(1)

a) La capacidad térmica especifica de las monedas de niquel.

Datos

Agua:
$m = .15\,[Kg]$
$T = 40\,[°C]$
$m_n = .350\,[Kg]$
$T = 21\,[°C]$
$T_q = 36\,[°C]$

$\sum Q = 0 \quad Q_a + Q_m = \emptyset$

$Q = m \cdot C_p \cdot \Delta T$ para H_2O y las monedas

$m_a \cdot C_{pa} \cdot \Delta T_a + m_m \cdot C_{pm} \Delta T_m = 0$

$(0.15[Kg])(4186\left[\frac{J}{Kg}\right])(309.15[K] - 313.15[K]) + (0.35\,[Kg])$

$(C_{pm}) \cdot (309.15[K] - 294.15[K]) = \emptyset$

$(-2511.6)[J] + (0.35\,[Kg])(15\,[K])(C_{pm}) = 0$

$C_{pm} = -2514.7395 \,/\, (0.35\,[Kg])(15[K])$

$C_{pm} = 478.4 \;[J/Kg \cdot K]$

b) El % de exactitud del valor obtenido si se sabe que la capacidad termica especifica del niquel $444\left[\frac{J}{Kg\,°C}\right]$

$\%E = 100\% - \%EE$

$\%EE = \frac{|V_p - V|}{V_p} * 100 \;;\; \%EE = \frac{|444\left[\frac{J}{Kg\,C}\right] - 478.4\left[\frac{J}{Kg\,K}\right]|}{444\left[\frac{J}{KgC}\right]} * 100$

$\%EE = 7.7477\% \;;\; \%E = 100\% - 7.7477\%$

$\%E = 92.25\,\%$

c) La capacidad térmica de las monedas de niquel. C

$C\left[\frac{J}{Kg \cdot K}\right] = \frac{C\left[\frac{J}{K}\right]}{m\,[Kg]} \;;\; C\left[\frac{J}{K}\right] = c \cdot m \;;\; C = (478.4\left[\frac{J}{Kg \cdot K}\right])(0.35\,[Kg])$

$C = 167.44\left[\frac{J}{K}\right]$

(2)

ΔT[°C]
0
4
8
12
16
20

Q[J]
0
1400
3300
5700
7900
10100

a) El modelo matemático lineal del experimento, $Q = f(\Delta T)$

$$Q[J] = \left(517.1428571\left[\frac{J}{°C}\right]\right) T[°C] - 438.0952[J]$$

b) La capacidad térmica del agua.

$$m = C = 517.1429\left[\frac{J}{°C}\right]$$

c) La capacidad térmica especifica del agua.

$$c = \frac{C}{m}\ ;\quad c = \frac{517.1429\left[\frac{J}{°C}\right]}{0.12\,[Kg]} = 4309.5241$$

$$c = 4309.5241\left[\frac{J}{Kg \cdot °C}\right]$$

d) El porcentaje de error de exactitud de la capacidad térmica especifica obtenida si se sabe que el valor de referencia es $4,186\left[\frac{J}{Kg\,°C}\right]$.

$$\%EE = \frac{|V_p - V_i|}{V_p} \times 100$$

$$\%EE = \frac{\left|(4186 - 4309.5241)\left[\frac{J}{Kg\,°C}\right]\right|}{4186\left[\frac{J}{Kg\,°C}\right]} * 100$$

$$\%EE = 2.95\ \%$$

(3)

Datos

$m_{niq} = 0.35\,[Kg]$

$T = 21\,[°C]$

$m_{H_2O} = 0.15\,[Kg]$

$T = 40\,[°C]$

$c_{niq} = 444\left[\frac{J}{Kg\,°C}\right]$

$c_{H_2O} = 4186\left[\frac{J}{Kg\,°C}\right]$

a) La temperatura de equilibrio en [°C] $\Sigma Q = 0$

$Q_{H_2O} + Q_{2_{niq}} = 0$; $(m \cdot C \cdot \Delta T) + (m \cdot c \cdot \Delta T) = 0$

