

### Thermochemistry Worksheet 1

1. What are the two means by which a system may change its internal energy? What are the symbols?

Through heat (q) and work (w)

2. For the following cases give the system and surroundings and indicate the direction of heat transfer.

a. Coal being burned in the boiler of a coal fired power plant.  
Sample of coal is system, the pipes containing water are the surroundings; heat goes from system to surroundings  $\rightarrow -q$

b. Moisture evaporating from clothes drying on a clothesline.  
System: water in the clothing; Surroundings: the atmosphere around the clothes; heat goes from the surroundings to system to cause a phase change (l  $\rightarrow$  g) and  $+q$

3. Give the signs of heat and work for the following process: A reaction involving no heat transfer that expands the reaction vessel by a volume of 500 mL.

$q = 0$ ; w is -

4. In an internal combustion engine, the heat released by the combustion of gasoline causes the  $\text{CO}_2$  and  $\text{H}_2\text{O}$  products to expand and push the pistons outward. If the expanding gases do 250 J of work and the system loses 475 J of heat energy to the surroundings, calculate  $\Delta E$ .

$$\Delta E = -250 \text{ J} + (-475 \text{ J}) = -725 \text{ J}$$

5. When detonated,  $\Delta H$  of nitroglycerin is found to be  $-5720 \text{ kJ/mol}$ . Is this an exothermic or endothermic process?  
exothermic