

The specific heat capacity of liquid water is  $4.184 \text{ J}\cdot\text{g}^{-1}\cdot\text{°C}^{-1}$ . density = 1.00 g/mL for liquid water  
 The specific heat capacity of aluminum metal is  $0.901 \text{ J}\cdot\text{g}^{-1}\cdot\text{°C}^{-1}$ .  $\Delta H^\circ_{\text{fusion}} = 10.7 \text{ kJ/mol}$  for aluminum.

- 1) Calculate the heat change for 355 mL of liquid water cooling from  $30.0 \text{ °C}$  to  $0.0 \text{ °C}$ . ( $-4.46 \times 10^4 \text{ J}$ )
- 2) Calculate the heat required to melt 107.9 g of aluminum metal. (42.8 kJ)
- 3) 295 ml of liquid water at  $23.0 \text{ °C}$  is poured into a 130. g plastic cup at  $0.0 \text{ °C}$ . The final temperature of the cup and water is  $20.5 \text{ °C}$ . Calculate the specific heat capacity of the plastic assuming no heat loss. ( $1.2 \text{ J/g}\cdot\text{°C}$ )

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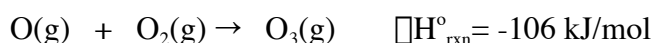
The specific heat capacity of glass is  $0.780 \text{ J/g}\cdot\text{°C}$ .

The specific heat capacity of copper metal is  $0.380 \text{ J/g}\cdot\text{°C}$ .  $\Delta H^\circ_{\text{fusion}} = 13.0 \text{ kJ/mol}$  for copper.

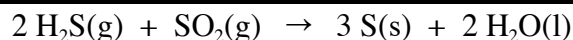
- 4) Calculate the heat change for 250.0 mL of liquid water cooling from  $80.0 \text{ °C}$  to  $20.0 \text{ °C}$ . ( $-6.28 \times 10^4 \text{ J}$ )
- 5) Calculate the heat required to melt 254.2 g of copper metal. (52.0 kJ)
- 6) A calorimeter consists of a 100.0 g glass beaker, 1000.0 g of liquid water and a 1000.0 g copper pail. What is the heat capacity of this calorimeter in  $\text{J/°C}$ ? (In other words, how much heat is required to raise the temperature of all three things by  $1 \text{ °C}$ ?) (4642  $\text{J/°C}$ )

7) A reaction ( $\Delta H^\circ_{\text{rxn}} = -46.46 \text{ kJ/mol}$ ) is run in a calorimeter with  $C_{\text{cal}} = 1195 \text{ J/°C}$ . What will be the temperature change of the calorimeter for 0.105 moles of reaction? (+4.08  $\text{°C}$ )

8) A reaction ( $\Delta H^\circ_{\text{rxn}} = -327.9 \text{ kJ/mol}$ ) is run in a calorimeter with  $C_{\text{cal}} = 4234 \text{ J/°C}$ . What will be the temperature change of the calorimeter for 0.111 moles of reaction? (+8.60  $\text{°C}$ )



- 9) Use these two reactions to calculate  $\Delta H^\circ_{\text{rxn}}$  for the reaction:  $3 \text{O}_2(\text{g}) \rightarrow 2 \text{O}_3(\text{g})$  (286 kJ/2 moles  $\text{O}_3$ )



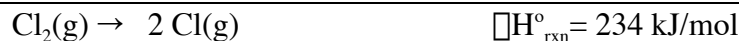
- 10) Calculate  $\Delta H^\circ_{\text{rxn}}$  from standard enthalpies of formation. (-235 kJ/mole  $\text{SO}_2$ )

$$\Delta H^\circ_{\text{f}}(\text{SO}_2) = -297 \text{ kJ}\cdot\text{mol}^{-1}$$

$$\Delta H^\circ_{\text{f}}(\text{H}_2\text{S}) = -20.1 \text{ kJ}\cdot\text{mol}^{-1}$$

$$\Delta H^\circ_{\text{f}}(\text{H}_2\text{O}) = -286 \text{ kJ}\cdot\text{mol}^{-1}$$

- 11) Write down the balanced chemical equation for the formation reaction of  $\text{NaHCO}_3(\text{s})$ .



- 12) Use these two reactions to calculate  $\Delta H^\circ_{\text{rxn}}$  for the reaction:

