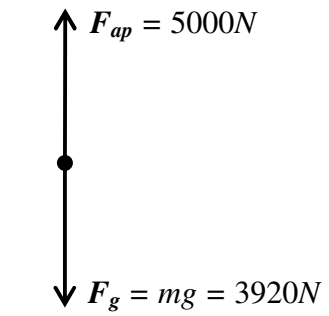
Answers to "Worksheet: More Simple Forces"

1. FBD:

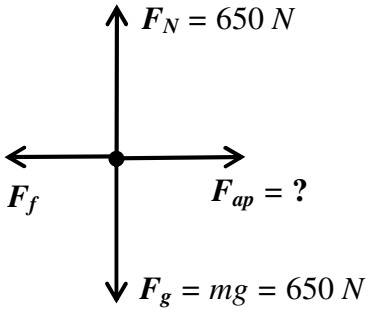


$$F_{net} = F_{ap} - F_g$$
$$F_{net} = 5000N - 3920N$$
$$F_{net} = 1080N$$

$$F_{net} = ma$$
$$a = \frac{F_{net}}{m} = \frac{1080N}{400kg} = 2.7\ \tfrac{m}{s^2}$$

Ans: 2.7 m/s^2

2. FBD:



$$F_f = \mu_k F_N$$
$$F_f = (0.25)(650N)$$
$$F_f = 162.5N$$

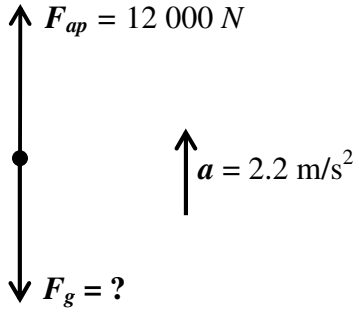
$$F_{net} = 0!$$

$$F_{net} = F_{ap} - F_f$$
$$0 = F_{ap} - F_f$$
$$F_{ap} = F_f$$
$$F_{ap} = 162.5N$$

Ans: 162.5 N

3. FBD:

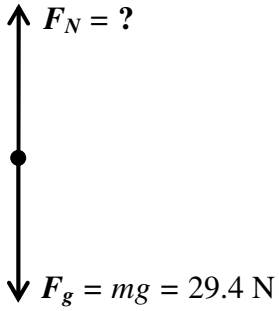
$$F_{net} = ma$$



$$F_{net} = F_{ap} - F_g$$
$$ma = 12000N - mg$$
$$m\left(2.2\ \tfrac{m}{s^2}\right) = 12000N - m(9.8\ \tfrac{m}{s^2})$$
$$m\left(2.2\ \tfrac{m}{s^2}\right) + m(9.8\ \tfrac{m}{s^2}) = 12000N$$
$$m(12\ \tfrac{m}{s^2}) = 12000N$$
$$m = \frac{12000N}{12\ \frac{m}{s^2}} = 1000kg$$

Ans: 1000 kg

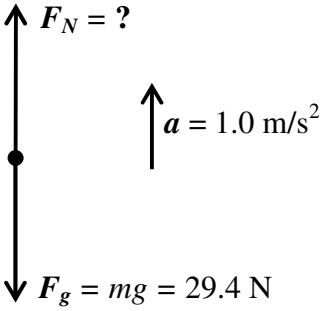
4. **a.** FBD:



$F_{net} = 0$

Ans: 29.4 N

b. FBD:



$F_{net} = ma$

$F_{net} = (3.0kg)(1.00\frac{m}{s^2})$

$F_{net} = 3.0N$

$F_{net} = F_N - F_g$

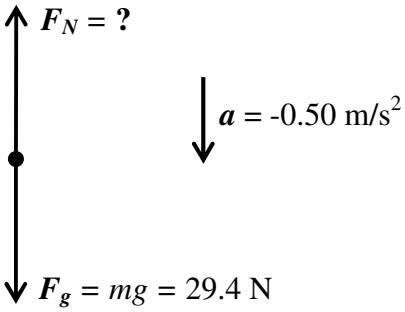
$F_N = F_{net} + F_g$

$F_N = 3.0N + 29.4N$

$F_N = 32.4N$

Ans: 32.4 N

c. FBD:



$F_{net} = ma$

$F_{net} = (3.0kg)(-0.5\frac{m}{s^2})$

$F_{net} = -1.5N$

* The elevator is moving up, but slowing down, therefore the acceleration is down (negative)!

$F_{net} = F_N - F_g$

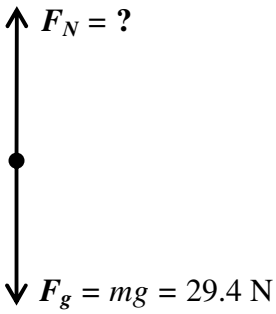
$F_N = F_{net} + F_g$

$F_N = -1.5N + 29.4N$

$F_N = 27.9N$

Ans: 27.9 N

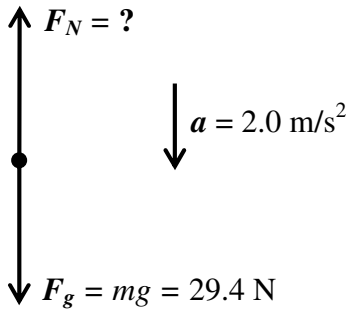
d. FBD:



$F_{net} = 0$

Ans: 29.4 N

e. FBD:

