FORCES

Find $\vec{a}$ of the block.

$$20N \rightarrow \boxed{m = 5 kg} \quad \mu_K = 0.1$$
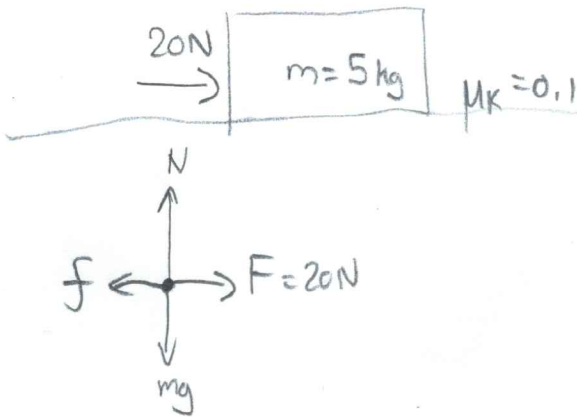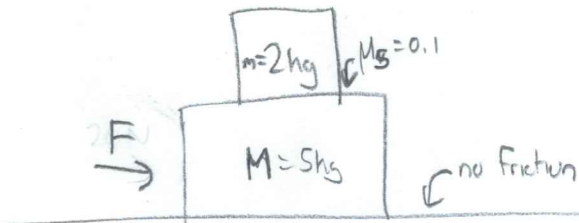

$$f_{friction} = \mu_K N = \mu_K mg$$

$$F_{net\,y} = 0 = N - mg \implies N = mg$$

$$F_{net\,x} = ma = F - \mu_K mg$$

$$\implies \boxed{a = \frac{F - \mu_K mg}{m}}$$

- FBD dot
- Newton 2nd Law Assumptions

$m = 2kg \quad \mu_s = 0.1$

$M = 5kg$ — no friction

Find F so that the 2kg block does not slide on top of 5kg.
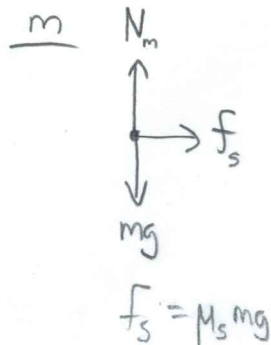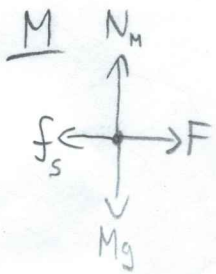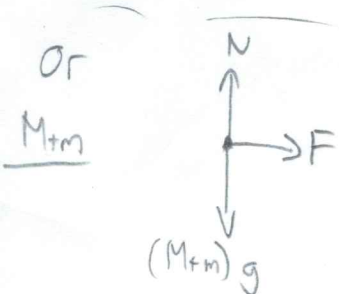
$$ma = f_s$$

$$a = \frac{f_s}{m}$$

$$Ma = F - f_s$$

$$M\left(\frac{f_s}{m}\right) = F - f_s$$

$$\frac{M}{m} f_s + f_s = F$$

$$f_s\left(\frac{M}{m} + 1\right) = F$$

$$F = \mu_s mg \frac{M}{m} + \mu_s mg$$

$$\boxed{F = \mu_s g (M + m)}$$

$$M \quad N_M$$
$$f_s \longleftrightarrow F$$
$$Mg$$

$$m \quad N_m$$
$$\longrightarrow f_s$$
$$mg$$

$$f_s = \mu_s mg$$

Or

$M+m$

$$N$$
$$\longrightarrow F$$
$$(M+m) g$$

$$(M+m) a = F$$
$$a = \frac{F}{M+m}$$

$$ma = f_s$$
$$m \frac{F}{M+m} = f_s$$

$$F = \mu_s mg (M+m) = \mu_s g (M+m)$$