$(0.15\,[Kg])\left(4186\left[\frac{J}{Kg\,°C}\right]\right)(T_q - 40\,[°C]) +$

$(0.35\,[Kg])\left(444\left[\frac{J}{Kg\,°C}\right]\right)(T_q - 21\,[°C]) = 0$

$\left(627.9\left[\frac{J}{°C}\right]\right)(T_q - 40\,[°C]) + \left(155.4\left[\frac{J}{°C}\right]\right)(T_q - 21\,[°C]) = 0$

$627.9\left[\frac{J}{°C}\right] - 25116\,[J] + 155.4 \cdot T_q\left[\frac{J}{°C}\right] - 3263.4\,[J] = 0$

$783.3\left[\frac{J}{°C}\right] T_{eq} - 28379.4\,[J] = 0$

$$T_{eq} = \frac{28379.4\,[J]}{783.3\left[\frac{J}{°C}\right]} = 36.23\,[°C]$$

(3)

Datos

$m_{nig} = 0.35\,[Kg]$

$T = 21\,[°C]$

$m_{H_2O} = 0.51\,[Kg]$

$T = 40\,[°C]$

$C_{nig} = 444\left[\frac{J}{Kg\,°C}\right]$

$C_{H_2O} = 4186\left[\frac{J}{Kg\,°C}\right]$

a) $Q_{H_2O} + Q_{nig} = \emptyset \qquad \Sigma Q = \emptyset$

$(0.15\,[Kg])\left(4186\left[\frac{J}{Kg\,°C}\right]\right)(T_q - 40\,[°C]) +$

$(0.35\,[Kg])\left(444\left[\frac{J}{Kg\,°C}\right]\right)(T_q - 21\,[°C]) = \emptyset$

$\left(627.9\left[\frac{J}{C}\right]\right)(T_q - 40\,[°C]) + \left(155.4\left[\frac{J}{°C}\right]\right)$

$(T_q - 21\,[°C]) = \emptyset$

$627.9\left[\frac{J}{°C}\right] - 25116\,[J] + 155.4\,T_q\left[\frac{J}{°C}\right] - 3263.4\,[J]$

$= \emptyset$

$783.3\left[\frac{J}{°C}\right] T_{eq} - 28379.4\,[J] = \emptyset$

$$T_{eq} = \frac{28379.4\ [J]}{783.3\left[\frac{J}{°C}\right]}$$

$T_{eq} = 36.23\,[°C]$

b) $T_{eq}\,[K] = 36.23 + 273.15\,[K]$

$T_{eq}\,[K] = 309.38\,[K]$

(4)

Datos

$m = 0.15\,[Kg]$ H_2O

ΔT[°C]
8
16
24
32
40

Q[J]
1400
6400
11400
16400
21400

a) El modelo matemático que relaciona $Q = f(T)$ por regresión lineal

$$Q[J] = \left(625\left[\frac{J}{°C}\right]\right) T[°C] - 3600[J]$$

b) El significado físico de la pendiente.

$$m = C = 625\left[\frac{J}{°C}\right]$$

c) A partir del modelo anterior, obtenga el valor experimental de la capacidad térmica del agua.

$$C = 625\left[\frac{J}{°C}\right] \qquad m_{H_2O} = 0.15\,[Kg]$$

$$c = \frac{C}{m} \; ; \; c = \frac{625\left[\frac{J}{°C}\right]}{0.15\,[Kg]}$$

$$c = 4166.6666\left[\frac{J}{Kg \cdot °C}\right]$$

d) El porcentaje de exactitud del resultado del inciso anterior, considerando que el valor de capacidad térmica específica del agua es $4186\left[\frac{J}{Kg\,°C}\right]$.

$$\%E = 100\% - \%EE$$

$$\%EE = \frac{|V_p - V_t|}{V_p} \times 100 \; ; = \frac{\left|(4186 - 4166.666)\left[\frac{J}{Kg\,°C}\right]\right|}{4186\left[\frac{J}{Kg\,°C}\right]} * 100$$

$$\%EE = 0.461858\,\%$$

$$\%E = 100\% - 0.461858\,\%$$

$$\%E = 99.5382\%$$

e) La energía en forma de calor suministrado para una temp. de 30 [°C] en el agua.

