FACULTY OF ALLIED HEALTH SCIENCES UNIVERSITY OF RUHUNA
DEPARTMENT OF MEDICAL LABORATORY SCIENCE

Second End-Semester Examination – August, 2022

MLS1222 Basic Chemistry II - Theory

Date: 16thAugust 2022   Time: 11.00 a.m. – 12.00 noon   Duration: One (01) hour

- *Use of calculators is allowed.*
- *Answer **all** questions on this paper itself.*
- *Write your answer in the space provided for each question. Please note that the space*
- *provided is sufficient for the answer and that extensive answers are not expected.*

Index Number ....

For Examiner's Use Only

Question No	Marks
1	
2	
3	
4	
Total	
Percentage	

1

1. Answer **all** parts.

1.1 Consider the data given in the following table for quinone. **Calculate** the **absorption** at each wavelength considering the path-length as 1 cm and concentration as 0.5 mol dm^{-3}

λ (nm)	ε (cm^2 mol^{-1})	Absorption
240	24 00	
280	400	
430	20	

(30 marks)

1.2 Using the data generated in above table draw the absorption spectrum for quinone.

(40 marks)

1.3 Predict the colour of quinone?

....

(10 marks)

1.4 Benzoic acid has an absorption maximum at 230 nm. Considering the structures where do you expect to see the absorption maximum in cinnamic acid?
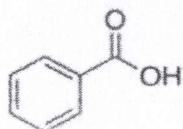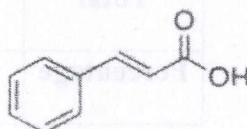
benzoic acid   cinnamic acid

....
....

(20 marks)

02. Answer all parts.

2.1 The following data were obtained for three compounds separated on a 20 m capillary column.

compound	t (min)	w (min)
A	8.04	0.15
B	8.26	0.15
C	8.43	0.16

2.2 Calculate the number of theoretical plates for compound B.

....

....

....

(15 marks)

2.2 Calculate the resolution between compounds B and C.

....

....

(15 marks)

2.3. Describe the difference between normal phase and reverse phase chromatography.

....

....

(20 marks)

2.4 Comment on the order of elution of the following compounds in a C_{18} column.
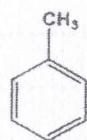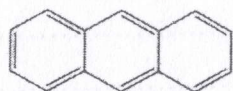
toluene   anthracene   8-methyl-2-napthol
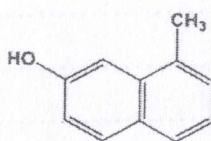
....

(30 marks)

2.5 Arrange following aqueous solutions, each 10% by mass in solute in order of increasing boiling point: Glucose ($C_6H_{12}O_6$), sucrose ($C_{12}H_{22}O_{11}$) and sodium nitrate ($NaNO_3$). Briefly explain reason for your answer.

....

....

....

(20 marks)

3

03. **Answer all parts.**

A galvanic cell utilizes the following reaction and operates under standard conditions at 298 K.

$$3 Ce^{4+}(aq) + Cr(s) \longrightarrow 3 Ce^{3+}(aq) + Cr^{3+}(aq)$$
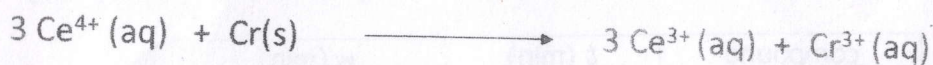
3.1 Identify the anode and the cathode of the above cell.

....

....

(10 marks)

3.2 Calculate the emf of this cell under the standard conditions using standard reduction potentials given bellow.

$$Cr^{3+}(aq) + 3e^- \longrightarrow Cr(s) \qquad E° = -0.74 \text{ V}$$

$$Ce^{4+}(aq) + e^- \longrightarrow Ce^{3+}(aq) \qquad E° = +1.61 \text{ V}$$

....

....

....

(20 marks)

3.3 Apply the Nerst equation ($E = E° - (0.0592/n)\log Q$) and **calculate** the emf of the cell when $[Ce^{4+}] = 2.0$ M, $[Ce^{3+}] = 0.010$ M and $[Cr^{3+}] = 0.010$ M.

....

....

....

....

....

....

....

....

(30 marks)

3.4 Calculate the ΔG for the above cell. (Faraday constant, 96,485 J/ V mol.)

....

....

....

(10 marks)

4

3.5 In the laboratory pH measurements are made using glass electrode. Identify parts **A** to **F**.

A

B

C

D

E

F

....

....

....
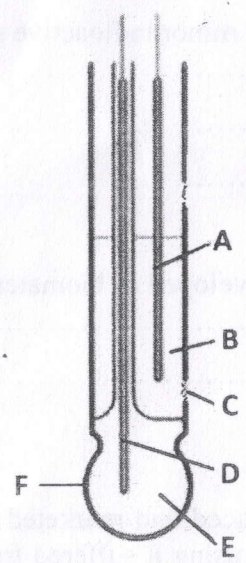
(30 marks)

04. Answer <u>all</u> parts.

4.1. To perform a PET scan, a positron-emitting radioisotope is produced in a cyclotron. Write the balanced nuclear equation for production of F-18 by **proton** bombardment of ^{18}O.

....

(10 marks)

4.2 A sample used for medical imaging labeled with ^{18}F, has a half-life of 110 min. What percentage of the original activity of the sample remains after 300 min?

....

....

....

....

....

....

....

(40 marks)

4.3 State **three** steps that should be taken during a minor radioactive spill in the laboratory.

....

....

....

(15 marks)

4.4 State **two** properties of a synthetic polymer developed as biomaterial should possess.

....

....

(20 marks)

4 5 Several years ago biomedical company produced and marketed a new efficient heart valve implant. Later it was withdrawn because patients using it suffered from severe loss of red blood cells. Describe what properties of the valve could have been responsible for this result.

....

....

....

(15 marks)

@@@@@@@@@@

6