

-1-

1. $m_w = 500 \text{ g}$ $t_i = 80^\circ\text{C}$
 $m_i = ?$ $t_i = -20^\circ\text{C}$ $t_f = 30^\circ\text{C}$

$$Q_i + Q_w = 0$$

$$[m_i \text{ sh}(T_f - t_i)] + [m_w \text{ sh}(T_f - t_i)] = 0$$

$$[m_i (2.06)(30 - 80)] + [500 (4.18)(30 - -20)] = 0$$

$$[-103 m_i] + [104500] = 0$$

$$m_i = 1.01 \times 10^3 \text{ g}$$

2. $m_u = 500 \text{ g}$ $t_i = 100^\circ\text{C}$
 $m_w = 200 \text{ g}$ $t_i = 20^\circ\text{C}$ $t_f = 23.2^\circ\text{C}$

$$Q_u + Q_w = 0$$

$$[m_u \text{ sh}(T_f - t_i)] + [m_w \text{ sh}(T_f - t_i)] = 0$$

$$[500 \text{ sh}(23.2 - 100)] + [200(4.18)(23.2 - 20)] = 0$$

$$-49976.8 \text{ sh} + 2675.2 = 0$$

$$\text{sh} = 5.35 \times 10^{-2} \frac{\text{J}}{\text{g}^\circ\text{C}}$$

3. $m_{cu} = 100 \times 3 \text{ g} = 300 \text{ g}$ $t_i = 100^\circ\text{C}$
 $m_w = 150 \text{ g}$ $t_i = 20^\circ\text{C}$ $t_f = ?$

$$Q_u + Q_w = 0$$

$$m_{cu} \text{ sh}(T_f - t_i) + m_w \text{ sh}(T_f - t_i) = 0$$

$$[300 \text{ g} (0.385) T_f - 300 \text{ g} (0.385)(100)] + [150 (4.18) T_f - 150 (4.18) 20] = 0$$

$$115.5 T_f - 11550 + 627 T_f - 12540 = 0$$

$$742.5 T_f - 24090 = 0$$

$$T_f = 32.4^\circ\text{C}$$

4. $L_i = 80 \text{ cm}$ $t_i = 20^\circ \text{C}$
 $L = 80.032 \text{ cm}$ $t_f = 40^\circ \text{C}$

$$\Delta L = L_i \alpha \Delta T$$

$$0.032 \text{ cm} = 80 \text{ cm} \alpha (40^\circ \text{C} - 20^\circ \text{C})$$

$$\alpha = \frac{2 \times 10^{-5}}{^\circ \text{C}}$$

5. $L_i = 1 \text{ m}$ $t_i = 50^\circ \text{C}$ $\alpha = 25 \times 10^{-6}$
 $L = ?$ $t_f = 7^\circ \text{C}$

$$\Delta L = L_i \alpha \Delta T$$

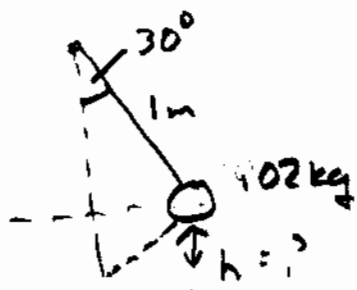
$$= 1 \text{ m} \frac{25 \times 10^{-6}}{^\circ \text{C}} (7^\circ \text{C} - 50^\circ \text{C})$$

$$\Delta L = -0.001075$$

$$\Delta L = L - 1 \text{ m}$$

$$-0.001075 = L - 1 \text{ m}$$

$$L = 0.999$$



$$\cos 30 = \frac{ADJ}{1 \text{ m}}$$

$$ADJ = 0.866 \text{ m}$$

$$h = 1 \text{ m} - 0.866 \text{ m}$$

$$h = 0.134 \text{ m}$$

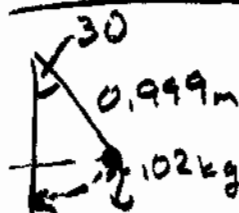
$$PE = mgh$$

$$= 0.02 \text{ kg} (9.8) (0.134)$$

$$= 2.63 \times 10^{-2} \text{ J}$$

$$\Delta PE = 2.65 \times 10^{-2} \text{ J} - 2.63 \times 10^{-2} \text{ J}$$

$$= \boxed{2 \times 10^{-4} \text{ J}}$$



$$\cos 30 = \frac{ADJ}{0.999}$$

$$ADJ = 0.865$$

$$h = 1 \text{ m} - 0.865 \text{ m}$$

$$h = 0.135 \text{ m}$$

$$PE = mgh$$

$$= (0.02) (9.8) (0.135)$$

$$= 2.65 \times 10^{-2} \text{ J}$$

6. $d = 3\text{cm}$ $t_i = 20^\circ\text{C}$ $t_f = ?$
 $h = 10\text{cm}$ $\beta = 6 \times 10^{-5} \frac{1}{^\circ\text{C}}$

$$V_i = \pi r^2 h$$

$$= (3.14)(1.5\text{cm})^2 10\text{cm}$$

$$= \underline{70.65\text{cm}^3}$$

$$\Delta V = 70.65 \times .25 = \underline{17.66\text{cm}^3}$$

$$V_f = 70.65 + 17.66\text{cm}^3 = \underline{88.31\text{cm}^3}$$

$$\Delta V = V_i \beta (T_f - T_i)$$

$$17.66\text{cm}^3 = 70.65\text{cm}^3 \left(\frac{6 \times 10^{-5}}{^\circ\text{C}} \right) (t_f - 20^\circ\text{C})$$

$$17.66 = 4.24 \times 10^{-3} t_f - 8.48 \times 10^{-2}$$

$$17.74 = 4.24 \times 10^{-3} t_f$$

$$t_f = \boxed{4.18 \times 10^3 \text{ } ^\circ\text{C}}$$

7. $V = 2500\text{L}$ $t_i = 25^\circ\text{C}$ $\beta = 1100 \times 10^{-6}$
 $t_f = 10^\circ\text{C}$

$$\Delta V = (2500\text{L}) \left(\frac{1100 \times 10^{-6}}{^\circ\text{C}} \right) (10^\circ\text{C} - 25^\circ\text{C})$$

$$= \underline{-41.25\text{L}}$$

8. $L_i = 80\text{m}$ $t_i = 35^\circ\text{C}$
 $L_f = ?$ $t_f = -12^\circ\text{C}$

$$\Delta L = L_i \alpha \Delta T$$

$$= 80\text{m} (12 \times 10^{-6}) (-12 - 35)$$

$$\underline{\Delta L = 0.0355\text{m}}$$

$$\Delta L = L_f - L_i$$

$$0.0355 = L_f - 80\text{m}$$

$$\boxed{L_f = 80.0355\text{m}}$$