Homework Solutions
9/12/2007

Conceptual

9. The force that causes an automobile to move is the road pushing on the tires. The force that causes a plane to move is the air pushing on the propeller. The force that cause a rowboat to move is the water pushing on the oar.

12. The scale will read the lifter's weight plus the downward force exerted on the lifter by the barbell. Thus, the harder the lifter pushes up on the barbell, the harder the barbell pushes back and the greater the scale reading. This would occur near the bottom of the barbell's cycle and it is being lifted upward. The scale will read an amount less than the combined weights of the lifter and the barbell near the top of the barbell's cycle because is allowed to move back downward and the lifter applies less force upward.

14. The net force on the rocket is the thrust of its engines minus the air resistance. As the rocket moves farther and farther from earth air resistance decreases and therefore net force increases. Because net force and acceleration are directly proportional, the acceleration will also increase and so will its speed.

19. The force of friction between the bed of the truck and the crate causes it to accelerate forward. If the driver slams on the brakes the crate could slide if static friction is exceeded.

Problems

43. a.

$$\Sigma F = mg - bv$$

$$a = \frac{\Sigma F}{m}$$

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$$0\frac{m}{s^2} = \frac{50kg\left(9.81\frac{m}{s^2}\right) - 15\frac{kg}{s}v}{50kg}$$

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$$15\frac{kg}{s}v = 50kg\left(9.81\frac{m}{s^2}\right)$$

$$v = 32.7\frac{m}{s}$$

b. It does not matter what the initial velocity of the object is.

48. a.

$$x = x_0 + v_0 t + \frac{1}{2}at^2$$

$$1.00m = \frac{1}{2}a(4s)^2$$

$$a = 0.125\frac{m}{s^2}$$

b.

$$\Sigma F_{m1} = T - mg$$

$$a = \frac{\Sigma F_{m1}}{m_1}$$

$$0.125\frac{m}{s^2} = \frac{T - 4.00kg\left(9.81\frac{m}{s^2}\right)}{4.00kg}$$

$$0.500N = T - 39.24N$$

$$T = 39.74N = 39.7N$$

c.

$$\Sigma F_{m2} = m_2 g\sin\theta - T - F_k$$

$$a_{m2} = \frac{m_2 g\sin\theta - T - F_k}{m_2}$$

$$0.125\frac{m}{s^2} = \frac{9.00kg\left(9.81\frac{m}{s^2}\right)\sin 40.0° - 39.7N - F_k}{9.00kg}$$

$$1.125N = 56.75N - 39.7N - F_k$$

$$F_k = 15.9N$$

$$F_k = \mu_k \eta$$

$$F_k = \mu_k\left(m_2 g\cos\theta\right)$$

$$15.9N = \mu_k(67.63N)$$

$$\mu_k = .235$$

55. a.

$$T_{up} = T\sin\theta$$

$$T_{up} = 60N\sin 45° = 42.43N$$

This is the upward tension in each cable. Since the tension to the left in the left cable and the tension to the right in the right cable are equal and opposite, the net force is twice the value from above, or 84.9N.

b. The weight of the stoplight is equal to the resultant upward force by the cables, 84.9N.