Homework Solutions
9/20/2007

Conceptual

12. Both friction from the snow and air resistance will do work on the sled and reduce the energy of the sled.

14. The kinetic energy of the car is reduced due to friction of the brake pads on the disc. This friction causes a corresponding increase in thermal energy in the form of heat. This means the disc brake will get hotter.

18. The work done by static friction and the normal force are zero because each force does not cause a displacement in its direction.

Problems

33. a.

$$Energy_{spring} = \frac{1}{2}kx^2$$

$$W_{spring} = \Delta PE$$

$$\frac{1}{2}kx^2 = mgh$$

$$k = \frac{2mgh}{x^2} = \frac{2(0.02kg)\left(9.81\frac{m}{s^2}\right)(20.0m)}{(0.120m)^2} = 545N$$

b.

$$KE_{bottom} = PE_{top}$$

$$\frac{1}{2}mv^2 = mgh$$

$$v = \sqrt{2gh} = \sqrt{2\left(9.81\frac{m}{s^2}\right)(20.0m)} = 19.8\frac{m}{s}$$

39.

$$W_{water} = \Delta KE = \Delta PE$$

$$F_{water} \bullet d = mgh$$

$$F_{water} = \frac{mgh}{d} = \frac{(70kg)\left(9.81\frac{m}{s^2}\right)(15m)}{5m} = 2100N$$

41.

$$h_{driveway} = 5m\sin 20°$$

$$h = 1.71m$$

$$PE_i + KE_i = PE_f + KE_f + W_{friction}$$

$$mgh = \frac{1}{2}mv_f^2 + F_{fricion} \bullet d$$

$$v_f = \sqrt{\frac{2\left(mgh - F_{fricion} \bullet d\right)}{m}}$$

$$v_f = \sqrt{\frac{2\left(\left(2100kg\right)\left(9.81\frac{m}{s^2}\right)(1.71m) - (4000N)(5.0m)\right)}{2100kg}}$$

$$v_f = 3.8\frac{m}{s}$$

77.

$$\left(U_g + KE + U_s\right)_i = \left(U_g + KE + U_s\right)_f$$

$$mgh_i = m + \frac{1}{2}kx^2$$

$$k = \frac{2\left(mgh_i - mgh_f\right)}{x^2} = \frac{2\left[\left(700N\right)\left(36.0m\right) - \left(700N\right)\left(4.0m\right)\right]}{\left(7.00m\right)^2} = 914\frac{N}{m}$$