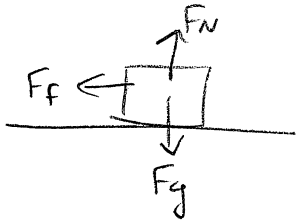
Friction

① 

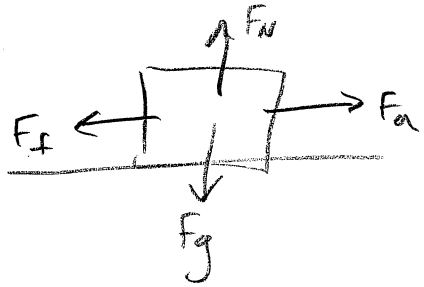
$F_N = F_g = mg$

(a) $F_f = \mu F_N = \mu mg = (0.010)(70)(9.8) = \underline{6.9\ N}$

(b) $v_i = 1.0\ m/s$
$v_f = 0$
$t = ?$
$a = \_\_\_$

$F_{net} = ma$
$-F_f = ma$
$-6.9 = 70a$
$a = -.099\ m/s^2$

$v_f = v_i + at$
$0 = 1 + (-.099)t$
$-1 = -.099t$
$t = \underline{10\ s}$

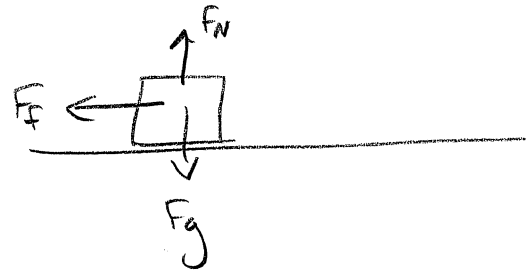
② 

$a = 2.0\ m/s^2$
$m = 10\ kg$
$\mu = 0.35$

$F_f = \mu F_N = \mu F_g = \mu mg = (0.35)(10)(9.8)$
$F_f = 34.3\ N$

$F_{net} = ma$
$F_a - F_f = ma$
$F_a - 34.3 = 10(2)$
$F_a = \underline{54\ N}$

(3)



$m = 10\ kg$ $\quad v_f = 0$

$d = 6\ m$ $\quad v_i = \_\_\_$

$t = 2.2\ s$ $\quad a = \_\_\_$

$\mu = ?$

$$d = \left(\frac{v_i + v_f}{2}\right)t$$

$$6 = \left(\frac{v_i + 0}{2}\right)2.2$$

$$12 = v_i(2.2)$$

$$v_i = 5.45\ m/s$$

$$v_f = v_i + at$$

$$0 = 5.45 + a(2.2)$$

$$-5.45 = a(2.2)$$

$$a = -2.48\ m/s^2$$

$$F_{net} = ma$$

$$-F_f = ma$$

$$-F_f = 10(-2.48)$$

$$-F_f = -24.8$$

$$F_f = 24.8\ N$$

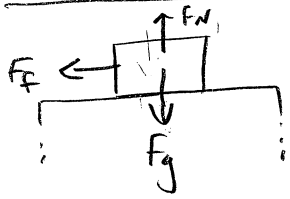
$$F_f = \mu F_N = \mu mg$$

$$24.8 = \mu(10)(9.8)$$

$$24.8 = \mu(98)$$

$$\mu = 0.25$$

(4) Between Blocks



$m = 0.5\ kg$

$F_f = \mu F_N = \mu F_g = \mu mg = (0.35)(.5)(9.8) = 1.715\ N$

so the maximum force acting on the top block can be 1.715 N

$$F = ma$$

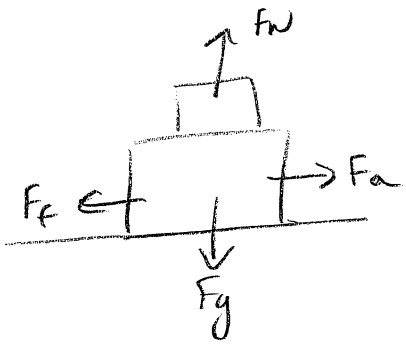
$$1.715 = 0.5a$$

$$a = 3.43\ m/s^2$$

The maximum acceleration of both blocks can be $3.43\ m/s^2$.