Sustituyendo en el modelo matemático:

$$Q[J] = \left(625\left[\frac{J}{°C}\right]\right)(30[°C]) - 3600[J]$$

$$Q = 18750\,[J] - 3600\,[J]$$

$$Q = 15150\,[J]$$

(5)

a) El modelo matemático exp. que relaciona el nivel de energía en función de la temp.. Es decir, $E = f(T)$.

Usar la temp. como se muestra.

$$E[J] = \left(195\left[\frac{J}{K}\right]\right) T[K] + 0[J] \quad ; \quad E[J] = \left(195\left[\frac{J}{K}\right]\right) T[C] + 53264.25\,[J]$$

b) Interpretar la pendiente y la ordenada al origen.

$m = C = 195\left[\frac{J}{K}\right]$

$m = C = 195\left[\frac{J}{°C}\right]$

La ordenada al origen es el nivel de energía inicial.

$E = C\,[J]$

Energía [J]	Temperatura[K]
61454.25	315.15
65159.25	334.15

c) Si la cantidad de materia es de un estimado de 1.5 [Kg], obtener la capacidad térmica específica.

$$c = \frac{C}{m} \quad ; \quad c = \frac{195\left[\frac{J}{K}\right]}{1.5\,[Kg]} = 130\left[\frac{J}{Kg \cdot K}\right]$$

d) Determinar la enagía a los 0 [°C]

Según el modelo matemático al ser T = 0 [°C] la energía a las 0 [°C], es 53264.25 [J]

$E = 53264.25\,[J]$

(6) Datos

$V = 900\,[cm^3]$

$\rho = 998\,[Kg/m^3]$

$c_{H_2O} = 4186\left[\frac{J}{Kg\,°C}\right]$

$T = 30\,[°C]$

$m_{Cu} = 500\,[g] = 0.5\,[Kg]$

$C = 380\left[\frac{J}{Kg \cdot K}\right]$

$T = 353\,[K]$

$900\,[cm^3]\left(\frac{1\times10^{-6}\,[m^3]}{1\,[cm^3]}\right)$

a) La temperatura de equilibrio de la mezcla en [°C]

Utilizando la 1ro ley de la Term.

$\sum Q = 0 \qquad Q_{H_2O} + Q_b = 0$

$Q = m \cdot c \cdot \Delta T$

$(m \cdot c \cdot \Delta T) + (m \cdot c \cdot \Delta T) = 0 \qquad \rho = \frac{m}{V}$

$$\rho_{H_2O} \cdot V_{H_2O} \cdot c_{pH_2O} \cdot (T_{eq} - T_{i\,H_2O}) + m_{Cu} \cdot c_{Cu} \cdot (T_{eq} - T_{i}) = 0$$

$(900\times10^{-6}\,[m^3])\left(998\left[\frac{Kg}{m^3}\right]\right)\left(4186\left[\frac{J}{Kg\,°C}\right]\right)(T_{eq} - 30\,[C]) + (0.5\,[Kg])\left(380\left[\frac{J}{Kg\,°C}\right]\right)(T_{eq} - 79.85\left[\frac{J}{°C}\right]) = 0$

$$\left(3759.8652\left[\frac{J}{°C}\right]\right)(T_{eq}-30[°C])+\left(190\left[\frac{J}{°C}\right]\right)(T_{eq}-79.85[°C])=0$$

$$3759.8652\,T_{eq}\left[\frac{J}{°C}\right]-112765.956[J]+190\,T_{eq}\left[\frac{J}{°C}\right]-15171.5[J]=0$$

$$3949.8652\left[\frac{J}{°C}\right]-127937.456[J]=0$$

$$T_{eq}=\frac{127937.456[J]}{3949.8652\left[\frac{J}{°C}\right]}=32.39[°C]$$

b)

