

Specific Heat Capacity / Molar Heat Capacity

- Specific heat capacity is the amount of heat energy ( $q$ ) required to raise the temperature of one gram of a substance by  $1\text{ }^{\circ}\text{C}$ .
- Molar heat capacity is the amount of heat energy ( $q$ ) required to raise the temperature of one mole of a substance by  $1\text{ }^{\circ}\text{C}$ .

$$\text{heat capacity} = c = \frac{q}{(m)(\Delta T)}, \text{ units} = \frac{\text{J}}{\text{g} \cdot ^{\circ}\text{C}} \text{ or } \text{J} \cdot \text{g}^{-1} \cdot ^{\circ}\text{C}^{-1}$$

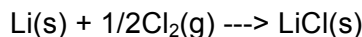
$$\text{molar heat capacity} = c_m = (c)(\text{molecular weight}), \text{ units} = \frac{\text{J}}{\text{mol} \cdot ^{\circ}\text{C}} \text{ or } \text{J} \cdot \text{mol}^{-1} \cdot ^{\circ}\text{C}^{-1}$$

Energy

$\Delta E = q + w$ , where  $\Delta E$  is the change in energy,  $q$  = heat,  $w$  = work

- Be able to solve for any of these variables.
- Energy, heat, or work, done on, or put into the system is a positive (+) sign.
- Energy or heat that leaves the system, or if the system does work on the surroundings, is a negative (-) sign.
- Must get the sign correct!

1. Calculate the net energy change (in kJ per mole) that occurs when lithium iodide forms from the elements. Show your work to get any credit.



Enthalpy of sublimation for Li	159 kJ/mole
Bond dissociation energy for $\text{Cl}_2$	243 kJ/mole
Lattice energy for LiCl	853 kJ/mole
Electron affinity for Cl	-349 kJ/mole
First ionization energy for Li	520 kJ/mole

2. The specific heat of copper is  $0.385\text{ (J/g}^{\circ}\text{C)}$ . A piece of copper weighs 21.3 grams and starts out at  $25^{\circ}\text{C}$ . It then absorbs 2.312 kJ of energy. What is the new temperature of the piece of copper? Show your work to get any credit.
3. Calculate  $\Delta E$  and indicate whether the internal energy of the system has increased or decreased in the following cases.
  - a) A system absorbs 130J of heat and does 150.0 kJ of work.  
 $\Delta E =$  \_\_\_\_\_  
 $E_{\text{system}}$  has increased or decreased (circle one)
  - b)  $q = -4.2\text{ kJ}$  and  $w = -650\text{ J}$   
 $\Delta E =$  \_\_\_\_\_  
 $E_{\text{system}}$  has increased or decreased (circle one)