UNIVERSITY OF RUHUNA – FACULTY OF MEDICINE

ALLIED HEALTH SCIENCES DEGREE PROGRAMME

THIRD BPHARM PART I EXAMINATION – NOVEMBER 2014

PH 3113 ANALYTICAL CHEMISTRY (SEQ)

TIME: TWO (02) HOURS

INSTRUCTIONS

- Answer **all four (04)** questions in the given answer book.
- Use of calculators is allowed.
- No paper should be removed from the examination hall.
- Marks will be penalized for illegible hand writing.
- Do not use any correction fluid.

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01. Answer **all** parts

1.1 What is Total Quality Management? [*10 marks*]

1.2 Name 05 aspects of how quality vary in pharmaceuticals? [*10 marks*]

1.3 Explain 03 of the above aspects. [*30 marks*]

1.4 What is GMP? [*15 marks*]

1.5 Name five official standards accepted in Sri Lanka for quality assessment of pharmaceuticals? [*10 marks*]

1.6 What is meant by impurities in pharmaceuticals? [15 marks]

1.7 Name five sources of impurities in pharmaceuticals? [*10 marks*]

02 Answer **all** parts

2.1 What is a buffer solution? [*05 marks*]

2.2 State the two factors that determine the pH of a weak acid solution. [*05 marks*]

2.3 Explain how buffers maintain the pH on the addition of small amounts of OH^- ions. [*10 marks*]

2.4 Calculate the pH of the resulting solution, if 25.00 cm^3 of 0.500 mol dm^{-3} acetic acid is mixed with 25.00 cm^3 of 0.250 mol dm^{-3} NaOH solution. (Note: K_a of acetic acid is 1.75×10^{-5} at 25 °C) [*20 marks*]

2.5 If the resulting solution of the part 2.4 is quantitatively transferred to a 100.00 cm^3 volumetric flask and diluted with distilled water up to the mark, what changes would be expected in terms of:

2.5.1 pH [*05 marks*]

2.5.2 Buffer capacity [*05 marks*]

2.6 What is a primary standard? List the properties of an ideal primary standard for acid-base titrations. [*10 marks*]

2.7

2.7.1 On the same graph sketch the approximate curves for titrating 0.10 mol dm^{-3} hydrochloric acid with 0.10 mol dm^{-3} sodium hydroxide and for titrating 0.10 mol dm^{-3} acetic acid with 0.10 mol dm^{-3} sodium hydroxide. [*05 marks*]

2.7.2 What are **three** major differences between these two curves? [*15 marks*]

2.7.3 Calculate the pH at 50% and 100% neutralization points of both titrations. [*15 marks*]

2.7.4 Indicate whether the indicator methyl red (K_a =7.9 x10^{-6}) is suitable for both titrations. [*05 marks*]

03 Answer **all** parts

3.1 Calculate the concentration of free Fe^{3+} in a solution of 0.0100 *mol dm*$^{-3}$ FeY^- at pH 4.00 and pH 1.00.

$K_{f(FeY^-)}=1.3\times10^{25}$, $\alpha_{Y^{4-}}(pH\ 4.00)=3.8\times10^{-9}$ *and* $\alpha_{Y^{4-}}(pH\ 1.00)=1.9\times10^{-18}$

[*25 marks*]

3.2 Using the above results suggest the most suitable pH to determine the concentration of Fe^{3+} in a solution, by EDTA titration. [*10 marks*]

3.3 A student titrated 50.00 mL of Ca^{2+} ion solution buffered to pH 10 with 0.0600 mol *dm*$^{-3}$ EDTA solution in the presence of calmagite indicator. He observed a sharp colour change when 25.00 mL 0.0600 mol dm^{-3} EDTA solution was reacted with the Ca^{2+} solution.

3.3.1 What is the Ca^{2+} ion concentration of the solution? [*10 marks*]

3.3.2 Calculate the conditional formation constant K_f' for the CaY^{2-}complex at pH =10.

Note: For Ca^{2+} $\log K_f$ = 10.65, α_{Y4-} = 0.30 for EDTA at pH = 10

[*10 marks*]

3.3.3 Calculate the concentration of CaY^{2-} at the equivalence point. [*10 marks*]

3.3.4 Calculate the pCa at the equivalence point. [*10 marks*]

3.4 State desired properties of a precipitate that can be used in gravimetric analysis. [*15 marks*]

3.5 What steps would you take to maximize crystal growth in gravimetric analysis? [*10 marks*]

04. Answer **all** parts

4.1 Define the following types of solvents:

4.1.1 Amphoprotic.

4.1.2 Nonionizable.

4.1.3 Aprotic (inert)

[*30 marks*]

4.2 What is the preferred titrant for titrations carried out in acetic acid and other non-basic solvents? Describe briefly how it is prepared and standardized.

[*15 marks*]

4.3 Explain how an amine hydrochloride ($RNH_4^+ Cl^-$) can be titrated as a base in non-aqueous solvents.

[*15 marks*]

4.4.1 Explain the principle behind the diazotization titrations used in sulphadrug assays.

[*10 marks*]

4.4.2 Give the conditions for the diazotization titrations and explain how the end-point is determined.

[*10 marks*]

4.5 Explain the following statements:

4.5.1 Na_2CrO_4 can be used as an indicator in the determination of Cl^- ions by precipitation titration with $AgNO_3$.

[*10 marks*]

4.5.2 In the Volhard method the titration must be carried out in acidic medium.

[*10 marks*]

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