WORK ENERGY PRACTICE PROBLEMS KEY

Note Title 2016-02-29

① a) $W = F\cdot d = mg\cdot h = 175\,kg\left(9.80\,\frac{N}{kg}\right)2.00\,m = \underline{3430\,J}$

b) $\Delta h = 0 \therefore$ no work done

② a) $W = F_f\cdot d = 120\,N \times 2.00\,m = \underline{240\,J}$

b) $W = mg\Delta h = 35.0\,(9.80)(2.00) = \underline{686\,J}$

③ $F_f = \mu F_N = \mu mg = 0.060\,(240)(9.80) = 141.1\,N$

$W = F_f\cdot d = 141.1 \times 55{,}000 = \underline{7.76\times10^6\,J}$

④ $W = Fd = 50.0\,N \times 25.0\,m = \underline{1250\,J}$

⑤ $W_{TOTAL} = W_1 + W_2 + W_3$

$= F_1 d_1 + F_2 d_2 + F_3 d_3 = (15\,N \times 6.0\,m) + (45\,N \times 4.0\,m) + (20\,N \times 10\,m)$

$W = \underline{470\,J}$

⑧ $\Delta E_p = mg\Delta h = 0.300\,(9.8)(2.20 - 2.80) = -\underline{1.76\,J}$

⑨ $W = F\cdot d \therefore F = \frac{W}{d} = \frac{\Delta E_k}{d} = \frac{0 - \frac{1}{2}mv^2}{d} = \frac{\frac{1}{2}(0.140)(30)^2}{0.35} = \underline{180\,N}$

⑩ a) $W = W_f = F_f\cdot d = \mu mgd = 0.060\,(75.0)(9.8)(2000)$

$= \underline{8.82\times10^4\,J}$

b) $W = W_{accel} + W_f = F_{accel}\cdot d + \mu mgd$

$= mad + \mu mgd$

$= 75\,(1.15)(2000) + 8.82\times10^4$

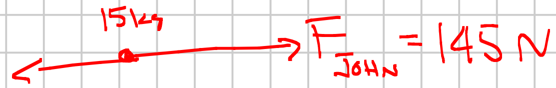
$= 172{,}500 + 88{,}200$

$= \underline{2.61\times10^5\,J}$

c) $W_{frict} = \mu m g d = -8.82 \times 10^4 \text{ J}$

(11) $W = F \times d \therefore F = \frac{W}{d} = \frac{1.20 \times 10^4}{175 \text{ m}} = 68.6 \text{ N}$

(12)



TYPO: He pulls the box for 12.0 m.

$d = 12.0 \text{ m}$

$F_f = \mu m g$

$= 0.190(15)(9.8)$

$F_f = 27.93 \text{ N}$

a) $W_{JOHN} = 145 \text{ N} \times 12.0 \text{ m} = 1740 \text{ J}$

b) $W_{FRICTION} = 27.93 \text{ N} \times 12.0 \text{ m} = 335 \text{ J}$

c) $W_{net} = W_{JOHN} - W_{FRICTION} = 1740 - 335 = 1400 \text{ J}$

(13) $W_{TOTAL} = W_{LIFT} + W_{CARRY} + W_{LOWER}$

$= \Delta E_p + 0 + \Delta E_p$ (in all three movements, the change in speed is neglibile)

$= 2.25(9.8)(1.25) + 0 + 2.25(9.8)(-0.90)$

$W = 7.7 \text{ J}$

(14) $W = \Delta E_p = mg\Delta h \therefore \Delta h = \frac{W}{mg} = \frac{17500}{250.0(9.80)} = 7.14 \text{ m}$

(15) a) $W = F \cdot d = 50.0 \text{ N} \times 2.00 \text{ m} = 100 \text{ J}$

b) $W = F \cdot d \quad d = v \cdot t \therefore W = F \cdot v \cdot t = 50.0 \text{ N}(1.25 \text{ m/s})(3.00 \text{ s})$

$W = 188 \text{ J}$

c) $W = \Delta E_k$ (there is acceleration)

$= \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2 \qquad v_0 = 0, \; v = at = 1.25 \text{ m/s}^2 \cdot 3.00^2 = 11.25 \text{ m/s}$

$\therefore W = \frac{1}{2}(6.00 \text{ kg})(11.25)^2 = 380 \text{ J}$

(16) a) $W = F \cdot d = 525\,N \cdot 28.0\,m = \underline{14,700\,N}$

b) WORK DONE BY THE FATHER IS THE SAME: SAME FORCE USED, SAME DISTANCE

c) THE SLED WILL BE TRAVELING SLOWER AFTER 28 m WITH THE FRICTION.
in a), all the work done by the father turns into E_K. In b) $40\,N \times 28\,m = 1120\,J$ of work turn into heat due to friction.

(17) The person is doing work, because force is being exerted on the piano to move it across the floor.

The refrigerator is not gaining energy (no change in speed or height), because friction is doing negative work on the refigerator. F_f is the same size as the $F_{applied}$, but opposite in direction.