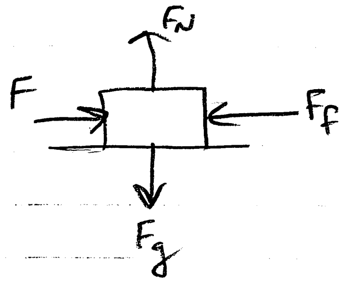
More friction Problems

(1)



maximum force

$F = F_f$

$F_f = \mu F_N$

$= (0.62)(78.4N)$

$= 48.61$

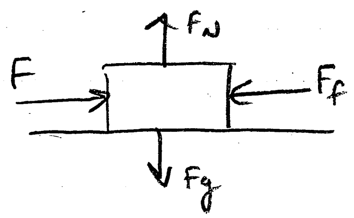
$F_N = F_g = mg$

$= (8\,kg)(9.8\,m/s)$

$= 78.4N$

$\underline{F = 48.61N}$

(2)



$F = F_f$

$F_f = 50N$

$F_N = F_g$

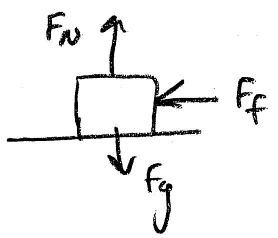
$F_N = 200\,N$

$F_f = \mu F_N$

$50 = \mu(200)$

$\underline{\mu = 0.25}$

(3)



$F_f = \mu F_N$

$F_N = F_g = mg = (2500kg)(9.8\,m/s^2)$

$= 24500N$

$F_f = (.8)(24500N)$

$= 19600N$

$\Sigma F = ma$

$F_f = ma$

$19600N = (2500kg)a$

$a = -7.84\,m/s^2$

(car will be slowing down)

3 cont'd

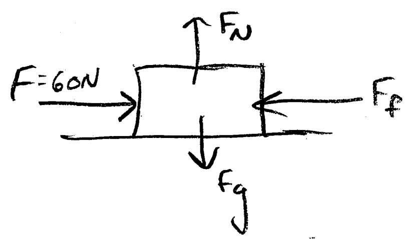
$V_f^2 = V_i^2 + 2ad$

$0 = (50)^2 + 2(-7.84)d$

$d = 159\ m$

No batman does not stop in time.

(4)



(a) $\Sigma F = ma$

$F - F_f = ma$

$60N - F_f = (10kg)(2m/s^2)$

$F_f = 40N$

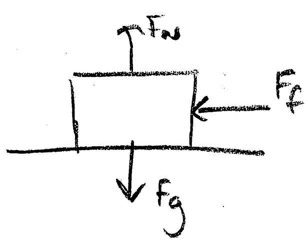
(b) $F_N = F_g = mg = (10kg)(9.8m/s^2) = 98N$

$F_f = \mu F_N$

$40N = \mu(98N)$

$\mu = 0.41$

(5)



$\Sigma F = ma$

$F_f = ma$

$\mu mg = ma$

$a = (.3)(9.8)$

$a = -2.94\ m/s^2$ (block is slowing down)

$F_N = F_g = mg$

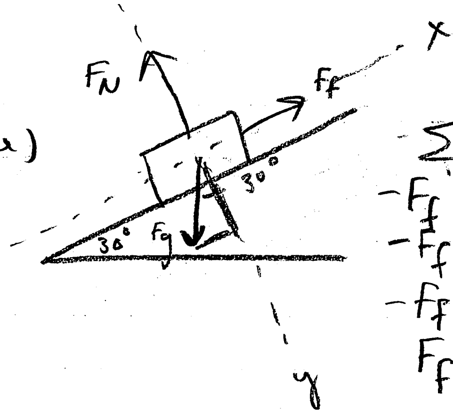
$F_f = \mu F_N = \mu mg$

$V_f^2 = V_i^2 + 2ad$

$0 = (5m/s)^2 + 2(-2.94m/s^2)d$

$d = 4.25m$

⑥ (a)



x

$$\Sigma F = 0$$
$$-F_f + F_g \sin 30 = 0$$
$$-F_f + mg \sin 30 = 0$$
$$-F_f + 10(9.8)\sin 30 = 0$$
$$F_f = 49N$$

y

$$\Sigma F = 0$$
$$F_N - F_g \cos 30 = 0$$
$$F_N - mg \cos 30 = 0$$
$$F_N - 10(9.8)\cos 30 = 0$$
$$F_N = 84.87\,N$$

$$F_f = \mu F_N$$
$$49 = \mu(84.87)$$
$$\underline{\mu = 0.58}$$

(b) same diagram.

