Fill in the blanks. 2.5 points for each blank. Fill the **final results** in the blanks only.
All answers must be **written on the answer sheet**.
※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

1. If $[H^+] = (8.0 \pm 0.4) \times 10^{-5}$ M, pH = ________. $\log 2 = 0.30$
   The uncertainty must be included in the final answer.
2. Four measurements of the percentage of an additive in food yield a confidence limit of 1.40 ~ 1.88 at 95% confidence level (t is 3.2 for 3 degrees of freedom). For these measurements, the mean is ________ and the standard deviation is ________.
3. A 50-mL aqueous solution contains 0.32 mg of a pesticide (molar mass = 320 g/mol). The concentration of the pesticide is ________ M, or ________ ppm.
4. An unknown sample of Pb^{2+} gives a signal of 0.40 in an AA analysis. Then 1.0 mL of solution containing 200 ppb Pb^{2+} is mixed with 95.0 mL unknown, and the mixture is diluted to 100.0 mL with a volumetric flask. The resulting solution gives a signal of 0.70.
   (a) the concentration of Pb^{2+} in the unknown is ________
   (b) the method used in this question is called: ________
5. Consider 0.10 M aqueous solutions of the following four species: (i) Na_2CO_3 (ii) $KHSO_4$ (iii) NH_4Cl (iv) NH_4F List these four solutions in the order of increasing pH: ________
6. The volume of 0.50 M HCl(aq) needed to add to 0.50 M, 60 mL of NH_3(aq) ($pK_b = 5.0$) to make a buffer solution of pH 8.7 is ________ mL.
7. Consider adding 50 mL of a buffer solution containing 1.0 M HA ($pK_a = 5.0$) and 1.0 M NaA to 50 mL of each of the following aqueous solutions: (i) 0.10 M NaA(aq), (ii) 0.10 M HA(aq), (iii) 0.10 M NaOH(aq), (iv) 0.1 M HCl(aq). The order of increasing pH values for these four mixed solutions is ________.
8. Given: $HA + B^- \rightleftharpoons A^- + HB$, K < 1 and $B^- + H_2O \rightleftharpoons HB + OH^-$, $pK_b < 7$. List the order of decreasing values of K's for $K_a(HA)$, $K_a(HB)$, $K_b(A^-)$, and $K_b(B^-)$: ________
9. A sample solution is prepared by dissolving 3.2 g of a monoprotic acid HA ($pK_a = 5.0$) in water and dilute to 100 mL with a volumetric flask. Take 20 mL of the sample solution and titrate with 0.20 M NaOH(aq). It requires 20 mL NaOH(aq) to reach the end point.
   (a) The molar mass of HA is ________ g/mol
   (b) the pH of solution at equivalence point is ________
   (c) the pH of solution after adding 10 mL NaOH(aq) is ________.
10. The triprotic acid H_3A has $pK_1 = 3.0$, $pK_2 = 6.0$, and $pK_3 = 9.0$.
   (a) For $[H_3A] = [A^{3-}]$, pH = ________
   (b) At pH 8.0, $[HA^{2-}]/[A^{3-}]$ = ________
   (c) For 1.11 M H_3A(aq) at pH 7.0, $[A^{3-}]$ = ________ M.
11. The solubility of AgCN ($K_{sp} = 1.0 \times 10^{-16}$) is S in water and 500S in 0.010 M $HClO_4$(aq).
   (a) S = ________ M (b) $K_a(HCN)$ = ________
   (c) $[CN^-]$ = ________ M for AgCN(s) dissolved in 0.010 M $HClO_4$(aq).
12. A 25.0 mL sample solution of Ca^{2+}(aq) is titrated with 0.16 M EDTA (H_6Y^{2+}) solution at pH 9.0; it requires 15.0 mL to reach the end point. EBT (Eriochrome black T) is used as the indicator, which is blue at pH 9.0. Given: $K_f(CaY^{2-}) = 4.8 \times 10^{10}$; $\alpha_4 = [Y^{4-}]/[H_6Y^{2+}]_{total} = 0.050$.
   (a) the conditional formation constant for CaY^{2-} at pH 9.0 is ________
   (b) $[Ca^{2+}]$ of sample solution = ________ M
   (c) $[Ca^{2+}]$ at the equivalence point = ________
   (d) Indicate the color change of EBT around the equivalence point: ________.
13. A battery is constructed from two half cells: $Zn|Zn^{2+}$(1.0 M) and $Mn|Mn^{2+}$(1.0 M); the volume of each electrolyte solution is 100 mL. The battery is allowed to discharge at a constant current of 9.65 A. Given: F = 96500 C·mol^{-1}; $Zn^{2+} + 2e \rightarrow Zn$, E° = −0.76 V; $Mn^{2+} + 2e \rightarrow Mn$, E° = −1.18 V.

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(a) the anode of the cell is ________ (b) the direction of electrode flow is ________ (c) the standard cell potential is ________

(d) $[Zn^{2+}]$ = ________ after 400 seconds of discharging.

14. A 200-mg sample of glycerol ($C_3H_8O_3$; Mw = 92) is treated with 50.0 mL, 0.10 M Ce^{4+}(aq) to give HCOOH and Ce^{3+} in 3 M $HClO_4$ at 50°C for 15 min. The excess Ce^{4+} required 20.0 mL of 0.050 M Fe^{2+} to reach the end point.

(a) give a balanced equation for the reaction of glycerol and Ce^{4+}: ________

(b) give a balanced equation for the reaction of Ce^{4+} and Fe^{2+}: ________

(c) indicate the reducing agents for these two reactions: ________

(d) the percentage of glycerol in the sample is ________

(e) the procedure used in this question is called: ________

15. A three-electrode system commonly used in electrochemical measurements consists of working, auxiliary (also called counter) and reference electrodes.

(a) write the half-reaction for calomel electrode (a reference electrode): ________

(b) indicate the purpose of working electrode: ________

(c) indicate the purpose of auxiliary electrode: ________

16. A sample solution of compound X exhibits an absorbance of 0.60 at 500 nm using a 2.0-cm cuvet. The molar absorptivity of X is 10000 $M^{-1}\cdot cm^{-1}$ at 500 nm.

(a) [X] = ________ (b) the percentage of transmitted light is ________

(c) give a common light source for this measurement: ________

(d) give a common detector for this measurement: ________

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