Thermochemistry Worksheet

Heat capacity	Heat to cause temp change	Enthalpy
Heat capacity(J/°C) $=mc$	$q=m\times c\times\Delta T$	$H=E+PV$ $\Delta H_{reaction}=H_{products}-H_{reactants}$
m = mass of the material c =the specific heat of the material	q = amount of heat added to the system m = mass of the substance c = specific heat of the substance ΔT =change in temperature.	H=enthalpy E=internal energy P=pressure V=volume

1. Calculate the amount of heat needed to increase the temperature of 125 g of water from 22°C to 59°C (Specific heat of water is 4.184 J/g-^{o}C).

   $q=m\times c\times\Delta T$

   q=(125 g)(4.184 J/g-^{o}C)(59°C -22°C) = 19,351 J

2. Calculate the specific heat of copper, given that 204.75 J of energy raises the temperature of 15 g of copper from 35°C to 70°C.

   $q=m\times c\times\Delta T$ c= q/m×ΔT

   c=(204.75 J)/(15g)(70°C -35°C) = 0.39 J/g-^{o}C

3. 432 J of energy is required to raise the temperature of a block of aluminum (c_{alum}= 0.89 J °C^{-1} g^{-1}) from 20°C to 60°C. Calculate the mass of aluminum present.

   $q=m\times c\times\Delta T$ m= q/c×ΔT

   m=(432 J)/(0.089 J/g-^{o}C)(60°C -20°C) = 121.3g

4. Calculate ΔH_{rxn} for the reaction: $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$ [ΔH_f of CO= -110.5 kJ/mol, ΔH_f of O_2= 0 kJ/mol, ΔH_f of CO_2= -393.5 kJ/mol]. Is this reaction Exothermic or Endothermic?

   $\Delta H_{reaction}=H_{products}-H_{reactants}$

   $\Delta H_{reaction}=H_{CO2}-[2H_{co}+H_{o2}]$

   $\Delta H_{reaction}$= -393.5 −[2(-110.5) + 0] = **-172.5** kJ/mol

   Exothermic

5. A pure gold ring and pure silver ring have a total mass of 17.0 g. The two rings are heated to 65.4 °C and dropped into 12.4 mL of water at 22.3 °C. When equilibrium is reached, the temperature of the water is 24.7 °C. What is the mass of the gold ring? [C_p gold= 0.129 J g^{-1} °C^{-1}, C_p silver= 0.237 J g^{-1} °C^{-1}]

   (mass gold) (Δt gold) (C_p gold) + (mass silver) (Δt silver) (C_p silver) = (mass water) (Δt water) (C_p water)

   (x) (40.7 °C) (0.129 J g^{-1} °C^{-1}) + (17.0 g - x) (40.7 °C) (0.237 J g^{-1} °C^{-1}) = (12.4 g) (2.4 °C) (4.184 J g^{-1} °C^{-1})

   x = 8.98 g