

Name _____

Period _____

Thermochemistry Review Worksheet

Vocabulary Review

Match the correct vocabulary term to each numbered statement. Write the letter of the correct term on the line.

Column A

- ____ 1. the quantity of heat that raises the temperature of 1 g of pure water by 1 °C
- ____ 2. the capacity to do work or to supply heat
- ____ 3. a device used to measure the amount of heat absorbed or released during chemical or physical processes
- ____ 4. the heat content of a substance
- ____ 5. the SI unit of energy
- ____ 6. the heat absorbed by 1 mole of a substance in melting from a solid to a liquid at a constant temperature
- ____ 7. If two or more thermochemical equations are added to give a final equation, their heat changes can be added to determine the final heat change.
- ____ 8. the heat absorbed or released by the dissolution of 1 mole of substance
- ____ 9. a chemical change in which heat is absorbed
- ____ 10. a process that loses heat to the surroundings

Column B

- a. calorie
- b. joule
- c. exothermic
- d. molar heat of solution
- e. molar heat of fusion
- f. calorimeter
- g. enthalpy
- h. energy
- i. Hess's law of heat summation
- j. endothermic reaction

Concepts and Problems

Be sure to use complete thoughts and scientific answers as you respond to the questions. Be sure to **show your work, and include units!**

THE FLOW OF ENERGY—HEAT AND WORK

1. How many kilojoules of energy are in a donut that contains 200.0 Calories?

2. What is the specific heat of a substance that has a mass of 25.0 g and requires 525.0 calories to raise its temperature by 15.0°C?

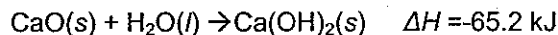
3. Suppose 100.0 g of H₂O(s) absorbs 1255.0 J of heat. What is the corresponding temperature change? The specific heat capacity of H₂O(s) is 2.1 J/g^oC.

4. How many joules of heat energy are required to raise the temperature of 100.0 g of aluminum by 120.0^oC? The specific heat capacity of aluminum is 0.90 J/gp^oC.

MEASURING AND EXPRESSING ENTHALPY CHANGES

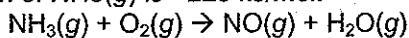
1. A student mixed 75.0 mL of water containing 0.75 mol HCl at 25^oC with 75.0 mL of water containing 0.75 mol of NaOH at 25^oC in a foam cup calorimeter. The temperature of the resulting solution increased to 35^oC. How much heat in kilojoules was released by this reaction? $C_{\text{water}} = 4.18 \text{ J/g-}^{\circ}\text{C}$

2. Calculate the amount of heat evolved when 15.0 g of Ca(OH)₂ forms from the reaction of CaO(s)+ H₂O(l).



3. Calculate the amount of heat produced when 52.4 g of methane, CH₄, burns in an excess of air, according to the following equation. $\text{CH}_4\text{(g)} + 2\text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)} + 2\text{H}_2\text{O(l)}$ $\Delta H = -890.2 \text{ kJ}$

4. Balance the following equation, then calculate the enthalpy change for the reaction given that the standard heat of combustion of NH₃(g) is - 226 kJ/mol.

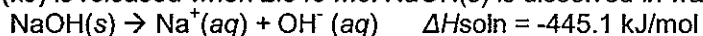


HEAT IN CHANGES OF STATE

1. Calculate the amount of heat needed to melt 35.0 g of ice at 0°C. Express your answer in kilojoules. (Specific heat of ice is 2.1 J/g°C)

2. Calculate the amount of heat needed to convert 190.0 g of liquid water at 18°C to 100.0°C.

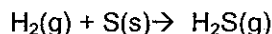
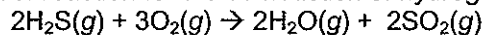
3. How much heat (kJ) is released when 2.543 mol NaOH(s) is dissolved in water?



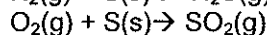
4. Calculate the amount of heat needed to convert 96 g of ice at -24°C to water at 28°C. The specific heat capacity of H₂O(s) is 2.1 J/g°C. *Hint: this is a two step process!!!*

CALCULATING HEATS OF REACTION

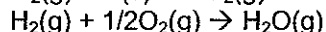
1. What is the standard heat of reaction for the combustion of hydrogen sulfide?



$$\Delta H = -20.17 \text{ kJ/mol}$$

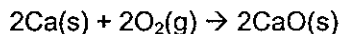
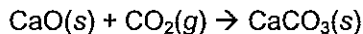


$$\Delta H = -296.9 \text{ kJ/mol}$$

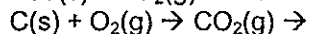


$$\Delta H = -241.82 \text{ kJ/mol}$$

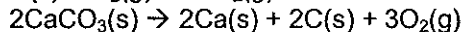
2. Calculate the enthalpy change (in kJ) for the following reaction. State whether the reaction is exothermic or endothermic..



$$\Delta H = -1143.2 \text{ kJ/mol}$$

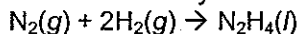


$$\Delta H = -393.5 \text{ kJ/mol}$$

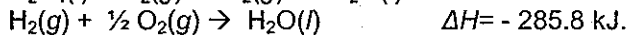
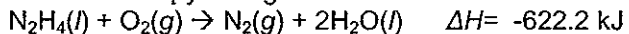


$$\Delta H = +2414.2 \text{ kJ/mol}$$

3. What is the enthalpy change for the formation of hydrazine, N₂H₄(l), from its elements?



Use the following reactions and enthalpy changes:



1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It includes a detailed description of the experimental procedures and the statistical tools employed.

