



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE

SCH 815: MINERAL PROCESSING AND RECYCLING PROCESSES

DATE: Wednesday, 10th May 2017

TIME: 9.00 a.m. - 12.00 p.m.

INSTRUCTIONS:

Answer ALL Questions

Question One (40 Marks)

- a) State and briefly explain the major properties used in geological classification of mineral rocks. (8 Marks)
- b) State two simple tests that can be used to authenticate gold. (2 Marks)
- c) Briefly explain the following terms used in mineralogy. (10 Marks)
 - i) Unit cell
 - ii) Mineral
 - iii) Cation Exchange Capacity, CEC
 - iv) Non-renewable
 - v) Crystalline
- d) Outline the basic general principles of spectroscopic techniques with respect to elemental characterization. (4 Marks)
- e) Briefly explain the cause of the current global warming. (4 Marks)
- f) Explain the differences between X-Rays Fluorescence, XRF and X-Ray Diffraction, XRD techniques in relation to:
 - i) Basic working principles. (8 Marks)
 - ii) Applications (4 Marks)

Question Two (30 Marks)

- a) State the basic components of kaolinite clay and briefly explain its geometric arrangement. (4 Marks)
- b) Give the reason why clay is elastic when wet and hard when fired. (4 Marks)
- c) Give an outline of the processes and various methods used in ore beneficiation. (10 Marks)
- d) The European Commission has included rare earth elements, (REE) in a list of Critical Materials.
 - i) What are critical materials? (2 Marks)
 - ii) Briefly explain what REE's are and list four elements that belong to the group. (4 Marks)
 - iii) Give reasons why demand for REE's has grown over the last few decade and their high demand projected in future. (4 Marks)
 - iv) Explain why borates are included by EU in the list of critical materials. (2 Marks)

Question Three(30 Marks)

- a) Respond to the questions below that relate to the concept of sustainability.
 - i) What is sustainability? (2 Marks)
 - ii) Give the key reasons why the concept of sustainability is of critical importance to the present generation. (6 Marks)
- b) Respond to the questions below that relate to the concept of planetary boundaries.
 - i) What do these boundaries define? (1 mark)
 - ii) State any two of the planetary boundaries that have already been crossed. (2 Marks)
 - iii) For each of the boundaries you have listed in part ii above, briefly explain human activities that have contributed and the expected ramifications as a result of crossing them. (7 Marks)
- c) Outline the key steps necessary in order to achieve an integrated sustainable solid waste management, ISSWM, system. (8 Marks)
- d) Give key reasons why 3D-printing is listed among disruptive technology. (4 Marks)