x

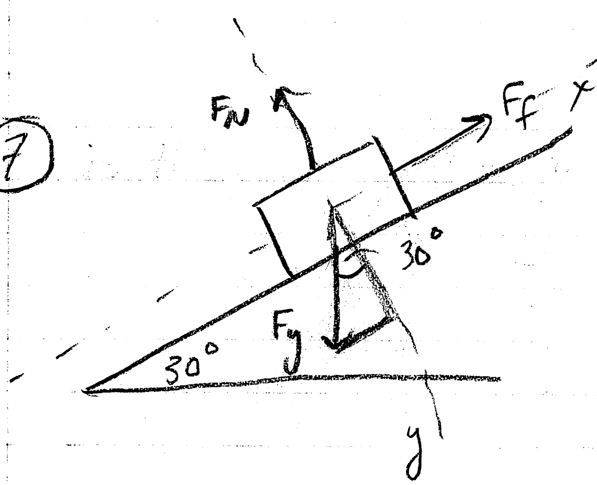
$$\Sigma F = ma$$
$$-F_f + F_g \sin 30 = ma$$
$$-F_f + mg \sin 30 = ma$$
$$-F_f + 10(9.8)\sin 30 = 10(2)$$
$$F_f = 29N$$

y

$$\Sigma F = 0$$
$$F_N - F_g \cos 30 = 0$$
$$F_N - mg \cos 30 = 0$$
$$F_N - 10(9.8)\cos 30 = 0$$
$$F_N = 84.87\,N$$

$$F_f = \mu F_N$$
$$29 = \mu(84.87)$$
$$\underline{\mu = 0.34}$$

⑦



there are only two forces in the x direction

F_f and $F_g \sin 30$

if the box is going to move.

$F_g \sin 30 > F_f$

$\underline{y}$

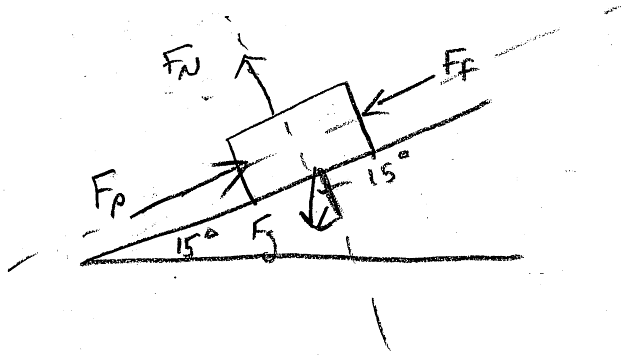
$$\Sigma F = 0$$
$$F_N - F_g \cos 30 = 0$$
$$F_N - mg \cos 30 = 0$$
$$F_N - 4(9.8) \cos 30 = 0$$
$$F_N = 32.15 N$$

$$F_g \sin 30 = ?$$
$$mg \sin 30 = ?$$
$$4(9.8) \sin 30 = ?$$
$$19.6 N$$

$$F_f = \mu F_N$$
$$= (.68)(32.15)$$
$$F_f = 21.86 N$$

The maximum static friction (F_f) is greater than $F_g \sin 30$, therefore the box remains at rest.

(8)



$\underline{x}$

$$\Sigma F = 0$$
$$F_p - F_f - F_g \sin 15 = 0$$
$$F_p - F_f - mg \sin 15 = 0$$
$$F_p - (141.99) - 60(9.8) \sin 15 = 0$$

$\underline{F_p = 294.18 N}$

$\underline{y}$

$$\Sigma F = 0$$
$$F_N - F_g \cos 15 = 0$$
$$F_N - mg \cos 15 = 0$$
$$F_N - 60(9.8) \cos 15 = 0$$
$$F_N = 567.96 N$$

$$F_f = \mu F_N$$
$$= (.25)(567.96)$$
$$= 141.99 N$$