$$(\rho_{H_2O}\cdot V_{H_2O}\cdot C_{D\,H_2O}\cdot\Delta T)+(m_{cu}\cdot C_{cu}\cdot\Delta T)=0$$

$$(900\times10^{-6}[m^3])\left(998\left[\frac{Kg}{m^3}\right]\right)\left(4186\left[\frac{J}{Kg\,°C}\right]\right)(35[°C]-30[°C])+m_{cu}$$

$$\left(380\left[\frac{J}{Kg\,°C}\right]\right)(35[°C]-79.85[°C])=0$$

$$18799.326[J]+m_{cu}\left(-17043\left[\frac{J}{Kg}\right]\right)=0$$

$$m_{cu}=\frac{18799.326[J]}{17043\left[\frac{J}{Kg}\right]}=1.10305[Kg]$$

$$\boxed{m_{cu}=1.10305[Kg]}$$

---

⑦ a) por regresion lineal

$$Q[J]=\left(230\left[\frac{J}{K}\right]\right)T[K]-5060[J]$$

b) Capacidad termica especifica

$$c=\frac{C}{m}$$ C corresponde a la pendiente

$$c=\frac{230\left[\frac{J}{K}\right]}{0.5[Kg]}=460\left[\frac{J}{Kg\cdot K}\right]$$

c)

$$Q=m\cdot c\cdot\Delta T \qquad \Sigma Q=0$$

$$T_{eq}=30°[°C]$$

Q[J]	T[°C]
1840	30
4140	40

T[°K]
303.15
313.15

c)

$$m_{H_2O}\cdot C_{H_2O}\cdot\Delta T+m_x\cdot C_x\cdot\Delta T=0$$

$$m_{H_2O}\times4186\left[\frac{J}{Kg\,°C}\right]\times(30-50[°C])+$$

$$(0.5[Kg])(460\left[\frac{J}{Kg\cdot C}\right])(30-20[°C])$$

$$\ldots=0$$

$$-83720\left[\frac{J}{Kg}\right]m_{H_2O}+2300[J]=0$$

$$m_{H_2O}=\frac{23000[J]}{83720\left[\frac{J}{Kg}\right]}$$

$m_{H_2O} = 0.274725\ [Kg]$

(8)

$C_{agua\ liq} = 4186 \left[\frac{J}{Kg\,°C}\right]$

$\rho = 996 \left[\frac{Kg}{m^3}\right]$

T[°C]	T[°K]
24	297.15
28	301.15
32	305.15
36	309.15

a) El modelo matemático del calor proporcionado Q en función de la temperatura (T) de la agua.

$Q[J] = (1697.5 \left[\frac{J}{K}\right]) T[K] - 34450\ [J]$

Q[KJ]	Q[J]
6.7	6700
12.4	12400
20	20000
26.8	26800

b) La masa de agua empleada en el experimento y su temperatura inicial.

$\Sigma Q = 0 \qquad Q = m \cdot c \cdot \Delta T \qquad C = 1697.5$ corresponde a la pendiente $\left[\frac{J}{K}\right]$

$c = \frac{C}{m} \; ; \; m = \frac{C}{c} \; ; \; m = \frac{1697.5 \left[\frac{J}{K}\right]}{4186 \left[\frac{J}{Kg\,°K}\right]}$

$m = 0.4055\ [Kg]$

Con el modelo matemático igualando a 0;

$T[K] = \frac{498122.125\ [J]}{1697.5 \left[\frac{J}{K}\right]} = 293.44\ [K]$

(9)

T[°C]	T[°K]	Q[J]
19	292.15	0
21	294.15	1330
23	296.15	2800
25	298.15	3850
27	300.15	4970
29	302.15	6300

Datos

$m = .15\,[Kg]$

H_2O_{liq}

a) $Q[J] = \left(621\left[\frac{J}{°C}\right]\right) T[°C] - 11695.6667[J]$

b) La pendiente es la capacidad termica.

