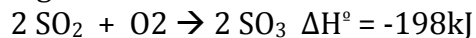


Thermodynamics Unit - Enthalpy

1. Calculate the heat evolved from a reaction mixture of 13.4L SO₂ at 1 atm and 273K and 15 g of O₂.



2. The oxidation of nitrogen in the hot exhaust of jet engines and automobile engines occurs by the reaction



a. How much heat is absorbed by the formation of 1.55 mol of NO?

b. How much heat is absorbed by the reaction of 5.45 L of nitrogen measured at 1.00 atm and 273K? (R=0.08206 L*atm*mol⁻¹*K⁻¹)

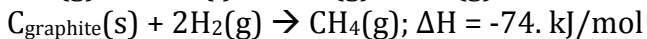
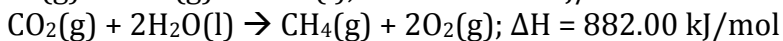
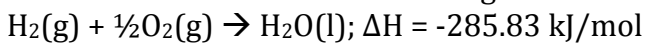
3. Estimate the heat released when ethene ($\text{CH}_2=\text{CH}_2$) reacts with HBr to give $\text{CH}_3\text{CH}_2\text{Br}$. Bond enthalpies are C-H: 412 kJ/mol, C-C: 348 kJ/mol, C=C: 612 kJ/mol, C-Br: 276 kJ/mol, Br-Br: 193 kJ/mol, H-Br: 366 kJ/mol.

4. Calculate the standard reaction enthalpy for the reaction of calcite with hydrochloric acid: $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$. The standard enthalpies of formation for $\text{CaCO}_3(\text{s})$: -1206.9 kJ/mol, $\text{CaCl}_2(\text{aq})$: -877.1 kJ/mol, $\text{HCl}(\text{aq})$: -167.16 kJ/mol, $\text{H}_2\text{O}(\text{l})$: -285.83 kJ/mol, $\text{CO}_2(\text{g})$: -393.51 kJ/mol.

5. Which of the following reactions is an enthalpy of formation reaction?

- a. $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
- b. $2\text{Fe}(\text{s}) + 3/2\text{O}_2(\text{g}) \rightarrow \text{Fe}_2\text{O}_3(\text{s})$
- c. $\text{C}_{\text{diamond}}(\text{s}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g})$
- d. $\text{Hg}(\text{s}) + 1/2\text{O}_2(\text{g}) \rightarrow \text{HgO}(\text{s})$

6. Calculate the change in enthalpy for the combustion of graphite by first stating the combustion reaction and then using the data below.



7. Which of $\text{O}_2(\text{g})$, $\text{O}_2(\text{l})$, $\text{H}_2(\text{g})$, $\text{H}_2(\text{l})$, $\text{H}_2\text{O}(\text{g})$, $\text{H}_2\text{O}(\text{l})$ have a heat of formation equal to zero?

8. Calculate the reaction enthalpy for the formation of anhydrous aluminum chloride by first stating the formation reaction and then using the data below:

