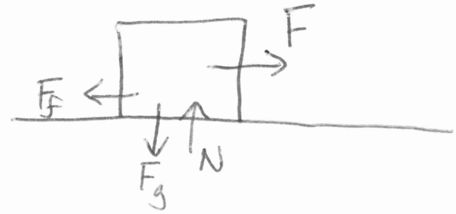
Recitation Week 5 Solutions

Ch. 6 #3

a) Constant velocity so $F_{Tot} = 0$



$F + F_f = 0$

$F = -F_f = -\mu_k N = -\mu_k mg$

$= -(0.25)(30)(-9.8)$

$= \boxed{73.5\ N}$

b) $W = F \cdot d = 73.5 \cdot 4.5 = \boxed{330.75\ J}$

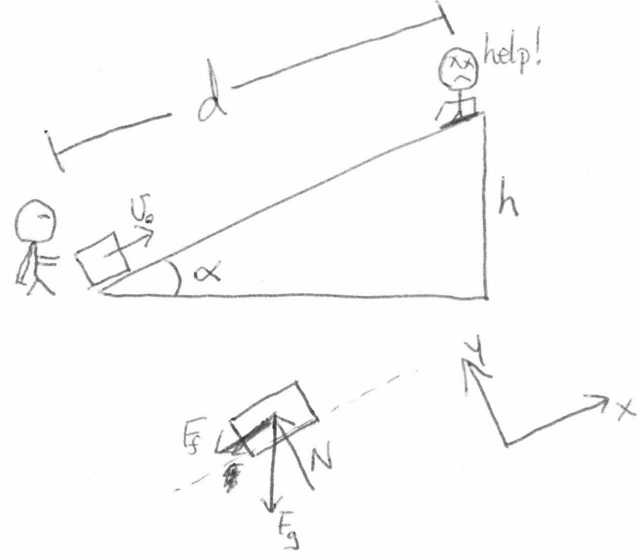
c) $W = F \cdot d = -73.5 \cdot 4.5 = \boxed{-330.75\ J}$

d) Crate did not move vertically, so $d = 0$.

$W = 0$ for F_g and N

e) Total work $= \boxed{0\ J}$

Ch.6 #17



$$\sin\alpha = \frac{h}{d}$$

$$d = \frac{h}{\sin\alpha}$$

$$N = mg\cos\alpha$$

$$F_{gx} = mg\sin\alpha$$

$$F_{Tot} = F_{gx} + F_f = mg\sin\alpha + \mu_k mg\cos\alpha$$

Work done on box must equal initial kinetic energy of box.

$$KE = W$$

$$\frac{1}{2}mv^2 = F \cdot d$$

$$\frac{1}{2}mv_0^2 = (mg\sin\alpha + \mu_k mg\cos\alpha) \cdot \frac{h}{\sin\alpha}$$

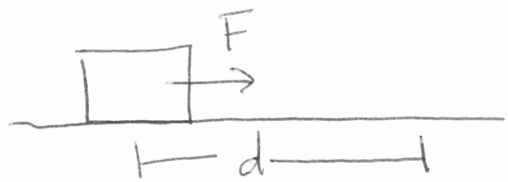
$$\frac{1}{2}v_0^2 = gh + \mu_k gh\frac{\cos\alpha}{\sin\alpha}$$

$$v_0^2 = 2gh(1 + \mu_k\cot\alpha)$$

$$\boxed{v_0 = \sqrt{2gh(1 + \mu_k\cot\alpha)}}$$

Ch. 6 #23

$W = F \cdot d = 36.0(1.20)$
$= 43.2\ J$



$d = 1.20\ m.$
$F = 36.0\ N$
$m = 4.30\ kg$
$\mu = 0.30$

a) $W = \Delta K = 43.2\ J$

$K_f - K_o^{\,0} = 43.2\ J$

$\frac{1}{2} m v_f^2 = 43.2$

$v_f^2 = \frac{86.4}{m} = \frac{86.4}{4.30} = 20.1$

$v_f = \boxed{4.5\ m/s}$

b) $F_{Tot} = F + F_f$

$F_f = \mu m g = 0.30(4.30)(-9.8)$
$= -12.64\ N$

$F_{Tot} = 36.0 - 12.64 = 23.36\ N$

$W = F_{Tot} \cdot d = 23.36(1.20) = 28.03\ J$

$\frac{1}{2} m v_f^2 = 28.03$

$v_f^2 = \frac{56.06}{4.30} = 13.04$

$v_f = \boxed{3.6\ m/s}$

Ch. 6 #48

$P = F \cdot v$ constant velocity, so $F = F_g$

Power to keep acceleration at 0 and maintain v

is $P = F_g \cdot v$

$= mgv$

$= 700(9.8)(2.5)$

$= 17{,}150 \text{ W}$

Total power supplied is 75 kW = 75,000 W

Fraction of power used to climb is $\frac{P}{P_{Tot}} = \frac{17{,}150}{75{,}000} = \boxed{0.23}$