

- To prepare a solution of NaCl, you weigh out 2.634 (± 0.002)g and dissolve it in a volumetric flask whose volume is 100.00 ± 0.08 mL. Express the molarity of the resulting solution, and its uncertainty, with the correct number of significant figures. (10%)
Given: Na: 22.990 gmol^{-1} , Cl: 35.453 gmol^{-1} .
- An organic compound weighing 5.714 mg produced 14.414 mg of CO_2 and 2.529 mg of H_2O upon combustion. Find the weight percent of C and H in the sample. (10%)
Given: C: 12.011 gmol^{-1} , H: 1.008 gmol^{-1} , O: 15.999 gmol^{-1} .
- A 30.00 mL solution containing an unknown amount of I^- was treated with 50.00 mL of 0.3650 M AgNO_3 . The precipitated AgI was filtered off, and the filtrate (plus Fe^{3+}) was titrated with 0.2780 M KSCN . When 37.60 mL had been added, the solution turned red. How many milligrams of I^- were present in the original solution? (10%)
Given: Ag: $107.868 \text{ gmol}^{-1}$, I: $126.904 \text{ gmol}^{-1}$.
- A solution contains plumbous (Pb^{2+}) and mercurous (Hg_2^{2+}) ions, each at a concentration of 0.010 M. Is it possible to complete separate the Pb^{2+} and Hg_2^{2+} by selectively precipitating the latter with iodide? "Complete" separation means that we seek to reduce the Hg_2^{2+} concentration to 0.01% of its original value without precipitating Pb^{2+} . (15%)
Given: $\text{PbI}_2(\text{s}) = \text{Pb}^{2+} + 2\text{I}^- \quad K_{\text{sp}} = 7.9 \times 10^{-9}$
 $\text{Hg}_2\text{I}_2(\text{s}) = \text{Hg}_2^{2+} + 2\text{I}^- \quad K_{\text{sp}} = 1.1 \times 10^{-28}$
- How many grams of ammonium chloride (MW=53.5) and how many milliliters of concentrated ammonium hydroxide (16.0M) should be dissolved, mixed, and diluted to 100 mL to prepare a solution with a pH of 9.00 and a total molar concentration of 5.00? The $\text{p}K_b$ of NH_4OH is 4.76. (15%)
- Acid-base indicators are themselves acids or bases. Consider an indicator, HIn , which dissociates according to the equation
$$\text{HIn} = \text{H}^+ + \text{In}^-$$

Suppose that the molar absorptivity, ϵ , is $2080 \text{ M}^{-1}\text{cm}^{-1}$ for HIn and is $14200 \text{ M}^{-1}\text{cm}^{-1}$ for In^- , at a wavelength of 440 nm.

(背面仍有題目,請繼續作答)

- (a) Write the expression giving the absorbance at 440 nm of a solution containing HIn at a concentration (HIn) and In⁻ at a concentration (In⁻). Assume the cell-length is 1.00 cm. Note that absorbance is additive. The total absorbance is the sum of absorbances of all components. (5%)
- (b) A solution containing the indicator at a formal concentration of 1.84×10^{-4} M is adjusted to pH 6.23 and found to exhibit an absorbance of 0.868 at 440 nm. Calculate pK_a for this indicator. (10%)

7. Choose the correct one, and explain briefly. (25%)

- <1> Is the complex of a metal ion with EDTA affected by pH of the solution? (a) Yes, (b) No.
- <2> How does the pH of pure water change with increasing temperature? (a) Increase, (b) Decrease, (c) No change.
- <3> Which lamp is generally used for the source of atomic absorption spectrometer? (a) W lamp, (b) Hollow Cathode Lamp, (c) Laser lamp.
- <4> Two species, A and B, are separated by a gas chromatographic column. The distribution coefficient $K (= C_s/C_m)$ for A is larger than for B. Which one come out from the column firstly? (a) A, (b) B, (c) The same.
- <5> In the determination of Pb by flame emission spectrometer, two results of calibration (*ie.* emission intensity versus concentration of Pb) obtained under different conditions were expressed as follows.
- (I) $I = 0.0312 + 1.12 C_{Pb}$
- (II) $I = 0.0235 + 1.29 C_{Pb}$
- Which one has higher sensitivity? (a) I, (b) II, (c) undetermined.