



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4406 : FUEL CHEMISTRY & TECHNOLOGY (PAPER 1)

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: Pick Date Dec 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

(a) Discuss the fundamental principles and give an appropriate example for each of the following forms of energy: (12 Marks)

- i. Mechanical
- ii. Chemical
- iii. Electrical
- iv. Heat/ Thermal
- v. Nuclear
- vi. Light/ Radiant

(b) Justify why fossil fuels are classified as 'primary energy sources' while electricity is classified as 'secondary energy source'. (2 Marks)

(c) Coal, Oil and Natural gas (NG) are the main constituents of fossil fuels. Outline the 3 main variables that determine the eventual type of fossil fuel formed. (6 Marks)

Question TWO

- (a) Differentiate coal from carbon. (3 Marks)
- (b) Outline the following phases of coal formation; (6 Marks)
- i. Biochemical phase,
 - ii. Geochemical phase.
- (c) List the 3 main compositional ingredients of coal. (3 Marks)
- (d) Petrography is a science about rocks. (2 Marks)
- i. Give 2 goals of coal petrography. (2 Marks)
 - ii. Name and briefly discuss the features of the 3 main petrographic structures of coal. (6 Marks)

Question THREE

- (a) With regard to petroleum geology, discuss the following terminology; (6 Marks)
- i. Diagenesis
 - ii. Catagenesis
 - iii. Metagenesis.
- (b) Outline the 5 factors that dictate the formation of an oil accumulation. (5 Marks)
- (c) With the aid of a well-labeled diagram, explain the concept of enhanced oil recovery. (3 Marks)
- (d) Discuss the significance of the following chemical conversion processes in petroleum refining. (6 Marks)
- i. Cracking
 - ii. Polymerization
 - iii. Alkylation

Question FOUR

- (a) With the aid of a well labeled diagram, explain the electricity generation process from fuels. (5 Marks)
- (b) Outline the energy conversions that occur in transforming the following sources into electricity. (5 Marks)
- i. Nuclear,
 - ii. Solar,
 - iii. Wind,
 - iv. Hydro,
 - v. Geothermal.
- (c) For each of the energy sources mentioned in (b) above, give 1 advantage and 1 disadvantage to its utilization for electricity production. (10 Marks)

Question FIVE

- (a) What are fuel cells? (2 Marks)
- (b) With the aid of sketches to illustrate process, explain the difference between combustion and fuel cell technology. (4 Marks)
- (c) Using equations, illustrate the chemical reactions of a fuel cell at: (4 Marks)
- i. Anode
 - ii. Cathode
- (d) List 2 advantages and 2 disadvantages of fuel cells as sources of energy. (4 Marks)
- (e) Hydrogen is currently considered as the fuel (energy carrier) for the future. However, H_2 does not exist independently in nature. Suggest and briefly discuss 3 ways of renewably producing H_2 . (6 Marks)