Calorimetry

- All the heat released/absorbed by the system is absorbed/released by the surroundings.

- Therefore:

$$q_{system} = {}^{(-)} q_{surroundings}$$

Ex) A 400.0g iron bar is heated & then plunged into 1000.0g of water originally at 20.0°C. The iron & water will reach equilibrium & their final temperature is 32.8°C. What is the original temperature of the iron? $C_{H_2O} = 4.184$ J/g°C & $C_{Fe} = .444$ J/g°C

So what information do we know?

Fe	H_2O
$m_{Fe} = 400.0g$	$m_{H_2O} = 1000.0g$
$T_f = 32.8°C$	$T_i = 20.00°C$
$C_{Fe} = .444$ J/g°C	$T_f = 32.8°C$
	$C_{H_2O} = 4.184$ J/g°C

$$q = mC\Delta T$$

$$\Delta T = T_f - T_i$$

$$q_{Fe} = {}^{(-)} q_{H_2O}$$

What information are we missing?

- T_i for Fe
- q_{H_2O}
- q_{Fe}

- Since we have all the information to solve for q_{H_2O}, do that 1st

$$q_{H_2O} = m_{H_2O} C_{H_2O} \Delta T \qquad \Delta T = 32.8°C - 20.00°C = 12.8°C$$

$$q_{H_2O} = (1000.0g)(4.184\text{ J/g°C})(12.8°C)$$

$$\boxed{q_{H_2O} = 53555.2\text{ J}}$$

- 2nd Since $q_{Fe} = {}^{(-)} q_{H_2O}$, you can find q_{Fe}

$$\boxed{q_{Fe} = {}^{-}53555.2J}$$

$$\Delta T = \frac{q}{(m \cdot C)} = \frac{{}^{-}53555.2J}{(400.0g \cdot .444 J/g°C)} = \boxed{{}^{-}302°C}$$

- 3rd you have all the information to find ΔT_{Fe} & then T_i

$$\Delta T = T_f - T_i$$

$$T_i = T_f - \Delta T = 32.8°C - {}^{-}302°C$$

$$\boxed{T_i = 335°C}$$

(Ex) A 237g sample of molybdenum is heated to 100.1°C and dropped into an insulated cup containing 244g of water at 10.0°C. If the final temp. of the molybdenum & water is 15.3°C, what is the...

- heat absorbed by the water?
- heat released by the molybdenum?
- what is the heat capacity of molybdenum?

Mo	H_2O
✓ q = ?	✓ q = ?
m = 237g	m = 244g
C = ?	C = 4.184 J/g°C
Ti = 100.1°C	Ti = 10.0°C
Tf = 15.3°C	Tf = 15.3°C
ΔT = 15.3°C − 100.1°C = −84.8°C	ΔT = 15.3°C − 10.0°C = 5.3°C

$$q_{mo} = -q_{H_2O}$$

$$q = mC\Delta T$$

$$q_{H_2O} = (244g)(4.184\ J/g°C)(5.3°C)$$

$$\boxed{q_{H_2O} = 5410.7488\ J}$$

$$\boxed{q_{mo} = -5410.7488\ J}$$

$$C_{mo} = \frac{q_{mo}}{(m \cdot \Delta T)} = \frac{-5410.7488\ J}{(237g \cdot -84.8°C)}$$

$$C_{mo} = \frac{-5410.7488\ J}{-20097.6\ g \cdot °C}$$

$$C_{mo} = .269223629\ J/g°C$$

$$\boxed{C_{mo} = .269\ J/g°C}$$