※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

Attentions:

a) **Do not** leave your answers in the table on the first page of the answer booklet. Write all your answers in the second and subsequent pages of the answer booklet.
b) Answers should appear in order in the answer booklet. Each answer should be preceded with its question number/code. Answers not preceded with question numbers/codes will not be credited.
c) Pay attention to the sign and unit of your answers.
d) The following values may be of some use: exp(1.00) = 2.718; exp(2.00) = 7.389; exp(3.00) = 20.09; exp(5.00) = 148.4; ln(2.00) = 0.6931; ln(3.00) = 1.099; ln(5.00) = 1.609; 1 L-atm = 101.325 J; R = 0.08206 L-atm/K-mol = 8.3145 J/K·mol
e) The following atomic masses may be of some use: C=12.011, O=15.999, H=1.008, Na=22.990

1.(8%) Write down the full name in English of any 8 abbreviations or symbols from the following list of the abbreviations/symbols used in Analytical Chemistry and Statistical Analysis: (a) ANOVA, (b) CI, (c) ICP, (d) AAS, (e) TOF, (f) K_{sp}, (g) CV, (h) RRD, (i) iHPLC, (j) ECD, (k) FIA.

2.(15%) Describe or define any 15 terms from the following list of terms used in analytical chemistry: (a) stoichiometry, (b) homogeneous precipitation, (c) occlusion, (d) electric double layer, (e) isoelectric point, (f) zwitterion, (g) liquid junction, (h) plus right rule, (i) autocatalysis, (j) acid error, (k) kinetic polarization, (l) half-wave potential, (m) supporting electrolyte, (n) sparging, (o) phosphorescence, (p) monochromator, (q) dielectric, (r) dark current, (s) photoelectron, (t) Michaelis constant.

3.(12%) Define any 6 terms from the following list of terms used in Analytical Chemistry (Note: in addition to providing written statements for the definition, each definition has to also contain a *properly labeled equation* for the definition): (a) analytical sensitivity, (b) buffer capacity, (c) ionic strength, (d) thermodynamic equilibrium constant, (e) relative supersaturation, (f) Nernst equation, (g) Beer's Law, (h) resolution of mass spectrometer.

4.(11%) (Note: you will receive no credit for merely translating the terms into Chinese.)
(A) Make a clear distinction, respectively, between any 4 pairs of analytical chemistry terms from the following list: (a) ligand and chelating agent, (b) equivalence point and end point, (c) formal potential and standard electrode potential, (d) matrix modifier and masking agent, (e) internal standard and external standard, (f) solvent blank and reagent blank.
(B) Make a clear distinction among limit of linearity, limit of detection, and limit of quantitation.

5.(4%) (a) Write down two terms that are widely used as quantitative measures of chromatographic column efficiency. (b) Define each of these two terms.

6.(6%) Fill in the blanks below:

a) 1 kg = 1 x ___ ng.　　b) 1 mA = 1 x ___ μA　　c) 1 Å = 1 x ___ pm.
d) 1 ML = 1 x ___ dL　　e) 1 fsec = 1 x ___ Gsec　　f) 1 cm = 1 x ___ Tm.

7.(5%) Calculate the analytical and equilibrium molar concentrations of the solute species in an aqueous solution of 10.0 mL that contains 120.0 mg of acetic acid (The acid is 75.0% ionized in water).

8.(8%) For y = log α, analytical statistics shows that s_y (i.e., the standard deviation of y) is $0.434(s_\alpha/\alpha)$. Quantitative molecular absorption spectrometry is performed using a sample cell that has the thickness of the absorbing solution of 1.00 cm. An unknown solution S has a molar absorptivity of 2500(±12) $M^{-1}cm^{-1}$. Its molar concentration c_s is measured using this sample cell and produces replicate transmittance results of 0.180, 0.220, 0.210, and 0.190. Calculate (a) the molar concentration (c_s) of the analyte; and (b) the absolute standard deviation of the c_s.

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9. The following list of constants may be needed for answering parts (A), (B), and/or (C).
$K_a(HCl) = 1.3\times10^{6}$; $K_a(HOAc) = 1.75\times10^{-5}$; $K_a(HClO_4) = \sim10^{9}$; $K_a(H_3AsO_4) = 5.8\times10^{-3}$, 1.1×10^{-7}, 3.2×10^{-12}; $K_a(Cl_3CCOOH) = 3.0\times10^{0}$; $K_a(HF) = 6.8\times10^{-4}$; $K_a(HIO_3) = 1.58\times10^{-1}$; $K_a(HI) = 3.2\times10^{9}$; $K_a(HSCN) = 1.32\times10^{-1}$; $K_b(CH_3NH_2) = 4.37\times10^{-4}$.

(A).(9%)
(a) Explain whether 10 M HCl is a strong acid or not.
(b) For the two-component solution that includes HCl, write down all the possible other component (i.e., other than HCl) of the solution in which HCl behaves as a weak acid. (Use the chemicals provided in the list above only.)
(c)(i) Using the list provided above, write down the chemical composition of a five-component solution and specify which four chemicals of the components will all behave as strong acids. (ii) What is the chemical term generally used for the chemical substance that forms a solution with these four chemicals that all behave as strong acids?
(d) Other than methods available to determine the end point, list all other conditions required for a titration to be effective.
(e) Use the conditions listed in (c) to explain whether the titration of HCl by CH_3NH_2 can be performed effectively.

(B).(6%)
(a) A buffer solution can be prepared based on HOAc. Describe how you might prepare 200.0 mL of a pH 5.00 buffer solution from NaOAc and 1.00 M HOAc.
(b) Can a buffer solution be prepared based on CH_3NH_2? If no, explain; if yes, calculate the pH buffer range for this buffer to have a reasonable capacity.

(C).(16%)
(a) Calculate the pH of a 0.1000 M H_3AsO_4 solution (neglecting activities).
(b) Assuming that the activity coefficient of H^+ in the 0.1000 M H_3AsO_4 solution is 0.83, calculate the pH of a 0.1000 M H_3AsO_4 solution.
(c) For the titration of 25.00 mL of 0.1000 M H_3AsO_4 by 0.1000 M NaOH, calculate the pH at addition of 10.00, 30.00, and 80.00 mL titrant and at the first and second equivalence points.