pendiente $m = C = 621\left[\frac{J}{°C}\right]$

c)

$$C = \frac{C_{H_2O}}{m} \quad ; \quad m = .15\,[Kg] \quad C = 621\left[\frac{J}{°C}\right] \quad ; \quad C_{H_2O} = \frac{621\left[\frac{J}{°C}\right]}{0.15\,[Kg]}$$

$$C_{H_2O} = 4140\left[\frac{J}{Kg\,°C}\right]$$

d) C_{H_2O} Teorica $= 4186\left[\frac{J}{Kg\,°C}\right]$ $\quad C_{H_2O}$ Exp $= 4140\left[\frac{J}{Kg\,°C}\right]$

$$\%E = 100\% - \%EE \qquad \%EE = \frac{|V_p - V_e|}{V_p} \times 100$$

$$\%EE = \frac{\left|\left(4186\left[\frac{J}{Kg\,°C}\right] - 4140\left[\frac{J}{Kg\,°C}\right]\right)\right|}{4186\left[\frac{J}{Kg\,°C}\right]} \times 100 = 1.098901099\,\%$$

$$\%E = 100\% - 1.0989\ldots\%$$

$$\%E = 98.901\,\%$$

(10) a) $Q[J] = (1737.5\left[\frac{J}{°C}\right])\, T(°C) - 35750\,[J]$

b) $C_{H_2O} = \frac{C}{m} \rightarrow m = \frac{C}{C_{H_2O}}$; $m = \frac{1737.50\left[\frac{J}{°C}\right]}{4186\left[\frac{J}{Kg\,°C}\right]}$

$m = 0.41507405\,64\,[Kg]$

T[°C]	Q[KJ]
24	6.5
28	12
32	20
36	27

$Q[J] = 0$

$(1737.5\left[\frac{J}{°C}\right])\, T[°C] - 35750\,[J] = 0$

$T[°C] = \frac{35750[J]}{1737.5\left[\frac{J}{°C}\right]} = 20.5755\,[°C]$

Q[J]
6500
12000
20000
27000

(11)

a) $Q[J] = 624.2857\left[\frac{J}{°C}\right] T[°C] - 504.762[J]$

b) La capacidad térmica corresponde a la pendiente (m)

$m = C = 624.2857\left[\frac{J}{°C}\right]$ $m = 0.15\,[Kg]$

T[°C]	Q[J]
0	273.15
700	275.15
1650	277.15
2850	279.15
3950	281.15
6550	283.15

c) $C_{H_2O} = \frac{C}{m}$; $C_{H_2O} = \frac{624.2857\left[\frac{J}{°C}\right]}{0.15\,[Kg]}$

$C_{H_2O} = 4161.904667\left[\frac{J}{Kg\,°C}\right]$

d) $C_{Teorica} = 4186\left[\frac{J}{Kg\,°C}\right]$ $C_{Ex} = 4161.9046$

$\%E = 100\% - \%EE$

$\%EE = \frac{|V_p - V_e|}{V_p} \times 100$

$\%EE = \frac{\left|\left(4186\left[\frac{J}{Kg\,°C}\right] - 4161.9046\left[\frac{J}{Kg\,°C}\right]\right)\right|}{4186\left[\frac{J}{Kg\,°C}\right]} \times 100$

$\%EE = 0.575618\,\%$

$\%E = 100\% - 0.57618\,\%$

$\%E = 99.42438\,\%$

(12) **Datos**

$m_{Cu} = 0.4\ [Kg]$

$T_{Cu} = 21\ [°C]$

$m_{H_2O} = 0.2\ [Kg]$

$T_{H_2O} = 80\ [°C]$

$c_{Cu} = 385 \left[\frac{J}{Kg\,°C}\right]$

$c_{H_2C} = 4186 \left[\frac{J}{Kg\,°C}\right]$

a) $\Sigma Q = 0 \qquad Q = m \cdot c \cdot \Delta T$

$Q + Q = 0$

$m \cdot c \cdot \Delta T + m \cdot c \cdot \Delta T = 0$

(H_2C / Cu)

