Calculations of Solutions:

(1) Volumetric Analysis

-2007 II

Ⅱ A 40.0l sample of N_2 gas containing SO_2 gas as an impurity was bubbled through a 3% solution of H_2O_2. The SO_2 was converted to H_2SO_4:

$$SO_2 + H_2O_2 \rightarrow H_2SO_4$$

A 25.0ml portion of 0.0100mol/l NaOH was added to the solution, and the excess base was back-titrated with 13.6ml of 0.0100mol/l HCl. Calculate the parts per million of SO_2 (that is, ml $SO_2/10^6$ml sample) if the density of SO_2 is 2.85g/l. (Atomic weights; H=1.0, N=14.0, O=16.0, Na=23.0, S=32.0, and Cl=35.5)

ppm

-2018 VII(2)

The compound in (1) is ammonium sulfate

VII Answer the following questions concerning the determination of nitrogen (Kjeldahl method).

(1) When 0.056g of protein was heated with concentrated sulfuric acid, the protein was completely decomposed. Which of 1) to 5) is the nitrogen compound that is formed?

1) ammonium sulfate 2) aniline 3) pyridine 4) ammonium chloride
5) carbon dioxide

(2) Ammonia, which is generated by alkalizing the nitrogen compound produced in the above question (1), is completely collected with 10.0 mL of a 0.050 mol L^{-1} H_2SO_4 solution. When an acid-base titration of the solution with 0.10 mol L^{-1} NaOH aqueous solution is performed, 3.6 mL of the NaOH aqueous solution is required. What weight percentage of nitrogen did the protein used in (1) contain? Answer the value to two significant figures. Use the following value necessary; the atomic weight of N is 14.

(2) Solubility

-2006 I(8)

A maximum of 25g can be dissolved in 100g of water in 22°C for sodium carbonate. What is the maximum mass (g) of its hydrous compound $Na_2CO_3 \cdot 10H_2O$

that can dissolve in 100g of water in 22°C?

1) 0.556g 2) 0.762g 3) 9.27g

4) 67.5g 5) 81.7g 6) 117g

-2009 III(2)

Ⅲ The solubility of sodium sulfite (Na_2SO_3) is 27 (g/100 g-water) at 20℃. Answer the following questions (1) and (2). (Atomic weights : H : 1.0, O : 16.0, Na : 23.0, and S : 32.0)

(2) How many grams of $Na_2SO_3 \cdot 7H_2O$ is soluble in 50 g water at 20℃?

(3) Effect of Impurities to the Melting/Boiling Point

-2012 IV

IV Write the correct answer to the questions below to two significant figures.

(1) 9.0 g of glucose, $C_6H_{12}O_6$, was dissolved in 100 g of water. The freezing point of the glucose solution was determined to be −0.94 °C. Determine the molar freezing-point depression of water in the unit of (K kg / mol).

(2) A salt is composed of cation M^+ and anion X^-, and perfectly dissociates when dissolved in water. 2.0 g of this salt was dissolved in 100 g of water. The freezing point of the salt solution was determined to be −1.3 °C. Determine the formula mass of the salt.

-2013 I(7)

(7) 10 g of substances 1) to 4) were dissolved in each 1.0 L of water. Which solution will have the highest boiling point?

1) glucose
2) sodium chloride
3) sodium sulfate
4) magnesium chloride