※ 考生請注意：本試題可使用計算機，並限「考選部核定之國家考試電子計算器」機型

Part I　Multiple choice questions　5% for each question

1. Calculate the molar solubility of AgCl in 0.010 M MH_3. (This is the final concentration of free NH_3 molecules in the solution). Giving are K_w of AgCl = 1.0×10^{-10} and stability constants $K_1 = 2.3 \times 10^3$ and $K_2 = 6.0 \times 10^3$.
   a. 2.4×10^{-3}
   b. 3.7×10^{-3}
   c. 2.4×10^{-2}
   d. 4.7×10^{-4}
   e. 5.2×10^{-3}

2. The activity coefficients of a solution will
   a. Always decrease with increase of ionic strength of solution.
   b. Always will be unit for neutral compound no matter the ionic strength of solution.
   c. Will vary with ionic strength, ion size and ion charge.
   d. Have no effects on equilibrium constants.
   e. Decrease with increase of non-related ions in solution, which cause the increase of solubility of salts.

3. The pH value of a 2.0×10^{-7} M hydrochloride acid is
   a. 6.80×10^{-7}
   b. 6.85×10^{-7}
   c. 6.90×10^{-7}
   d. 6.95×10^{-7}
   e. 7.00×10^{-7}

4. Which of the following gas chromatographic detectors are used for detection of permanent gas samples, such as N_2, O_2 CO_2 etc.?
   a. Flame ionization detector
   b. Thermo-conductance detector
   c. Nitrogen phosphor detector
   d. Mass spectrometry detector
   e. Photon ionization detector

5. What is the pH value at the equivalence point when 0.030 M NaF is titrated with 0.060 M $HClO_4$? The pK_a for HF is 3.15.
   a. 2.47
   b. 3.47
   c. 4.47
   d. 5.47
   e. 6.47

6. Which of the following detectors used in chromatographic instrument are concentration sensitive types?
   a. Flame ionization detector
   b. Ultra violet detector
   c. Thermo-conductance detector
   d. Flame photometric detector
   e. Electron capture detector

7. Which of the following procedures were not used to identify the system errors that might occurred in the proceeding of experiment?
   a. Blank test
   b. Duplicate test
   c. Spiking recovery test
   d. Quality control sample test
   e. Method detection limit test

8. Which of the following statements are true for a titration analysis?
   a. The reaction must proceed according to a definite chemical equation. There should be no side reactions.
   b. It is desirable that the reaction be rapid, so that the titration can be completed in a few minutes.
   c. It has to be available for some methods for determine the equivalence point of the titration.
   d. The reaction should proceed to virtual completion at the equivalence point.

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  e. For titration with a sample of mixtures, the p function value of equilibrium constants for these analaytes reaction with tartans must be great than 4.

9. Calcium fluoride, CaF_2, has a K_{sp} of 4.0×10^{-11}. Calculate its solubility at pH of 3. The pK_a for HF is 3.15.
  a. 6.1×10^{-7}
  b. 6.4×10^{-6}
  c. 1.5×10^{-8}
  d. 1.7×10^{-8}
  e. 1.2×10^{-7}

10. A sample of L-dopa, a drug used for treatment of the symptoms of Parkinson's disease, is electrolyzed exhaustively with 42.0 μC. The process requires two electrons per molecule. The formula weight of L-dopa is 197.2. What is the mass of L-dopa in the sample?
  a. 2.17×10^{-10}
  b. 4.36×10^{-10}
  c. 4.29×10^{-8}
  d. 4.29×10^{-7}
  e. 2.17×10^{-7}

11. Which of the following type compounds are suitable for using an electron capture detector to quantization?
  a. Polychlorinated biphenyls
  b. Polycyclic aromatic hydrocarbons
  c. Fatty acids
  d. Triglycerides
  e. Dioxins and furans related compounds

12. Which factors in below that will influence the pH of a buffer solution?
  a. pK_a
  b. Temperature
  c. Ionic strength
  d. Concentration of solute
  e. Ratio of the acid (base) and it salt

13. Calculate the pH value for water containing 0.10 M KCl at 25 (giving γ_{H+}=0.83 γ_{OH-} = 0.76).
  a. 7.00
  b. 6.98
  c. 6.96
  d. 7.02
  e. 6.93

14. Mixing two compounds made a solution. The absorb for each compound in the same wavelength was measured, it was founded that at λ_1, ε_{1a} = 500 and ε_{1b} = 3000; at λ_2, ε_{2a} = 2100 and ε_{2b} = 160. The absorbance for the solution at the same wavelength were also measured at λ_1, the $A(\lambda_1)$ = 0.450 and at λ_2, the $A(\lambda_2)$ = 0.560. What are the concentration for those compounds?
  a. $C_1 = 2.61 \times 10^{-3}$, $C_2 = 1.07 \times 10^{-3}$
  b. $C_1 = 2.61 \times 10^{-3}$, $C_2 = 1.07 \times 10^{-2}$
  c. $C_1 = 2.61 \times 10^{-4}$, $C_2 = 1.07 \times 10^{-4}$
  d. $C_1 = 2.61 \times 10^{-4}$, $C_2 = 1.07 \times 10^{-3}$
  e. $C_1 = 2.61 \times 10^{-3}$, $C_2 = 1.07 \times 10^{-4}$

Part II 10% for each question

  1. Please describe principles, applications and limitations of SPE and SPME in detail.
  2. Please describe and compare their applications in details of the ionization methods of Mass Spectrometry.
  3. What are the hardware devices for noise reduction? And please compare their advantages and disadvantages?