

1.

a.  $4\text{N} / 0.2\text{kg} = 20 \text{ m/s}^2$

b.  $4\text{N} \cdot 12\text{s} = 48 \text{ N}\cdot\text{s}$

c.  $\Delta t = \frac{120\frac{\text{m}}{\text{s}}}{20\frac{\text{m}}{\text{s}^2}} = 6\text{s}$

d.  $v = 20\text{m/s}^2 \cdot 8\text{s} = 160 \text{ m/s}$

e. Area =  $16 \text{ kg}\cdot\text{m/s}$

f. c would increase, a and d would decrease

2.

a. Area =  $12 \text{ N}\cdot\text{s}$

b.  $12 \text{ N}\cdot\text{s} / 5\text{kg} = 2.4 \text{ m/s}$

c. i.  $\frac{13 \text{ kg}\cdot\frac{\text{m}}{\text{s}} - 12\text{N}\cdot\text{s}}{0.5\text{kg}} = 2 \text{ m/s}$

ii. right

d.  $[\frac{1}{2}(5)(2.4^2) + \frac{1}{2}(0.5)(2.0^2)] - \frac{1}{2}(0.5)(26^2) = -153.6 \text{ J}$

e.  $(2.4\text{m/s})(0.495\text{s}) - (2.0\text{m/s})(0.495\text{s}) = 0.198 \text{ m}$

3.

a.  $\frac{-0.18\frac{\text{m}}{\text{s}} - 0.22\frac{\text{m}}{\text{s}}}{0.04\text{s}} - 10 \text{ m/s}^2$

b. Area =  $0.6 \text{ N}\cdot\text{s}$

c.  $\frac{-0.6 \text{ N}\cdot\text{s}}{-0.18\frac{\text{m}}{\text{s}} - 0.22\frac{\text{m}}{\text{s}}} = 1.5 \text{ kg}$

d.  $\frac{1}{2}(1.5)(-0.18)^2 - \frac{1}{2}(1.5)(0.22)^2 = 0.012\text{J}$

4.

a.  $6\text{kg}\cdot\text{m/s} - 5\text{N}\cdot\text{s} \frac{6\text{kg}\cdot\text{m/s} - 5\text{N}\cdot\text{s}}{2\text{kg}} = 0.5\text{m/s}$

b.  $\frac{5\text{N}\cdot\text{s}}{1.6\text{ m/s}} = 3.125\text{kg}$

c.  $\frac{0.5\frac{\text{m}}{\text{s}} - 1.6\frac{\text{m}}{\text{s}}}{1.5\text{s}} = -0.73\text{ m/s}^2$

d. Area = 5.525m

e. The ramp goes up to an elevation of 0.118m

$$(3.125)(9.8)(0) + \frac{1}{2}(3.125)(1.6^2) = (3.125)(9.8)(h) + \frac{1}{2}(3.125)(0.5^2)$$

f. A steeper ramp would create a higher negative acceleration, but the equation above would still apply by conservation of energy, so the final velocity would remain the same.

5.

a.

$$K = \frac{1}{2} \cdot m \cdot v^2 = \frac{1}{2}(2.2 \times 10^{14})(879^2) = 8.5 \times 10^{19} \text{J}$$

$$U_G = \frac{-G \cdot m_{\text{sun}} \cdot m_{\text{comet}}}{R} = \frac{-(6.67E-11)(1.99E30)(2.2E14)}{(35.1)(1.496E11)} = -5.56 \times 10^{21} \text{J}$$

$$E_{\text{total}} = K + U_G = -5.476 \times 10^{21} \text{J}$$

b.

$$U_G = \frac{-G \cdot m_{\text{sun}} \cdot m_{\text{comet}}}{R} = \frac{-(6.67E-11)(1.99E30)(2.2E14)}{(0.586)(1.496E11)} = -3.33 \times 10^{23} \text{J}$$

$$K = E_{\text{total}} - U = -5.476 \times 10^{21} - (-3.33 \times 10^{23} \text{J}) = 3.276 \times 10^{23} \text{J}$$

c.

$$3.276 \times 10^{23} \text{J} = \frac{1}{2}(2.2 \times 10^{14})(v^2)$$

$$v = 54,574 \text{m/s}$$

$$d. W = \Delta K = K_f - K_i = 3.276 \times 10^{23} \text{J} - 8.5 \times 10^{19} \text{J} = 3.275 \times 10^{23} \text{J}$$