

Chemistry Lab

C Division

Team Number: _____

School Name: _____

Team Name: _____

Team Members: _____

Scores:

Thermodynamics Pg 1 _____

Thermodynamics Pg 2 _____

Thermo score (40 pts): _____

Physical Properties Pg 1 _____

Physical Properties Pg 2 _____

Phys Prop score (40 pts): _____

Total Score (80 pts): _____

RANK: _____

Raisbeck Aviation Invitational Dec, 2017 **Chemistry Lab** TEAM #: C-_____ (Names: _____)

Part I: Thermodynamics (40 points)

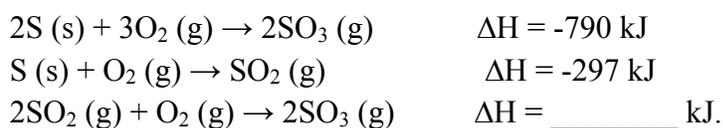
- _____ The thermodynamic quantity to express the degree of disorder in a system is: (2 pts)
 A. enthalpy B. entropy C. bond energy D. internal energy
- Convert normal human body temp, 98.6°F, to Celsius and Kelvin. (4 pts)
- If someone has a temperature of 308 kelvin, do they have a fever? Explain (2 pt)
- Write the term from the options below that matches each definition. (10 pts)
 Heat capacity Calorie Heat of fusion Heat of formation
 Joule Exothermic Endothermic Heat of vaporization

| | |
|---|--|
| The amount of energy needed to melt a given mass of a solid at its melting point temperature. | |
| A reaction or process accompanied by or requiring the absorption of heat. | |
| The energy that must be added to the liquid substance to transform a quantity of that substance into a gas. | |
| A reaction or process accompanied by the release of heat. | |
| The heat released or absorbed when a pure substance is formed from its elements, at constant pressure. | |
| The energy needed to raise the temperature of 1 gram of water through 1 °C | |
| The work done on an object when a force of one newton acts on that object through a distance of one meter | |
| The amount of heat needed to raise the temperature of a pure substance by one degree. | |

5. Circle the options to make the statement correct: (10 pts)

- If a chemical reaction absorbs heat from its surroundings, it has a **positive / negative** ΔH at constant pressure and is **endothermic / exothermic**.
- In an **endothermic / exothermic** reaction, products are generally more stable (stronger bonds) than reactants.
- Heat of reaction is calculated by multiplying the **specific heat capacity / heat of formation** by the **volume / mass** of the solution by the change in temperature.

6. _____ Calculate ΔH (in kJ) for the third reaction: (2 pts)



- A. 196 B. -1384 C. -196 D. -543

7. You have 48.82 g of pure lead. The lead is placed in a beaker of water and heated to boiling. The water will boil at _____ (1 pt). The lead is pulled out and immediately placed in a new beaker with 50mL of 24 °C water. The temperature of the water is monitored until it is no longer changing, so the lead presumed to have the same temperature as the water. This temperature reading is now 26.8°C.

- To calculate the specific heat of lead we use the equality: _____ = _____ (1 pt).
- The change in temperature of the water was: _____ (1 pt).
- The change in temperature of the lead was: _____ (1 pt).
- The specific heat of water is: _____ (1 pt)
- Using this information find the specific heat of lead, show your work for full points. (3 pts)

Specific heat of lead: _____

- The actual specific heat of lead is 1.60 J/g°C. Calculate your percent error. (2 pts)

Part II: Physical property LAB: “The Great Unknown” (40 points)

Lab Goal: *Determine number of unique substances, including relative % and unique properties.*

Properties to identify (as possible): *Density, solubility, conductivity, color, and magnetism*

LAB materials

| Limited access (dispose in waste container) | Must be returned in original condition: |
|---|---|
| Filter paper (1 or 2 pieces) | Beaker |
| Baking soda (< 10 mL) | Graduated cylinder |
| Vinegar (< mL) | Scale (0.01 g) |
| Foil (less than 10 cm x 10 cm) | Stir rod |
| Distilled water (50 mL) | Magnet (wrapped in foil) |

Possible substances (Your answers WILL come from this list):

| | | | |
|---------------|-------------------------|--------------------------------------|-------------------|
| aluminum (Al) | copper (Cu) | copper chloride (CuCl ₂) | iron (Fe) |
| sand | sodium hydroxide (NaOH) | sucrose | table salt (NaCl) |
| tomato seeds | wood shavings | shredded paper | zinc (Zn) |

I. Design a plan : *Outline how you will separate the mixture using 5 logical tasks (8 POINTS)*

| |
|----|
| a. |
| b. |
| c. |
| d. |
| e. |

II. **Data:** Record data about substances found in mixture. There may be up to 4 unique substances

A. Original Mass (g) of mixture (**2 POINTS**) : _____

B. Observations (**10 POINTS**) (write "N/A" if property not relevant)

| | Color | Density | Solubility | Conductivity | Color |
|-----------------------------|---|----------------|-------------------|---------------------|--------------|
| Up to 4 Possible substances | Property (circle whether each property above is intensive or extensive- 5 MORE POINTS) | | | | |
| | Intensive | Intensive | Intensive | Intensive | Intensive |
| | Extensive | Extensive | Extensive | Extensive | Extensive |
| | BOTH | BOTH | BOTH | BOTH | BOTH |
| A. | | | | | |
| B. | | | | | |
| C. | | | | | |
| D. | | | | | |

III. **Conclusions:**

A. How many unique substances were identified (circle one) (**4 POINTS**): 1 2 3 4

B. Determine % composition of at least one item (**2 POINTS**)

| | | |
|---|-----------------------------------|------------------------------|
| C. Find the volume of at least one substance from the mixture (4 POINTS) | Table of known densities (metals) | |
| | Substance | Density (g/cm ³) |
| | aluminum | 2.70 |
| | copper | 8.96 |
| | iron | 7.87 |
| | zinc | 7.13 |

D. Identify substance that exhibits EACH described behavior. Possible substances:
 aluminum (Al)copper (Cu) copper chloride (CuCl₂) iron (Fe)
 sand sodium hydroxide (NaOH) sucrose table salt (NaCl)
 tomato seeds wood shavings shredded paper zinc (Zn)

| Select a substance FROM THE LIST ABOVE that WOULD | Likely substance |
|---|------------------|
| 1. dissolve in water (2 POINTS) | |
| 2. be identified using conductivity (2 POINTS) | |
| 3. have a unique and identifiable color (2 POINTS) | |
| 4. separate with a magnet (2 POINTS) | |