Friday Worksheet **Name: …….**

Chemical calorimetry worksheet 4

1) An electric current of 1.35A at a potential difference of 6.80V was passed for 4.00 minutes through a calorimeter containing 80.0 mL of water. The temperature rose from 22.00 to 26.53 ºC.
   a) Calculate the calibration factor in in J/°C, for this calorimeter
      Calibration factor = VIt / ΔT
      ⇨ 6.80 x 1.35 x 4.00 X 60.0 / (26.53 – 22.00) = 486 J/^{o}C
   b) 40.0 mL of 1.00 mol L^{-1} lead(II) nitrate solution, $Pb(NO_3)_2$, at 20.6^{o}C was added to 40 mL of a solution containing excess potassium iodide, KI also at 20.6^{o}C.
      i. Write a balanced chemical equation for the reaction

      $Pb(NO_3)_2(aq) + 2KI(aq) \Rightarrow PbI_2(s) + 2KNO_3(aq)$

      ii. Calculate the ΔH for the reaction above if the temperature of the water in the calorimeter reached a maximum of 27.8 ^{o}C.

      Step 1 Calculate the mol of $Pb(NO_3)_2$ that reacted
      => n = C X V = 1.00 X 0.0400 = 4.00 X 10^{-2}
      Step 2 Calculate the amount of energy released
      => 486 J/^{o}C X (27.8 – 20.6) = 3499 J
      Step 3 Calculate ΔH
      => 3499J / 0.0400 = -87.5 kJ/mol

      iii. Using the same calorimeter, as above, 40.0 mL of 1.00 mol L^{-1} lead(II) nitrate solution, $Pb(NO_3)_2$, at 20.6^{o}C was added to 40.0 mL of 0.500 mol L^{-1} potassium iodide solution, KI, also at 20.6^{o}C. What is the highest temperature reached by the water

      Step 1 Find the mol of each reactant and determine the limiting reactant.
      In this case it is KI.
      $n_{\text{lead nitrate}}$ = 0.04 X 1.00 = 0.0400 mol
      $n_{\text{potassium iodide}}$ = 0.04 X 0.500 = 0.0200 mol
      Step 2 Calculate the amount of energy released if the 0.0200 mol of KI reacted.
      Since, according the thermochemical equation, for every 2 mol of KI used 87.5 Kj of energy is released we can write the expression below.
      => 87.5 kJ mol^{-} X 0.0200/2 = 0.875 kJ.
      Step 3 Calculate the temperature increase using the calibration factor.
      => 875.0 J / 486 J/^{o}C = 1.80^{o}C
      Step 4 Calculate the final temperature of the water.
      => 20.6 + 1.80 = 22.4^{o}C