3. The third part of the document presents the results of the study, showing the trends and patterns observed in the data. It includes several tables and graphs to illustrate the findings.

4. The fourth part of the document discusses the implications of the results and provides recommendations for future research. It highlights the areas that need further exploration and the potential applications of the findings.

5. The fifth part of the document concludes the study, summarizing the key points and the overall contribution of the research. It expresses the hope that the findings will be useful to other researchers in the field.

6. The sixth part of the document provides a list of references, citing the works of other authors that have influenced the study. It also includes a list of figures and tables for easy reference.

7. The seventh part of the document contains the appendix, which includes additional data and information that are not included in the main text. It provides a more detailed look at the raw data and the calculations used in the analysis.

8. The eighth part of the document is the index, which provides a quick and easy way to find specific information within the document. It lists the page numbers for each section and subsection.

9. The ninth part of the document is the glossary, which defines the key terms and concepts used in the study. It helps to ensure that everyone reading the document has a clear understanding of the terminology.

10. The tenth part of the document is the bibliography, which lists all the sources used in the study. It provides a comprehensive list of the literature that has been consulted and cited throughout the document.

11. The eleventh part of the document is the list of figures and tables, which provides a detailed description of each figure and table. It includes the titles, captions, and page numbers for each item.

12. The twelfth part of the document is the list of abbreviations, which provides a key for the abbreviations used throughout the document. It helps to ensure that everyone reading the document can understand the shorthand used.

Molarity & Specific Heat

- _____ 1. The most common form of energy encountered in chemical reactions is _____.
 - a. electrical energy
 - b. nuclear energy
 - c. light energy
 - d. heat
- _____ 2. In a chemical change, energy can be _____.
 - a. created, but not destroyed
 - b. destroyed, but not created
 - c. either created or destroyed
 - d. neither created nor destroyed
- _____ 3. The two terms below that are identical in meaning are _____.
 - a. calorie and Calorie
 - b. calorie and joule
 - c. Calorie and joule
 - d. kilocalorie and Calorie
- _____ 4. The main source of energy for living things on Earth is _____.
 - a. combustion of fossil fuels
 - b. oxidation of dead organisms
 - c. solar energy
 - d. geothermal energy
- _____ 5. In a(n) _____ reaction, the products are at a higher energy level than are the reactants.
 - a. activation
 - b. catalytic
 - c. endothermic
 - d. exothermic
- _____ 6. Even in an exothermic reaction, _____ is needed to get the reaction started.
 - a. activation energy
 - b. a catalyst
 - c. an endothermic reaction
 - d. an inhibitor
- _____ 7. A cake is placed in a heated oven and baked. The reactions that take place during this process are _____.
 - a. catalyzed
 - b. endothermic
 - c. exothermic
 - d. inhibited
- _____ 8. The energy involved in endothermic and exothermic reactions is _____.
 - a. chemical
 - b. heat
 - c. light
 - d. electrical
- _____ 9. The energy released in the formation of a compound from its elements is always _____ the energy required to decompose that compound into its elements.
 - a. greater than
 - b. identical to
 - c. less than
 - d. similar to
- _____ 10. If the heat of reaction is negative, the reaction is _____.
 - a. endothermic
 - b. exothermic
 - c. negative
 - d. positive
- _____ 11. A _____ is the heat required to raise the temperature of 1 g of liquid water by 1°C.
 - a. calorie
 - b. Calorie
 - c. kilocalorie
 - d. joule
- _____ 12. The energy value of foods is measured in units of _____.
 - a. calories
 - b. Calories
 - c. joules
 - d. nutrients
- _____ 13. The ultimate source of energy in the food web is _____.
 - a. the sun
 - b. photosynthesis
 - c. light reactions
 - d. the Calvin cycle
- _____ 14. Energy changes typically involve a flow of energy from an object at high temperature to one at low temperature, an energy transfer known as _____.
- _____ 15. In energy transfer, the total amount of energy at the end is always the same as that at the beginning, a generalization that is called the _____.
- _____ 16. One thousand calories is called a(n) _____.

1. How many moles of Na_2CO_3 are in 10.0 mL of a 2.0 M solution?
2. How many grams of $\text{Ca}(\text{OH})_2$ are needed to make 100.0 mL of 0.250 M solution?
3. What is the molarity of a solution made by dissolving 20.0 g of H_3PO_4 in 50.0 mL of solution?
4. What weight (in grams) of KCl is there in 2.50 liters of 0.50 M KCl solution?
5. How many calories of heat are required to raise the temperature of 550 g of water from 12.0°C to 18.0°C ? (remember the specific heat of water is $1.00 \text{ cal/g} \times ^\circ\text{C}$)
6. 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 $0.09 \text{ cal/g} \times ^\circ\text{C}$)
7. The specific heat of iron is $0.107 \text{ cal/g} \times ^\circ\text{C}$. How much heat is transferred when a 24.7 kg iron ingot is cooled from 880°C to 13°C ?
8. How many grams of water would require 22,000 of heat to raise its temperature from 34.0°C to 100.0°C ? (Remember the specific heat of water is $1.00 \text{ cal/g} \times ^\circ\text{C}$)
9. 2088 cal of heat are applied to a piece of aluminum, causing a 56°C increase in its temperature. The specific heat of aluminum is $0.22 \text{ cal/g} \times ^\circ\text{C}$. What is the mass of the aluminum?