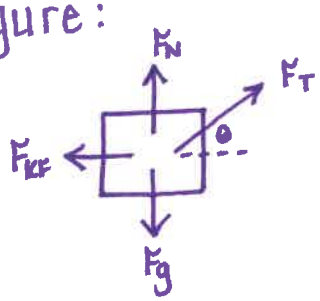
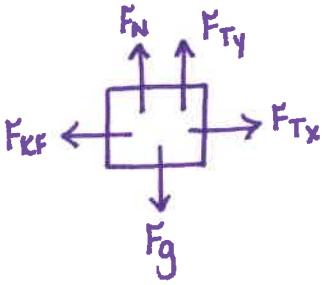
Problem 2

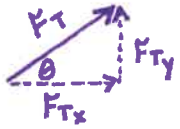
Given: constant speed, $\mu_K = 0.15$, $\theta = 65°$, $F_g = 70\ N$

Want: F_T

Figure:







$F_{Tx} = F_T \cos\theta$
$F_{Ty} = F_T \sin\theta$

Calculations:

constant speed ⇒ equilibrium ⇒ up forces = down forces
left forces = right forces

$F_N + F_{Ty} = F_g$
$F_N + F_T \sin\theta = F_g$
$F_N = F_g - F_T \sin\theta$

$F_{KF} = F_{Tx}$
$F_{KF} = F_T \cos\theta$
$\mu_K F_N = F_T \cos\theta$

Kinetic Friction:
$F_{KF} = \mu_K F_N$

$\mu_K (F_g - F_T \sin\theta) = F_T \cos\theta$
$\mu_K F_g - \mu_K F_T \sin\theta = F_T \cos\theta$
$\mu_K F_g = F_T \cos\theta + \mu_K F_T \sin\theta$
$\mu_K F_g = F_T (\cos\theta + \mu_K \sin\theta)$

$$F_T = \frac{\mu_K F_g}{\cos\theta + \mu_K \sin\theta}$$

$$F_T = \frac{(0.15)(70)}{\cos 65° + (0.15)\sin 65°}$$

$F_T = 18.7981\ N$

$\boxed{F_T = 20\ N}$

Conclusion: The tension in the string is 20 N.