$(0.2\,[Kg])\left(4186 \left[\frac{J}{Kg\,°C}\right]\right)(T_{eq} - 80\,[°C]) + (0.4\,[Kg])\left(385 \left[\frac{J}{Kg\,°C}\right]\right)(T_{eq} - 21\,[°C]) = 0$

$(837.2 \left[\frac{J}{°C}\right])(T_{eq} - 80\,[°C]) + (154 \left[\frac{J}{°C}\right])(T_{eq} - 21\,[°C]) = 0$

$837.2\ T_{eq} \left[\frac{J}{°C}\right] - 66976\,[J] + 154\ T_{eq} \left[\frac{J}{°C}\right] - 3234\,[J] = 0$

$991.2\ T_{eq} \left[\frac{J}{°C}\right] - 70210\,[J] = 0$

$T_{eq} = \frac{70210\,[J]}{991.2 \left[\frac{J}{°C}\right]} = 70.8333\,[°C]$

b) $c_{Acero} = 460 \left[\frac{J}{Kg\,°C}\right]$

$837.2\ T_{eq} \left[\frac{J}{°C}\right] - 66976\,[J] + (0.4\,[Kg])\left(460 \left[\frac{J}{Kg\,°C}\right]\right)(T_{eq} - 21\,[°C]) = 0$

$837.2\ T_{eq} \left[\frac{J}{°C}\right] - 66976\,[J] + 184\ T_{eq} \left[\frac{J}{°C}\right] - 3864\,[J] = 0$

$1021.2\ T_{eq} \left[\frac{J}{°C}\right] - 70840\,[J] = 0$

$T_{eq} = \frac{70840\,[J]}{1021.2 \left[\frac{J}{°C}\right]} = 69.3693\,[°C]$

$T_{eq} = 69.3693\,[°C]$

13)

Sustancia	Cantidad	c [J/(kg·Δ°C)]	δ [1]	$T_{inicial}$ [°C]
A	800 [g]	390	8.9	19
B	0.5 [L]	4 186	1.0	43

$\rho = 1000 \left[kg/m^3\right]$

a) Volumen especifico y la densidad de cada sustancia

A densidad:

$$S_A = \frac{\rho_A}{\rho_{agua}} \quad ; \quad \rho_A = S_A \cdot \rho_{agua} \quad ; \quad \rho_A = (8.9[1])\left(1000\left[\frac{kg}{m^3}\right]\right)$$

$$\rho_A = 8900 \left[kg/m^3\right]$$

$$V_A = \frac{1}{\rho} \quad ; = \frac{1}{8900} = 11.235 \times 10^{-6} \left[m^3/kg\right]$$

B:

densidad. $S_B = \frac{\rho_B}{\rho_{agua}}$ $\rho_B = S_B \cdot \rho_{agua}$; $\rho_B = (1[1])\left(1000\left[\frac{kg}{m^3}\right]\right)$

$\rho_B = 1000 \left[kg/m^3\right]$ | $V_B = \frac{1}{\rho} \; ; = \frac{1}{1000\left[kg/m^3\right]} = 0.001$

$V_B = 1 \times 10^{-3} \left[m^3/kg\right]$

b)

A: $800[g]\left(\frac{1[kg]}{1000[g]}\right) = 0.8[kg] = m_A$

B:

0.5 [kg] al ser agua y su densidad = 1,000 $\left[kg/m^3\right]$ $= 0.5[kg] = m_B$

$0.5[kg] = 0.5[L]$

c) $\sum Q = 0 \quad Q_1 + Q_2 = 0$

$m_A * c_A * \Delta T + m_B * c_B * \Delta T = 0$

$(0.8[Kg])(390\ [J/Kg.°C])(T_{eq}-19[°C])+(0.5[Kg])(4186\ [J/(Kg.C])$

$(T_{eq}-43[°C])=0$

$312\ [J/°C](T_{eq}-19[°C])+2093\ [J/°C](T_{eq}-43[°C])=0$

$312\ T_{eq}[J/°C]-5928[J]+2093 T_{eq}[J/°C]-89999[J]=0$

$2405\ T_{eq}[J/°C]-95927[J]=0$

$$T_{eq}=\frac{95927\ [J]}{2405\ [J/°C]}=39.88648\ [°C]$$

$[°C]\ 39.8864+273.15=°K$; $T_{eq}=313.6364\ [K]$

(14)

