



DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY
UNIVERSITY EXAMINATIONS AY 2019/2020
FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF
MASTER OF SCIENCE IN GEOTHERMAL TECHNOLOGY

GET 3005: EXPROLATION GEOCHEMISTRY

DATE: 25/9/2020

TIME: 9AM-12PM

INSTRUCTIONS:

This examination set consists of **4** questions. You are required to attempt **ALL** questions.

QUESTION ONE (30 MARKS)

- a) Define the following terms. (2 marks)
- i. Isotope geochemistry
 - ii. Aqueous geochemistry
 - iii. Geothermometers
 - iv. Geochemical exploration
- b) State any two major classes of scales in geothermal systems. (1 mark)
- c) With aid of chemical equations, explain how water-rock interactions influence the chemistry of the geothermal fluids. (6 marks)
- d) With the aid of well labelled diagrams outline the sampling of gases in geothermal active sites. (6 marks)
- e) Analysis of gases from fumaroles can pose a great challenge to exploration geochemists. Describe how these challenges have been addressed so far. (5 marks)
- f) Name four features indicative of geothermal activity. (2 marks)
- g) With the aid of a diagram, describe the origin of geothermal fluids. (6 marks)
- h) Give two ways through which the flow of the hydrothermal fluids can be traced. (2 marks)

QUESTION TWO (10 MARKS)

- Provide a sketch diagram to illustrate the Giggenbach classification of chemical constituents of geothermal fluids. (3 marks)
- Explain the limitations of Na-K-Ca geothermometer in geochemical exploration. (3 marks)
- Describe any four pretreatment/preservation methods for geochemical samples. (4 marks)

QUESTION THREE (10 MARKS)

- Explain the choice of sample containers to be used in a geochemical exploration exercise. (2 marks)
- What is the significance of geochemistry in production drilling and operation phase of a power plant? (2 marks)
- Name any four analytical techniques that can be used during geochemical exploration and the species they can be used to analyse. (2 marks)
- Though trace elements, by definition, constitute only a small fraction of a system of interest, they provide geochemical and geological information out of proportion to their abundance. Give four reasons for this. (4 marks)

QUESTION FOUR (10 MARKS)

- Give two assumptions made for chemical geothermometers that depend on the existence (at depth) of a temperature mineral-fluid equilibrium. (2 marks)
- A researcher visited two geographical sites and recorded silica concentrations for water samples from the sites in mg/kg. The recordings for both sites were 100 ppm. Site A was a hot spring while site B was a geyser.
 - Estimate temperatures for the two sites using silica geothermometer concept. (3 marks)

Hint:

$$t^{\circ}\text{C} = \frac{1522}{5.75 - \log(\text{SiO}_2)} - 273.15 \quad \text{for adiabatic system;} \quad t^{\circ}\text{C} = \frac{1409}{5.19 - \log(\text{SiO}_2)} - 273.15 \quad \text{for conductive system.}$$

- As a geochemical explorer, how would you interpret the results? (5 marks)