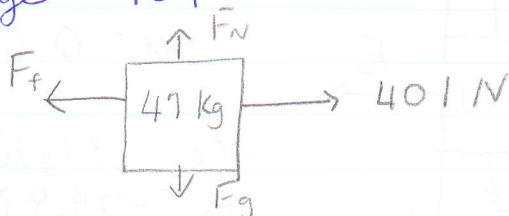


30.



$$\vec{v} = \text{constant}$$

$$\vec{a} = 0 \text{ m/s}^2$$

$$F_{\text{net}} = m(0 \text{ m/s}^2), \text{ so } F_f = -401 \text{ N}$$

$$F_N = -F_g = -(47 \text{ kg})(-9.81 \text{ m/s}^2)$$

$$F_N = 461.07 \text{ N}$$

$$F_f = \mu F_N$$

$$401 \text{ N} = \mu (461.07 \text{ N})$$

$$\mu = 0.87$$

31.



$$\vec{a} = 0 \text{ m/s}^2$$

$$F_{\text{net}} = m\vec{a}, \quad F_f = -385 \text{ N}$$

$$\text{Wood on wood: } \mu_k = \del{0.40} 0.20$$

$$F_f = \mu F_N, \quad F_N = -F_g$$

$$\therefore F_f = \mu F_g \quad (\text{remember that this equation doesn't care about directions})$$

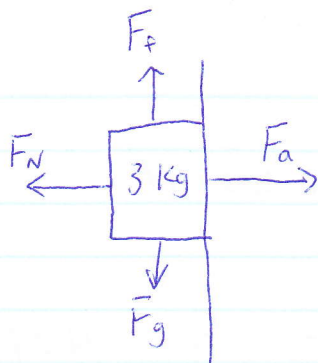
$$\bullet 385 \text{ N} = (0.20)(m)(9.81 \text{ m/s}^2)$$

~~$$m = 98.1 \text{ kg}$$~~

~~$$m = 49.05 \text{ kg}$$~~

$$m = 196 \text{ kg}$$

32.



$$\mu = 0.60$$

$$F_g = (3 \text{ kg})(-9.81 \text{ m/s}^2)$$

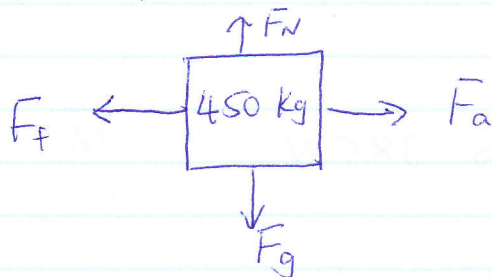
$$F_g = -29.43 \text{ N}$$

$$F_f = -F_g = 29.43 \text{ N}$$

$$F_N = -F_a, \quad F_f = \mu F_N \Rightarrow F_f = \mu F_a$$

$$29.43 \text{ N} = (0.60)(F_a)$$

$$F_a = 49.05 \text{ N}$$

34 ~~33~~ . @

$$-F_g = F_N \Rightarrow -(450 \text{ kg})(-9.81 \text{ m/s}^2) = F_N$$

$$F_N = 4414.5 \text{ N}$$

$$\textcircled{b} \quad F_f = \mu_s F_N = (0.35)(4414.5 \text{ N})$$

$$F_f = 1545.075 \text{ N}$$

$$\text{Minimum } F_a = 1545.075 \text{ N} = 1550 \text{ N}$$

$$\textcircled{c} \quad F_a = -F_f = 1100 \text{ N}$$

$$F_f = \mu_k F_N \Rightarrow 1100 \text{ N} = \mu_k (4414.5 \text{ N})$$

$$\mu_k = 0.25$$

33.

$$F_f = \mu F_N$$

Rubber on dry concrete:  $\mu = 1.00$   
 Rubber on wet concrete:  $\mu = 0.70$

$$457 \text{ N} = (1.00) F_N$$

$$F_N = 457 \text{ N}$$

$$\mu F_N = F_f$$

$$(457 \text{ N})(0.70) = 320. \text{ N}$$

Reduced:

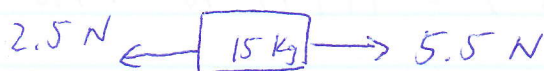
$$457 \text{ N} - 320. \text{ N}$$

$$= 137 \text{ N}$$

Force is reduced by 137 N

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4.



$$[5] \longrightarrow [N]$$

$$F_{\text{net}} = m\vec{a}$$

$$5.5 \text{ N} + (-2.5 \text{ N}) = (15 \text{ kg}) \vec{a}$$

$$3 \text{ N} = (15 \text{ kg}) \vec{a}$$

$$\vec{a} = 0.2 \text{ m/s}^2$$

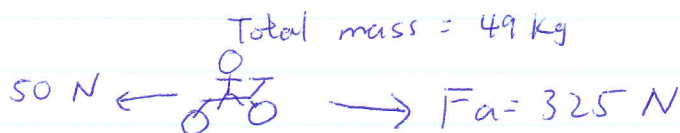
$$V_i = 0 \text{ m/s}, V_f = ?, t = 4.0 \text{ s}, \vec{d} = ?$$

$$\vec{d} = V_i t + \frac{1}{2} a t^2$$

$$d = 0 + \frac{1}{2} (0.2 \text{ m/s}^2) (4.0 \text{ s})^2$$

$$d = 1.6 \text{ m}$$

5.



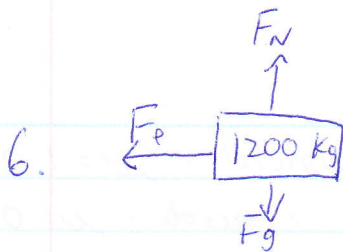
$$\text{a) } F_{\text{net}} = m\vec{a}$$

$$325 \text{ N} - 50 \text{ N} = (49 \text{ kg}) \vec{a}$$

$$\vec{a} = 5.6 \text{ m/s}^2$$

$$\text{b) } V_i = 3.0 \text{ m/s}, t = 8.0 \text{ s}, d = ?$$

$$d = V_i t + \frac{1}{2} a t^2 \Rightarrow d = (3.0 \text{ m/s})(8.0 \text{ s}) + \frac{1}{2} (5.6 \text{ m/s}^2) (8.0 \text{ s})^2 \Rightarrow d = 203.2 \text{ m}$$



$$v_i = 45 \text{ km/h} = 12.5 \text{ m/s} \quad v_f = 0 \text{ m/s}$$

$$d = \del{35} 35 \text{ m}, \quad a = ?$$

$$v_f^2 = v_i^2 + 2ad$$

$$0 = (12.5 \text{ m/s})^2 + 2a(35 \text{ m})$$

$$0 = 156.25 \text{ m}^2/\text{s}^2 + 70 \text{ m}(a)$$

$$a = -2.23 \text{ m/s}^2$$

$$F_f = ma = (1200 \text{ kg})(-2.23 \text{ m/s}^2)$$

$$F_f = -2676 \text{ N}$$

$$F_g = (1200 \text{ kg})(-9.81 \text{ m/s}^2) = -11772 \text{ N} = -F_N$$

$$F_f = \mu F_N, \quad 2676 \text{ N} = \mu(11772 \text{ N})$$

$$\mu = 0.23$$