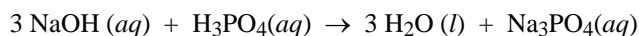


Name (PRINT) KEY

(28 points total)

1. In the CHM 151 lab, you are given a NaOH solution of unknown concentration, and you are asked to find its molar concentration (molarity). You start with 25.00 mL of the NaOH solution and titrate it with 1.500 M H<sub>3</sub>PO<sub>4</sub>. It takes 17.41 mL of H<sub>3</sub>PO<sub>4</sub> to reach the equivalence point of the titration. What is the **molarity** of the NaOH solution? [5 pts]



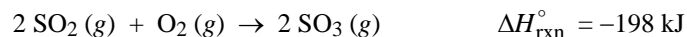
$$\text{mol H}_3\text{PO}_4 = \frac{1.500 \text{ mol}}{1 \text{ L}} \times (17.41 \times 10^{-3} \text{ L}) = 0.02612 \text{ mol H}_3\text{PO}_4$$

$$\text{mol NaOH} = 0.02612 \text{ mol H}_3\text{PO}_4 \times \frac{3 \text{ mol NaOH}}{1 \text{ mol H}_3\text{PO}_4} = 0.07836 \text{ mol NaOH}$$

$$M (\text{NaOH}) = \frac{\text{mol}}{\text{L}} = \frac{0.07836 \text{ mol NaOH}}{25.00 \times 10^{-3} \text{ L}} = \mathbf{3.134 \text{ M}}$$

2. Given the three statements below, which answer is **correct**? [3 pts]
- (1) The sign of  $\Delta H$  for an endothermic reaction is positive.  
(2) In an exothermic reaction, heat is transferred from the system to the surroundings.  
(3) An endothermic reaction releases heat.
- a) 1 and 3 are true, 2 is false                      b) **1 and 2 are true, 3 is false \***                      c) 2 and 3 are true, 1 is false  
d) 1, 2, and 3 are false                              e) 1, 2, and 3 are true
3. In an endothermic process, heat is transferred from the surroundings to the system. [2 pts]
4. Which of the following is **exothermic**? [3 pts]
- a) An icicle melts                                      b) Liquid nitrogen boils  
c) **Water condenses on a cold pipe \***              d) Dry ice (CO<sub>2</sub>) sublimates (solid → gas)  
e) All of these are exothermic

5. Given the thermochemical equation:



What is the **enthalpy change** ( $\Delta H^{\circ}$ ) for the decomposition of eight moles of SO<sub>3</sub>? [3 pts]



$$\frac{+198 \text{ kJ}}{2 \text{ mol SO}_3} \times 8.00 \text{ mol SO}_3 = \mathbf{+792 \text{ kJ}}$$

