

Vietnam National University, Hanoi
VNU University of Science

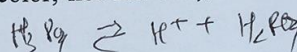
Analytical Chemistry (CHE1057) for International Biology
Final Examination Questions (No. 1)
Fall semester, Academic year of 2019-2020
Time: 90 min

Instructions:

Any documents are NOT allowed. Make sure there is an empty seat on each side of you. Working in groups was conducted during the course. It is not permitted during the exam. This is exam is a test of what YOU know. It is NOT a group exercise.

Good advice: read the entire exam all the way through, then answer the easiest questions first. You should use a pen or ball-pen (blue or black color, not red one), a calculator with a draft paper supported by VNU University of Science

THE EXAM CONTAINS 2 PAGES



1. Problem I (2.5 points)

Calculate pH of the following solutions:

- 1.1. pH of solution of a mixture of 0.050M H_3PO_4 ^{0.050M} and 0.020M NaH_2PO_4 (H_3PO_4 has $pK_1 = 2.12$; $pK_2 = 7.21$; and $pK_3 = 12.36$)
- 1.2. Solution of 10.0 mL 0.1M HA and 0.1M NaA ~~0.1M~~ if HA has $pK_a = 4.75$.
- 1.3. What is the pH value of above solution (1.2) when adding 10^{-3} mol HCl
- 1.4. What is the pH value of above solution (1.2) when adding 5×10^{-4} mol NaOH

2. Problem II (3.0 points)

To determine a mixture of Ca^{2+} and Mg^{2+} in mineral water by using Ethylenediaminetetraacetic acid (EDTA) with complexation titration, a procedure is applied as follows:

- Determination of 25.00 ml EDTA is required of 25.00 mL a standard solution of 0.020M $MgSO_4$. $Mg^{2+} (5.10^{-9})$

- To titrate Ca^{2+} and Mg^{2+} in 50.00 mL in a mineral water sample, we have to use ammonia buffer (pH 10) and 32.50 mL above EDTA using an indicator of Eriochrome Black T (ETOO)

When adding excess of NaOH to make a precipitation of Mg^{2+} (pH >12) to form $Mg(OH)_2$, Ca^{2+} can be determined using 28.00 ml EDTA with Murexide indicator.

2.1. Write all chemical reactions regarding to quatification in the procedure. How much concentration of EDTA.

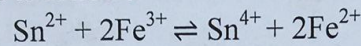
2.2. How much (mg) of $CaCO_3$ and $MgCO_3$ in 1 L of mineral water. (Ca =40; Mg =24; C=12; O=16)

3. Problem III (2.5 points)

Titration of 25.00 mL of 0.050 M Sn^{2+} with 0.100 M Fe^{3+} in 1 M HCl to give Fe^{2+} and Sn^{4+} using Pt and Ag/AgCl electrodes.

$[\text{H}^+] = 1\text{M}$

The balanced titration reaction is follows:



$$E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^0 = 0.732 \text{ V}; E_{\text{Sn}^{4+}/\text{Sn}^{2+}}^0 = 0.139 \text{ V}$$

- 3.1. Write two half-reactions for the indicator electrode.
- 3.2. Write two Nernst equations for the cell voltage
- 3.3. Calculate electrical potential (E) at the following volumes of Fe^{3+} : 1.0, 25.0, and 26.0 mL.

4. Problem IV (2.0 points)

Chromium (Cr (III)) at the trace level is vital for biology. Nevertheless, Cr(VI) is very toxic at any amount.

To determine concentration of Cr(VI) in urine samples of human who is exposed by heavy metal, the traditional spectrophotometric method of 540 nm, based on the violet complex formed with 1,5-diphenylcarbazine (DPC), is still widely used for determining Cr (VI). A couples of cuvettes with double-beam spectrophotometer were used.

Determination of Cr(VI) in ^{V = sample}one urine samples by additive method as the following:

- Pipet 10.0 mL to 50mL volumetric flask. Then, 1 mL of mixture acids of H_2SO_4 and H_3PO_4 was added before taking 2.0 mL solution of 0.1 % DPC. Fill up to the mark of 50 mL. A measuring absorbance (Abs) was 0.258.
- If adding 1.25 mL standard solution of 5.0 ppm Cr(VI) to above solution before filling up 50 mL, the Abs was found to be 0.409.

How much concentration of Cr(VI) (ppm) in the urine samples.

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