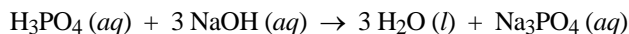


Name _____

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]



$$\frac{0.1015 \text{ mol NaOH}}{1 \text{ L}} \times 0.01957 \text{ L} = 0.001986 \text{ mol NaOH}$$

$$0.001986 \text{ mol NaOH} \times \frac{1 \text{ mol H}_3\text{PO}_4}{3 \text{ mol NaOH}} = 6.620 \times 10^{-4} \text{ mol H}_3\text{PO}_4$$

$$M_{\text{H}_3\text{PO}_4} = \frac{\text{mol H}_3\text{PO}_4}{\text{L soln}} = \frac{6.620 \times 10^{-4} \text{ mol H}_3\text{PO}_4}{0.02500 \text{ L}} = \mathbf{0.02648 \text{ M}}$$

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.

FALSE, **heat** is the transfer of thermal energy between two bodies at different temperatures.

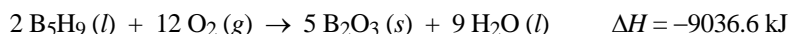
- b) The universe is composed of the surroundings and the system.

TRUE

- c) Enthalpy is a measure of the heat flow in chemical changes at constant volume.

FALSE, enthalpy is a measure of the heat flow in chemical changes at constant **pressure**.

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]

$$10.0 \text{ g B}_5\text{H}_9 \times \frac{1 \text{ mol B}_5\text{H}_9}{63.12 \text{ g B}_5\text{H}_9} = 0.1584 \text{ mol B}_5\text{H}_9$$

$$0.1584 \text{ mol B}_5\text{H}_9 \times \frac{-9036.6 \text{ kJ}}{2 \text{ mol B}_5\text{H}_9} = \mathbf{-715.7 \text{ kJ}}$$

