Problems of Redox titrations

1) 21.44 g of an impure sample of copper were dissolved in acid to obtain an aqueous solution of copper(I). The solution was titrated with 20 mL of potassium dichromate ($K_2Cr_2O_7$) 1.8 mol/L solution. At the end point we have copper(II) and Cr^{3+}. Determine:
   a) Mass of pure copper in the sample and its weight percentage.
   b) Normality of the potassium dichromate solution.

2) 100 mL of titanium(III) solution were titrated with 70 mL of nitric acid (HNO_3) 0.8 mol/L solution. At the end point we have titanium(IV) and NO. Determine:
   a) Molarity and normality of the titanium(III) ion solution.
   b) Normality of the nitric acid solution.

3) 4.413 g of a sample of iron are titrated with 80 mL of nitric acid (HNO_3) 0.8 mol/L solution. The metal is oxidized to iron(III) oxide and the oxidizing agent (titran) is reduced to NO. Calculate:
   a) Mass of iron in the sample and its weight percentage.
   b) Normality of the nitric acid solution.

4) 90 mL of vanadium(II) solution were titrated with 80 mL of potassium dichromate ($K_2Cr_2O_7$) 1.25 mol/L solution. At the end point we have vanadium(V) and Cr^{3+}. Calculate:
   a) Molarity and normality of the vanadium(II) ion solution.
   b) Normality of the potassium dichromate solution.
   c) Mass of vanadium in the solution.

5) 23.94 g of an impure sample of tin were dissolved in acid to obtain an aqueous solution of tin(II). The solution was titrated with 55 mL of potassium permanganate ($KMnO_4$) 1.1 mol/L solution. At the end point we have tin(IV) and Mn^{2+}. Determine:
   a) Mass of pure tin in the sample and its weight percentage.
   b) Normality of the potassium permanganate solution.

6) 60 mL of titanium(III) solution were titrated with 75 mL of nitric acid (HNO_3) 0.35 mol/L solution. At the end point we have titanium(IV) and NO. Determine:
   a) Molarity and normality of the titanium(III) ion solution.
   b) Normality of the nitric acid solution.

7) 8.405 g of a sample of vanadium are titrated with 65 mL of nitric acid (HNO_3) 2.75 mol/L solution. The metal is oxidized to vanadium(V) oxide and the oxidizing agent (titran) is reduced to NO. Determine:
   a) Mass of vanadium in the sample and its weight percentage.
   b) Normality of the nitric acid solution.

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8) 95 mL of vanadium(II) solution were titrated with 60 mL of potassium permanganate ($KMnO_4$) 0.1 mol/L solution. At the end point we have vanadium(V) and Mn^{2+}. Find out:

   a) Molarity and normality of the vanadium(II) ion solution.

   b) Normality of the potassium permanganate solution.

   c) Mass of vanadium in the solution.

Answers:

1)   **a)** 13.72 g, 64 %   **b)** 10.8 equiv/L.

2)   **a)** 1.68 mol/L, 1.68 equiv/L   **b)** 2.4 equiv/L.

3)   **a)** 3.574 g, 81 %   **b)** 2.4 equiv/L.

4)   **a)** 2.222 mol/L, 6.667 equiv/L   **b)** 7.5 equiv/L   **c)** 10.19 g.

5)   **a)** 17.95 g, 75 %   **b)** 5.5 equiv/L.

6)   **a)** 1.313 mol/L, 1.313 equiv/L   **b)** 1.05 equiv/L.

7)   **a)** 5.463 g, 65 %   **b)** 8.25 equiv/L.

8)   **a)** 0.1053 mol/L, 0.3158 equiv/L   **b)** 0.5 equiv/L   **c)** 0.5094 g.