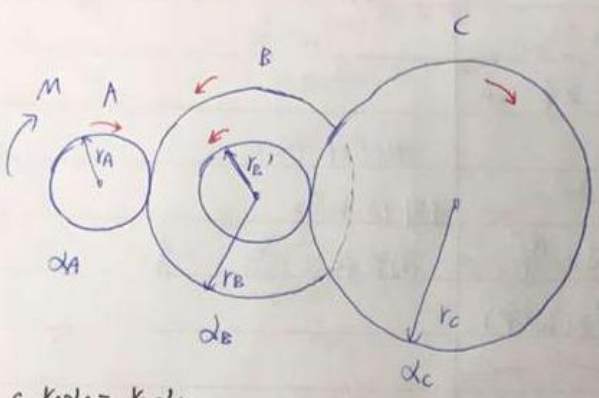
$\Rightarrow$ .....

(b)



$F_{AB} - m_B g = m_B a$

$\Rightarrow F_{AB} = 4320\,N$



$$\begin{cases} r_A\alpha_A = r_B\alpha_B \\ r_B'\alpha_B = r_C\alpha_C \end{cases} \Rightarrow \begin{cases} \alpha_B = 0.5\,\alpha_A \quad ① \\ \alpha_C = \frac{1}{6}\,\alpha_A \quad ② \end{cases}$$

$I_{GA} = m_A(k_{GA})^2 = (\frac{1}{32.2}) \times (\frac{1.3}{12})^2 = \dots$

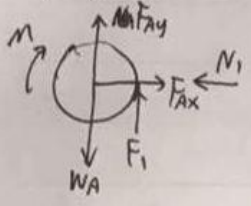
$I_{GB} = m_B(k_{GB})^2 = \dots$

$I_{GC} = m_C(k_{GC})^2 = \dots$

So from ① ② ③ ④ ⑤

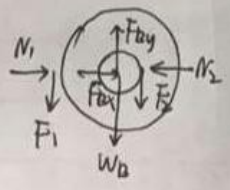
$\Rightarrow \dots$

for gear A



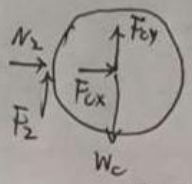
$M - F_1 r_A = I_{GA} \cdot \alpha_A$ ③

for gear B



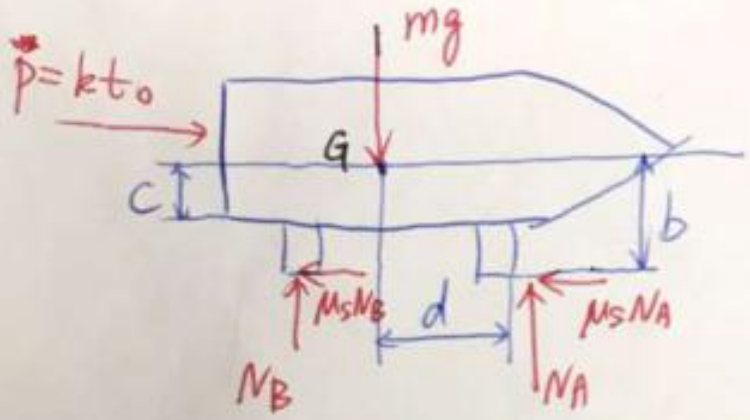
$F_1 \cdot r_B - F_2 \cdot r_B' = I_{GB} \cdot \alpha_B$ ④

for gear C



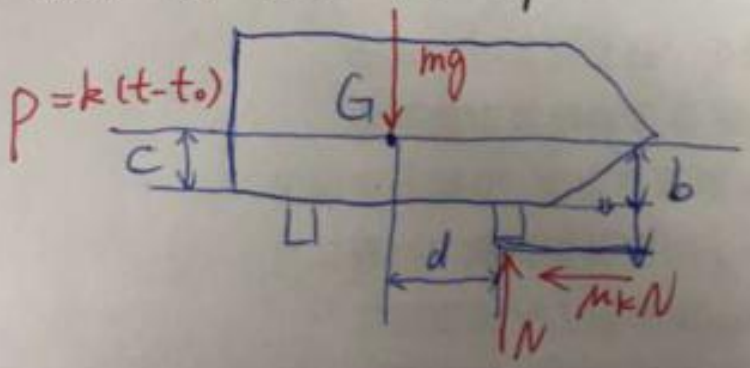
$F_2 \cdot r_C = I_{GC} \cdot \alpha_C$ ⑤

When the sled is static



$$\begin{cases} N_A + N_B = mg & ① \\ kt_0 = \mu_s (N_A + N_B) & ② \end{cases}$$

when the sled begins to slide and it start to tip



$$\begin{cases} k(t-t_0) - \mu_k N = m\bar{a} & ② \\ N = mg & ④ \\ N \cdot d - \mu_k N \cdot b - k(t-t_0) \cdot C = 0 & ⑤ \end{cases}$$

from ① ② ③ ④ ⑤

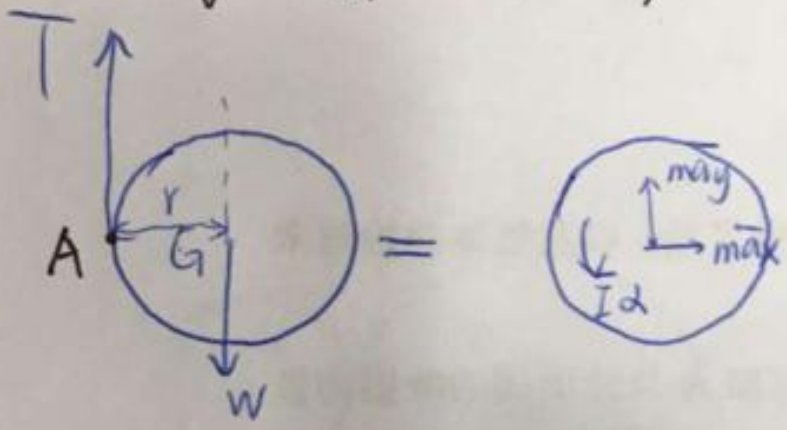
$\Rightarrow \dots$

Applying the Newton's second law in the x and y directions gives

$$\begin{cases} 0 = m\bar{a}_x \\ T - W = m\bar{a}_y \end{cases}$$

$$\Rightarrow \bar{a}_x = 0$$

$$\bar{a}_y = \frac{T-W}{m} = 2.19\ m/s^2 \uparrow$$



$$Tr = -\bar{I}\alpha = \frac{1}{2}mr^2\alpha$$

$$\alpha = -48\ rad/s^2 \downarrow$$

Hence

$$\vec{a}_{cord} = (\vec{a}_A)_t = \vec{\bar{a}} + (\vec{a}_{A/G})_t$$

$$= 2.19 \uparrow + 0.5 \times 48 \uparrow$$

$$= 26.2\ m/s^2 \uparrow$$