

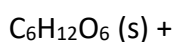
Physical Chemistry I: Thermodynamics
Chapter 4 homework; Heating your home.

Name _____

Maintaining the temperature inside of a space/home is one modern convenience that quickly became a necessity. The general term used to describe the control of temperature in a home is called, **HVAC** or **Heating, Ventilation, and Air Conditioning**. Although many homes do not have a central cooling system (commonly called just "AC") very few are without a means to heat.

The following fuel used to heat spaces:

Wood: Wood has a molecular formula that can be approximated by a simple sugar ($C_6H_{12}O_6$). Write below the balanced combustion reaction for $C_6H_{12}O_6$:



Using the heats for formation (ΔH_f) calculate the enthalpy of combustion (ΔH_{comb}) for $C_6H_{12}O_6$:

$$\Delta H_f (C_6H_{12}O_6 - \text{solid}) =$$

$$\Delta H_f (O_2 - \text{gas}) =$$

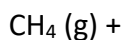
$$\Delta H_f (CO_2 - \text{gas}) =$$

$$\Delta H_f (H_2O - \text{liquid}) =$$

$$\Delta H_{comb} =$$

Answer ~ -2808 kJ/mol [for $H_2O (l)$]

Natural Gas: Natural gas is found in deposits around the world. This gas consist of methane (~95%) with the balance being mainly ethane (~4%). Natural gas is piped directly to homes/businesses just like water. Write below the balanced combustion reaction for CH_4 :



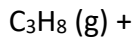
Using the heats for formation (ΔH_f) calculate the enthalpy of combustion (ΔH_{comb}) for CH_4 :

$$\Delta H_f (CH_4 - \text{gas}) =$$

$$\Delta H_{comb} =$$

Answer ~ -890 kJ/mol

Propane: Propane (C₃H₈) can be extracted from natural gas (only ~0.2%) or recovered during the refining of petroleum/gasoline. Liquefied propane gas (under pressure) is stored in horizontal, *pill-shaped* tanks or in small “gas-grill” cylinders. Write below the balanced combustion reaction for C₃H₈:



Using the heats for formation (ΔH_f) calculate the enthalpy of combustion (ΔH_{comb}) for C₃H₈:

ΔH_f (C₃H₈ - gas) =

ΔH_{comb} =

Answer ~ -2220 kJ/mol

Summary:

Fuel	ΔH_{comb} (kJ/mol)	ΔH_{comb} (kJ/gram)	Cost/gram
Wood			
Methane			
Propane			

Example: Cost of natural gas over the past 30 years...

