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**Chapter 10 Practice Worksheet:
Thermochemistry: Chemical Energy**

- 1) Describe the difference between potential energy and kinetic energy.

- 2) What is the difference between heat and temperature?

- 3) Describe what we mean by conservation of energy. Give an example.

- 4) Draw a picture showing the direction of heat flow in an endothermic reaction versus an exothermic reaction. Define the system and the surroundings in each case.

- 5) Explain why boiling water is an endothermic process. (Hint: Think about what is happening to the attractive forces between water molecules.)

- 6) Hydrogen gas and oxygen gas release 482.6 kJ of heat when they combine to form steam. Is this reaction endothermic or exothermic? In which direction does heat transfer (between system and the surroundings) for this reaction? Is ΔH for this reaction positive or negative?

- 7) $\text{___ H}_2(\text{g}) + \text{___ O}_2(\text{g}) \rightarrow \text{___ H}_2\text{O}(\text{g}) \quad \Delta H = -482.6 \text{ kJ}$
 - a. Interpret this thermochemical equation (i.e., how much heat is given off per amount of each substance?).

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b. How much heat is released if we begin with 2.0087 g of O₂ gas?

c. How much heat is released if we begin with 1.5021 g of H₂ gas?

8) Which substance in each pair below has a higher specific heat? Circle your answer.

- | | | |
|----|---|-------------------------------------|
| a) | aluminum foil | water |
| b) | wood | metal |
| c) | ethanol (C _p = 2460 J/kg·°C) | gold (C _p = 129 J/kg·°C) |
| d) | mercury | copper |

9) How much heat is lost when a 640 g piece of copper cools from 375°C to 26°C? (The specific heat of copper is 0.385 J/g·°C)

10) The specific heat of iron is 0.4494 J/g·°C. How much heat is transferred when a 24.7 kg iron bar is cooled from 880°C to 13°C?

11) 8750 J of heat are applied to a 170 g sample of metal, causing a 56°C increase in its temperature. What is the specific heat of the metal? Which metal is it?

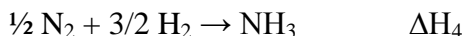
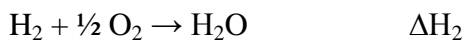
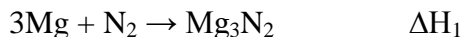
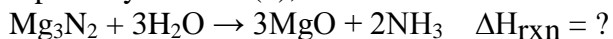
12) Use the following enthalpies of reaction to determine the enthalpy for the reaction of ethylene with fluorine.



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13) Using the thermochemical equations below, what combination of the following numbered ΔH 's (1-4) will determine the ΔH_{rxn} ? If a reaction needs to be reversed, write it as $-\Delta H$. If a reaction needs to be multiplied by a factor (x), write it as $x\Delta H$.



14) Which of the following substances do **NOT** have $\Delta H_f^\circ = 0$?

Cl₂ (g)

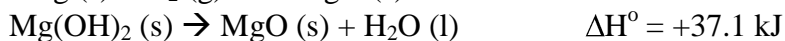
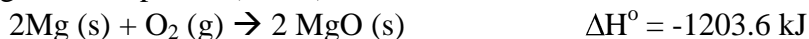
Na (l)

K (s)

O (g)

S₈ (s)Br₂ (l)

15) Calculate the standard enthalpy of formation of solid Mg(OH)₂ given the data shown below. (Hint: Write the equation for the standard enthalpy of formation of Mg(OH)₂ (starting from elements and forming 1 mol of product) first.)



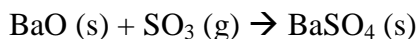
16) Write the equation that represents the standard enthalpy of formation of:

a) MgO (s):

b) H₂O (l):

c) BaCl₂ (s):

17) Calculate the ΔH° of reaction for:

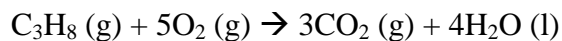


The values of ΔH_f° are as follows: BaO (s) = -548 kJ/mol; SO₃ (g) = -395.7 kJ/mol; BaSO₄ (s) = -1473 kJ/mol.

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18) Calculate the ΔH° of reaction for:



The values of ΔH°_f are as follows: $\text{C}_3\text{H}_8 (\text{g}) = -103.95 \text{ kJ/mol}$; $\text{CO}_2 (\text{g}) = -393.5 \text{ kJ/mol}$; $\text{H}_2\text{O} (\text{l}) = -285.8 \text{ kJ/mol}$

19) Determine the enthalpies of the following reactions using average bond enthalpies.