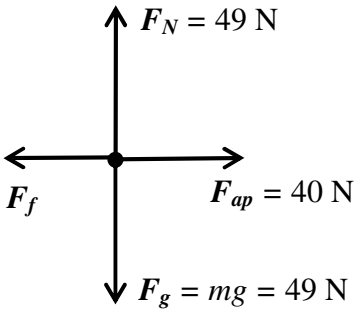


$$F_{net} = ma$$
$$F_{net} = (3.0kg)\left(-2.0\tfrac{m}{s^2}\right)$$
$$F_{net} = -6.0N$$

$$F_{net} = F_N - F_g$$
$$F_N = F_{net} + F_g$$
$$F_N = -6.0N + 29.4N$$
$$F_N = 23.4N$$

Ans: 23.4 N

5. FBD:



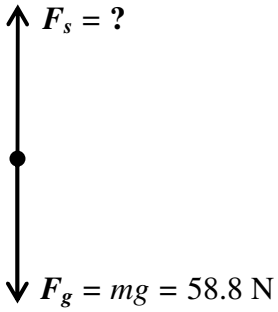
$$F_f = \mu_k F_N$$
$$F_f = (0.40)(49N)$$
$$F_f = 19.6N$$

$$F_{net} = F_{ap} - F_f$$
$$F_{net} = 40N - 19.6N$$
$$F_{net} = 20.4N$$

$$F_{net} = ma$$
$$a = \frac{F_{net}}{m} = \frac{20.4N}{5.0kg} = 4.08\tfrac{m}{s^2}$$

Ans: 4.08 m/s²

6. FBD:



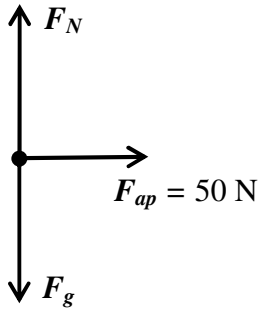
$$F_{net} = 0!$$

$$F_s = F_g$$
$$F_s = 58.8N$$

$$F_s = kx$$
$$k = \frac{F_s}{x} = \frac{58.8N}{0.04m} = 1470\tfrac{N}{m}$$

Ans: 1470 N/m

7. FBD:

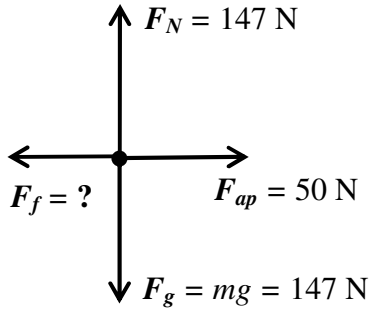


$$F_{net} = 50N$$

$$F_{net} = ma$$
$$a = \frac{F_{net}}{m} = \frac{50N}{20.0kg} = 2.5\tfrac{m}{s^2}$$

Ans: 2.5 m/s²

8. FBD:



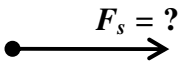
$$F_f = \mu_s F_N$$
$$F_f = (0.25)(147N)$$
$$F_f = 36.75N$$

This is the maximum force friction can exert.

The object **does not move** because the applied force (35 N) is not enough to overcome the friction.

Ans: NO

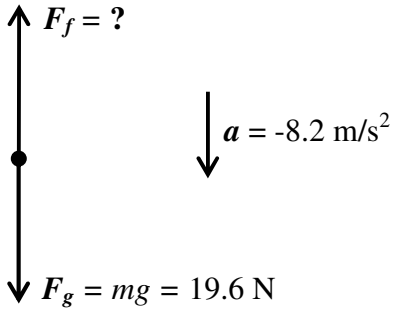
9. FBD:



$$F_s = kx$$
$$F_s = \left(2500\tfrac{N}{m}\right)(0.1m)$$
$$F_s = 250N$$

Ans: 250 N

10. FBD:

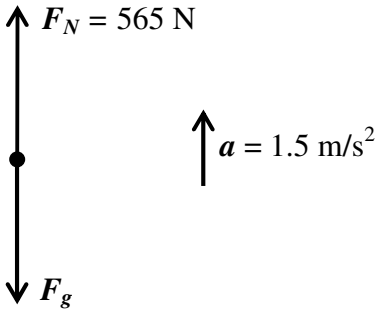


$$F_{net} = ma$$
$$F_{net} = (2.0kg)\left(-8.2\tfrac{m}{s^2}\right)$$
$$F_{net} = -16.4N$$

$$F_{net} = F_f - F_g$$
$$F_f = F_{net} + F_g$$
$$F_f = -16.4N + 19.6N$$
$$F_f = 3.2N$$

Ans: 3.2 N

11. FBD:

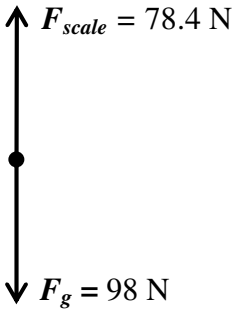


$$F_{net} = ma$$

$$F_{net} = F_N - F_g$$
$$ma = 565N - mg$$
$$m\left(1.50\tfrac{m}{s^2}\right) = 565N - m\left(9.8\tfrac{m}{s^2}\right)$$
$$m\left(11.3\tfrac{m}{s^2}\right) = 565N$$
$$m = \frac{565N}{11.3\frac{m}{s^2}} = 50kg$$

Ans: 50 kg

12. FBD:



$$F_{net} = F_{scale} - F_g$$
$$F_{net} = 78.4N - 98N$$
$$F_{net} = -19.6N$$

$$F_{net} = ma$$
$$a = \frac{F_{net}}{m} = \frac{-19.6N}{10kg} = -1.96\frac{m}{s^2}$$

Ans: -1.96 m/s^2