Unit 10 Homework – Text Problems

18. The area under this curve represents the work done. The net work is

$$W^{\text{net}} = (10\text{N})(2.0\text{ m}) + \tfrac{1}{2}(10\text{ N})(2.0\text{ m}) + 0\text{ J} + \tfrac{1}{2}(-5.0\text{N})(2.0\text{ m}) = 25\text{J}.$$

44. (a) The component of the force of gravity exerted on the ice block (of mass m) along the incline is $mg\sin\theta$, where $\theta = \sin^{-1}(0.91\text{ m}/1.5\text{ m})$ gives the angle of inclination for the inclined plane. Since the ice block slides down with uniform velocity, the worker must exert a force $\vec{F}^{\text{app}}$ "uphill" with a magnitude equal to $mg\sin\theta$. Consequently,

$$F^{\text{app}} = mg\sin\theta = (45\text{ kg})(9.8\text{ m/s}^2)\left(\frac{0.91\text{m}}{1.5\text{m}}\right) = 2.7\times10^2\text{ N}.$$

(b) Since the "downhill" displacement is opposite to $\vec{F}^{\text{app}}$, the work done by the worker is $W^{\text{app}} = -(2.7\times10^2\text{N})(1.5\text{ m}) = -4.0\times10^2\text{J}$.

(c) Since the displacement has a vertically downward component of magnitude 0.91 m (in the same direction as the force of gravity), we find the work done by gravity to be $W^{\text{grav}} = (45\text{ kg})(9.8\text{ m/s}^2)(0.91\text{ m}) = 4.0\times10^2\text{J}$.

(d) Since the normal force is perpendicular to the displacement, it does no work.

(e) The resultant force $\vec{F}^{\text{net}} = 0\text{ N}$ since there is no acceleration. Thus, the net work is zero, as can be checked by adding the above results $W^{\text{net}} = W^{\text{app}} + W^{\text{grav}} = 0\text{ J}$.