Datos

- $m_{Cu}=0.25[Kg]$
- $C_{Cu}=390\left[\frac{J}{Kg\cdot K}\right]$
- $m_{H_2O}=0.45[Kg]$
- $T_{H_2O_0}=323.15[K]$
- $T_{iB}=295.15[K]$
- $T_{eq}=35[°C]$
- $T_{eq}=22[°C]$

a) $Q_{Cu}+Q_{H_2O}+Q_B=0$

$m_{Cu}\cdot C_{Cu}\cdot(T_{eq}-T_{iCu})+m_{H_2O}\cdot C_{H_2O}\cdot(T_{eq}-T_{iH_2O})+$

$m_B\cdot C_B(T_{eq}-T_{iB})=0$

$(0.25[Kg])(390[\frac{J}{Kg\cdot K}])(308.15[K]-295.15[K])+$

$(0.45[Kg])(4186[\frac{J}{Kg\cdot K}])(308.15[K]-323.15[K])+$

$(0.3[Kg])(C_B)(308.15[K]-295.15[K])=0$

$(0.25[Kg])(390[\frac{J}{Kg\cdot K}])(13[K])+(0.45[Kg])$

$(4186[\frac{J}{Kg\cdot K}])(-15[K])+(0.3[Kg])\ C_{pB}(13K)=0$

$Q_{Cu}=1267.5[J]$

$+$

$Q_{H_2O}=-282255.5[J]$

$+$

$3.9[Kg\cdot K]\ C_{pB}=0$

$$\frac{-26988[J]}{3.9[Kg\cdot K]}=6920\left[\frac{J}{Kg\cdot K}\right]$$

$C_{pB}=6920\left[\frac{J}{Kg\cdot K}\right]$

(t)

b)

$V = 12\,[V]$

$I = 2.3\,[A]$

$P = \frac{m \cdot c_p \cdot \Delta T}{t}$; $V_1 = \frac{m \cdot c_p \cdot \Delta T}{t}$

$P = VI$

$t = m \cdot c_p \cdot \Delta T$

$P = \frac{E_i}{t}$ $P = \frac{Q}{t}$

$$t = \frac{(0.43\,[Kg])\left(4186\left[\frac{J}{Kg\,K}\right]\right)(323.15\,[Kg] - 295.15\,[Kg])}{(12\,[V])(2.3\,[A])}$$

$t = 1911\,[S]$

c)

$Q_{Cu} + Q_{H_2C} + Q_B = 0$

$m_c = 0.6\,[Kg]$

$m_{Cu} \cdot C_{pCu}(T_{eq} - T_{iCu}) + m_{H_2O} \cdot C_{pH_2C} \cdot (T_{eq} - T_{iH_2O}) + m_B \cdot C_{pB} \cdot (T_{eq} - T_{iB}) = 0$

$\rightarrow (0.25\,[Kg])\left(390\left[\frac{J}{Kg\,°C}\right]\right)(T_{eq} - 22\,[°C]) + (0.6\,[Kg])\left(4186\left[\frac{J}{Kg\,°C}\right]\right)$

$(T_{eq} - 50\,[°C]) + (0.3\,[Kg])\left(6920\left[\frac{J}{Kg\,°C}\right]\right)(T_{eq} - 22\,[°C]) = 0$

$\rightarrow \left(97.5\left[\frac{1}{°C}\right]\right) T_{eq} - 2145[J] + \left(2511.6\left[\frac{J}{°C}\right]\right) T_{eq} - 1255380[J] +$

$\left(2676\left[\frac{J}{°C}\right]\right) T_{eq} - 456722)] = 0$

$4685.1\left[\frac{1}{°C}\right] T_{eq} - 173397[J] = 0$

$$T_{eq} = \frac{173397\,[J]}{4685.1\left[\frac{J}{°C}\right]} = 37.01031\,[°C]$$