TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY (BTAC 2021S and BTAC 2022S)

ACH 4406: FUEL CHEMISTRY AND TECHNOLOGY

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2024

TIME: 2 HOURS

DATE: Pick DateSelect MonthPick Year

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) Explain each of the following terms:
   i) Fuel
   ii) Calorific value of a fuel
   iii) Octane number
   iv) Producer gas
   v) Power alcohol

(1 mark each, total 5 marks)

b) State five major characteristics of a good fuel (5 marks)

c) Using a suitable schematic diagram, describe the application of bomb calorimeter in measuring calorific value of a fuel (4 marks)

d) Explain two sustainable methods for improving the octane rating of petrol or diesel (4 marks)

e) Using a suitable schematic diagram, describe the working of each of the following fuel cells

   i) Direct methanol fuel cell (6 marks)

ii) Alkaline fuel cell (6 marks)

Question TWO

a) Define or explain each of the following terms:
   i) Primary fuel
   ii) Secondary fuel
   iii) High calorific value of a fuel
   iv) Low calorific value of a fuel
   v) Calorie

(1 mark each, total 5 marks)

b)
   i) Define or explain liquid fuels (2 marks)
   ii) State four advantages and four disadvantages of liquid fuels (8 marks)

c) Describe the production of synthetic petrol by Fischer-Tropsch method (5 marks)

Question THREE

a) Define or explain crude oil (2 marks)

b) Discuss the refining of crude oil under each of the following headings:
   i) Removal of solid impurities (4 marks)
   ii) Removal of water (4 marks)
   iii) Removal of harmful impurities (4 marks)
   iv) Fractional distillation (6 marks)

Question FOUR

a) Define or explain biogas (2 marks)

b) Using a suitable schematic diagram, describe the production of biogas (11 marks)

c) State five advantages and two disadvantages of biogas as a source of fuel (7 marks)

Question FIVE

a) Explain three reasons why hydrogen is preferred in fuel cells (6 marks)

b) Explain five advantages of fuel cells (10 marks)

c) Explain two major application areas for fuel cells (4 marks)