4 cont'd

Bottom block



$F_{net} = ma$

$F_a - F_f = ma$

↑ mass must be the total mass.

$F_f = \mu F_N = \mu F_g$

$= \mu mg$

$= (0.2)(1.5)(9.8)$

↑ mass must be total mass because the two blocks are together

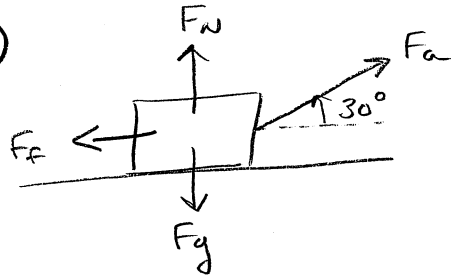
$F_f = 2.94N$

$F_a - F_f = ma$

$F_a - (2.94) = (1.5)(3.43)$

$F_a = 8.1\ N$

(5)



$m = 50\ kg$

$F_a = 200N$

$\mu = 0.3$

(a) Vertical forces: $F_{net} = 0$

$F_N + F_a \sin 30 - F_g = 0$

$F_N + 200 \sin 30 - 490 = 0$

$F_N - 390 = 0$

$F_N = 390N$

$F_g = mg$

$= 50(9.8)$

$= 490\ N$

(b) $F_f = \mu F_N = (0.3)(390) = 117N$

(c) Horizontal forces: $F_{net} = ma$

$-F_f + F_a \cos 30 = ma$

$-117 + 200 \cos 30 = 50a$

$56.21 = 50a$

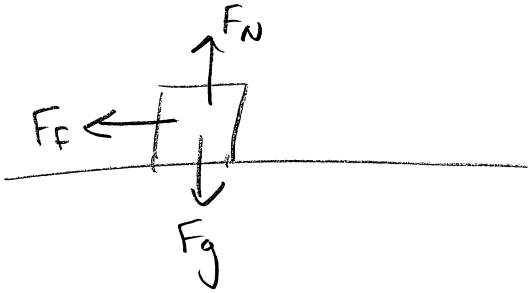
$a = 1.1\ m/s^2$

(6) $v_i = 2.0$ m/s

$v_f = 0$

$\mu = 0.20$

$d = ?$



to find d, we need t

to find t, we need a.

$F_f = \mu F_N$

$F_N = F_g$

$F_g = mg$

$F_f = \mu mg$

Horizontal: $F_{net} = ma$

$-F_f = ma$

$-\mu mg = ma$

$-(.2)(9.8) = a$

$-1.96 \text{ m/s}^2 = a$

$v_f = v_i + at$

$0 = 2 + (-1.96)t$

$-2 = -1.96t$

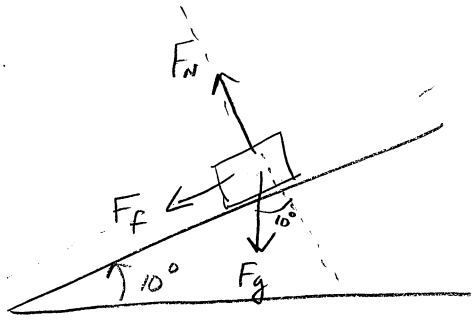
$t = 1.02$ s

$d = \left(\frac{v_i + v_f}{2}\right)t$

$= \left(\frac{2+0}{2}\right)(1.02)$

$d = 1.0$ m

(7)



$v_i = 20$ m/s

$v_f = 0$

$\mu = 0.1$

$d = ?$

We need time and acceleration for acceleration, we need net force

Vertical

$F_N = F_g \cos 10$

$F_N = mg \cos 10$

Horizontal

$F_{net} = ma$

$-F_f - F_g \sin 10 = ma$

$-\mu mg \cos 10 - mg \sin 10 = ma$

$-(.1)(9.8)\cos 10 - (9.8)\sin 10 = a$

$-.965 - 1.702 = a$

$-2.667 \text{ m/s}^2 = a$

$v_f = v_i + at$

$0 = 20 + (-2.667)t$

$-20 = -2.667$

$t = 7.499$ s

$d = \left(\frac{v_i + v_f}{2}\right) t$

$d = \left(\frac{20}{2}\right)(7.499)$

$d = 75$ m