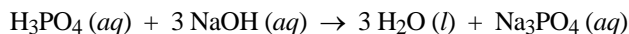


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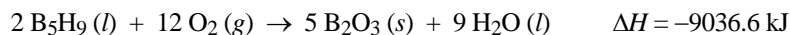
1. In the CHM 151 lab, you are given a 25.00 mL sample of phosphoric acid, $\text{H}_3\text{PO}_4(aq)$, of unknown concentration. Your assignment is to determine the concentration of the phosphoric acid by titrating it with a 0.1015 M sodium hydroxide, $\text{NaOH}(aq)$, solution. You use phenolphthalein as an indicator, and it takes 19.57 mL of sodium hydroxide to titrate to the end point of the titration. What is the **molarity** of the phosphoric acid solution? [5 pts]



2. Given the three statements below, which answer is **correct**? [3 pts]
- (1) In an endothermic reaction, heat is transferred from the surroundings to the system.
(2) The sign of ΔH for an endothermic reaction is positive.
(3) An exothermic reaction releases heat.
- a) 1 and 2 are true, 3 is false b) 1 and 3 are true, 2 is false c) 1, 2, and 3 are true
d) 1, 2, and 3 are false e) 2 and 3 are true, 1 is false

3. **True or False** [2 pts each]

- a) Temperature is the transfer of thermal energy between two bodies at different temperatures.
b) The universe is composed of the surroundings and the system.
c) Enthalpy is a measure of the heat flow in chemical changes at constant volume.
4. Pentaborane-9, B_5H_9 , is a colorless, highly reactive liquid that will burst into flame or even explode when exposed to oxygen. The reaction is

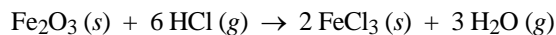


Calculate ΔH° for the above process when a 10.0 g sample of B_5H_9 is burned at constant pressure. [4 pts]

5. Consider the following reaction. What is the standard enthalpy of formation, ΔH_f° , of $\text{CO}(g)$? [2 pts]



6. Use the data given below to calculate the *standard enthalpy change*, $\Delta H_{\text{rxn}}^\circ$, for the following reaction: [4 pts]



$$\Delta H_f^\circ [\text{HCl}(g)] = -92.3 \text{ kJ/mol}$$

$$\Delta H_f^\circ [\text{FeCl}_2(s)] = -341.8 \text{ kJ/mol}$$

$$\Delta H_f^\circ [\text{Fe}_2\text{O}_3(s)] = -822.2 \text{ kJ/mol}$$

$$\Delta H_f^\circ [\text{H}_2\text{O}(l)] = -285.8 \text{ kJ/mol}$$

$$\Delta H_f^\circ [\text{H}_2\text{O}(g)] = -241.8 \text{ kJ/mol}$$

$$\Delta H_f^\circ [\text{FeCl}_3(s)] = -400.0 \text{ kJ/mol}$$

Circle the correct answer.

a) -281.4 kJ/mol

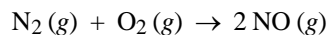
b) -149.4 kJ/mol

c) -1257 kJ/mol

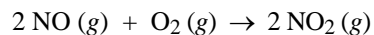
d) $+281.4 \text{ kJ/mol}$

e) $+149.4 \text{ kJ/mol}$

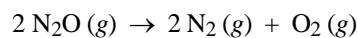
7. Given the following data, [4 pts]



$$\Delta H_{\text{rxn}}^\circ = +180.7 \text{ kJ}$$

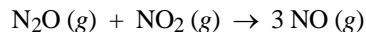


$$\Delta H_{\text{rxn}}^\circ = -113.1 \text{ kJ}$$



$$\Delta H_{\text{rxn}}^\circ = -163.2 \text{ kJ}$$

use Hess's law to calculate ΔH for the reaction:



$$\Delta H_{\text{rxn}}^\circ = ?$$

Potentially Useful Information

$$\Delta H_{\text{rxn}}^\circ = \sum n \Delta H_f^\circ(\text{prod.}) - \sum n \Delta H_f^\circ(\text{reac.})$$