# UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

## FIRST SEMESTER EXAMINATIONS, NOV. – DEC. 2018

**COURSE NO**: **MR 257**

**COURSE NAME**: **ANALYTICAL CHEMISTRY**

**CLASS**: **MR II** **TIME: 3HRS**

Name**:** _____Index Number: _____

**ANSWER ALL QUESTIONS**

**Q1a**

**(i)** Define analytes [**5 marks**]
**(ii)** Differentiate between qualitative and quantitative methods of chemical analysis [**5 marks**]
**(iii)** State the components of quantitative analysis [**5 marks**]
**(iv)** Explain the steps in chemical analysis [**10 marks**]
**(v)** Write short notes on quality control and quality assurance in analytical chemistry [**5 marks**]

**Q1b**

Explain the following terms

**(i)** Coulometry [**4 marks**]
**(ii)** Voltammetry [**4 marks**]
**(iii)** Polarography [**4 marks**]
**(iv)** Conductometry [**4 marks**]
**(v)** Titration curve [**4 marks**]

**Q2a**

Use the information provided in the potentiometric electrochemical cell (Figure 1) to answer the following questions:

**(i)** Write down the shorthand notation for Figure 1. [**2 marks**]
**(ii)** Explain why the two electrodes are placed in different compartments? [**2 marks**]
**(iii)** What is the function of the KCL solution? [**2 marks**]
**(iv)** What are the anodic, cathodic and overall reactions responsible for the potential of the electrochemical cell in Figure 1? [**5 marks**]
**(v)** What is the function of the porous frit? [**2 marks**]
**(vi)** State the potential of the anode and cathode in Figure using the Nernst Equation [**5 marks**]
**(vii)** Determine the potential of the electrochemical cell given in Figure. [Take $\mathbf{E^0_{Ag+/Ag} = 0.7996}$, $\mathbf{E^0_{Zn2+/Zn} = -0.7618}$] [**10 marks**]

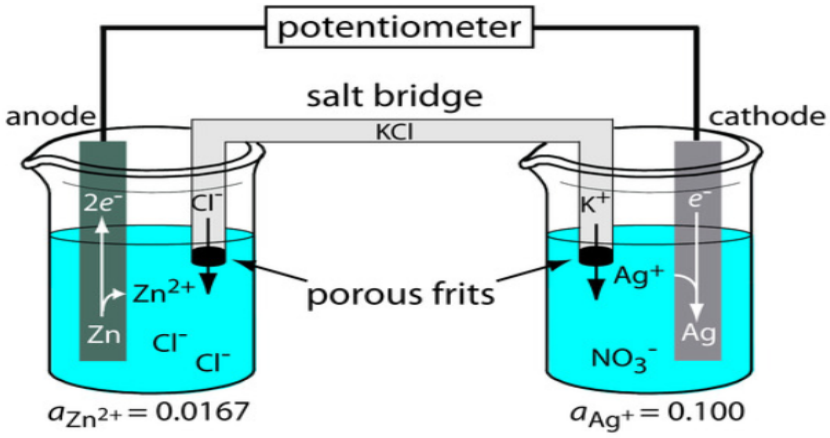


**Figure 1. Potentiometric electrochemical cell. The activities of $Zn^{2+}$ and $Ag^{+}$ are shown below the two half-cells.**

**Q3a**

An iron ore was analysed by dissolving a **1.1324 g** sample in concentrated **HCl.** The resulting solution was diluted with water, and the iron **(III)** was precipitated as the hydrous oxide **$Fe_2O_3.xH_2O$** by the addition of **$NH_3$**. After filtration and washing, the residue was ignited at a high temperature to give **0.5394 g** of pure **$Fe_2O_3$ (159.69 g/mol)**. Calculate

**(i)** The **%Fe (55.847 g/mol)** and [**5 marks**]

**(ii)** The **%$Fe_3O_4$ (231.54 g/mol)** in the sample. [**5 marks**]

**Q3b**

A **0.2356 g** sample containing only NaCl (**58.44 g/mol**) and $BaCl_2$ (**208.23 g/mol**) yielded **0.4637 g** of dried AgCl (**143.32 g/mol**). Calculate the percent of each halogen compound in the sample. [**12 marks**]

*Examiners*: ***Dr E. A. Agorhom****/ Dr S. N. Asare-Asher*