



**UNIVERSITY OF RUHUNA – FACULTY OF MEDICINE**  
**ALLIED HEALTH SCIENCES DEGREE PROGRAMME**  
**FOURTH BPHARM PART I EXAMINATION – DECEMBER 2015**  
**PH 4123: PHARMACEUTICAL ANALYSIS (SEQ)**

**TIME: TWO HOURS**

**INSTRUCTIONS**

- Answer **all** questions.
- Do not use any correction fluid.
- Answer questions in the space provided for each question.
- Marks will be deducted for illegible hand writing.

01. Answer **all** parts

1.1. Atomic absorption spectroscopy (AAS) is a quantitative technique which can be used to analyze the concentration of different metal ions in a solution. State the principle of this technique.

**(15 marks)**

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1.2. What are the four principle components in the atomic absorption spectrophotometer.

**(08 marks)**

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1.3. Define the term “atomization”.

**(07 marks)**

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1.4. Write down two types of atomization methods. **(10 marks)**

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1.5.  
1.5.1. Define the term "interference in the AAS". **(10 marks)**

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1.5.2. Write down the three types of interferences encounter in AAS. **(15 marks)**

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1.6. Write down the major difference between paper chromatography and thin layer chromatography (TLC). **(10 marks)**

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1.7. Explain briefly the principle of the separation process behind the thin layer chromatography. **(10 marks)**

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1.8.

1.8.1. Define the term “retention factor ( $R_f$ )” pertaining to TLC.

**(05 marks)**

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1.8.2. By drawing a schematic diagram of a TLC plate, briefly explain how you would use the retention factor to analyze a crude product of a drug synthesized in the laboratory compared to the standard drug.

**(10 marks)**

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2.1. An atom or a molecule can be excited by the application of energy, or by a chemical reaction. What are the photo-physical processes occur in giving up the excess energy of an excited state species?

**(20 marks)**

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2.2. Illustrate your answer given in the question 2.1. using a Jablonski diagram.

*(35 marks)*

2.3. Show the difference between fluorescence and phosphorescence by using **only** a schematic diagram of energy levels of a molecule.

*(20 marks)*

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2.3. Define the following terms.

(15 marks)

2.3.1. Singlet state of a molecule.

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2.3.2. Triplet state of a molecule

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2.3.3. Chemiluminescence

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2.4. Luminol is widely used to detect blood in forensic chemistry. Write down the chemical reaction involved in this detection process. (10 marks)

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3. Answer **all** parts.

3.1. Giving an example and corresponding half reaction for each group, classify electrodes into groups.

**(30 marks)**

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3.2. Design a suitable cell to determine the solubility product of  $PbCl_2$  and apply Nernst equation for the cell.

**(25 marks)**

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3.3. The solubility constant of  $\text{Cu}_3(\text{PO}_4)_2$  is  $1.3 \times 10^{-17}$ .

3.3.1. Calculate the solubility of  $\text{Cu}_3(\text{PO}_4)_2$

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3.3.2. Calculate the cell potential of the cell  $\text{Pt}|\text{H}_2(\text{g}, 1 \text{ atm})|\text{HCl } \text{pH}=0|| \text{Cu}_3(\text{PO}_4)_2$   
(aq, std)| $\text{Cu}(\text{s})$  at  $25^\circ\text{C}$ . Note:  $E_{\text{Cu}^{2+}/\text{Cu}}^0 = 0.334 \text{ V}$

(25 marks)

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3.4. Polarography is a versatile method used to analyze redox systems. Discuss.

(20 marks)

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04. Answer all parts

4.1. "Spectroscopy can be used to determine the water content in drugs." Explain.

(30 marks)

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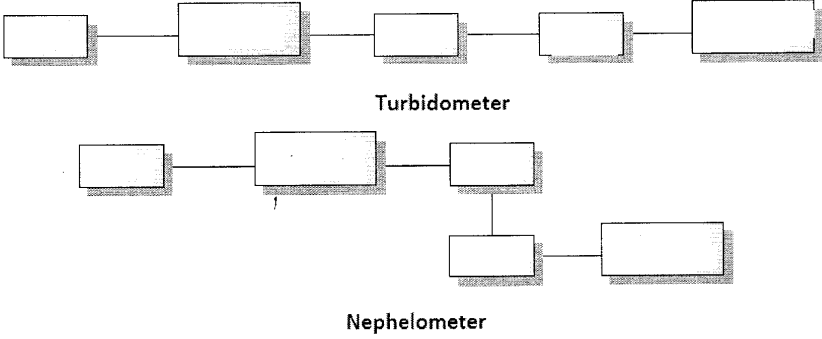
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4.2. Two related techniques in which an incident source of radiation is elastically scattered by a suspension of colloidal particles. Complete the following diagrams for turbidometer and nephelometer.



(20 marks)



4.3. Answer **all** parts.

4.3.1. Define the following terms used in NMR spectroscopy.

(i) chemical shift

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(05 marks)

(ii) spin spin coupling

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(05 marks)

4.3.2. The  $^1\text{H}$  NMR spectrum of a molecule with the molecular formula of  $\text{C}_4\text{H}_7\text{O}_2\text{Br}$  shows following signals:

1.05 (*t*, 3H), 2.05 (*q*, 2H), 4.25 (*t*, 1H), 10.95 (*s*, 1H) with the intensity ratio of 3:2:1:1 respectively. The signal at 10.95 ppm is absent in  $\text{D}_2\text{O}$ .

*s*-singlet,      *t*-triplet,      *q*-quintet

(i) Giving reasons determine the structure of the above molecule. (15 marks)

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(ii) Explain briefly why the signal at 10.95 ppm is absent in D<sub>2</sub>O.

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**(05 marks)**

(iii) Explain the intensity and number of lines in the multiplet obtained at 1.05 ppm using a suitable stick diagram.

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**(10 marks)**

4.3.3. Two unlabeled chemical bottles which are suspected to have *ethyl acetate* and *methyl propionate*, were found in the laboratory. If you can obtain the <sup>1</sup>H NMR spectra of above two chemicals how would you distinguish them only using the <sup>1</sup>H NMR spectra of them?

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**(10 marks)**

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