TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Pure & Applied Sciences
UNIVERSITY EXAMINATION FOR:
BSc.
ACH 4406 : Fuel Chemistry
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS
DATE: Pick Date **Sep 2018**

Instruction to Candidates:
You should have the following for this examination
- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions.
Maximum marks for each part of a question are as shown.
Do not write on the question paper.

Question ONE

a) What do we mean when we talk of renewable and non renewable energy sources give atlist two examples for each?   (4 marks)

b) Give three examples of biofuels and their uses   (6 marks)

c) What are fossil fuel give examples and name atlist two uses for each   (6 marks)

d) Describe two methods of production of alcohol for us as fuel.   (4 marks)

Question TWO

a) Explain the theories of petroleum formation   (6 marks)

b) What is the elementary composition of petroleum   (4 marks)

c) Explain the primary production of crude oil and describe each of the methods used   (5 marks)

d) What is catalytic cracking? Why is it carried out in oil refinery?   (5 marks)

Question THREE

a) Explain what we mean by carbonization of coal and describe the whole process.
                                                                   (5 marks)

b) Write an assay explaining clean carbon/coal energy   (15 marks)

Question FOUR

a) Define octane number of a Fuel   (3 marks)

b) Compound A is obtain from fractional distillation of crude oil and is converted to compound B by isomerisation.

   i) Give the systematic (IUPAC) names for A and B
   ii) Explain the term isomerisation
   iii) Draw a structure of another isomer of A and B
   iv) Predict whether A or B has a higher octane number and justify   (7 marks)

A

B
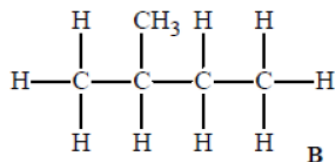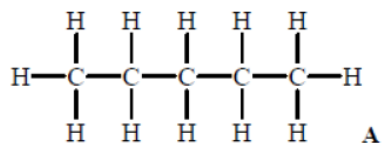
c) Ethylene is produce from calcium carbide and water according to the following balance equation :

$$CaC_{2\ (s)} + 2H_2O_{(l)} \rightarrow C_2H_{2\ (g)} + Ca(OH)_{2\ (s)}$$
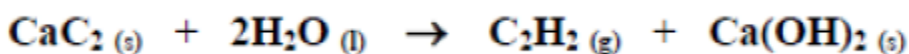
Calculate heat change for this reaction give that the heats of formation of calcium carbide, water, ethyne and calcium hydroxide are -59.8, -285.8, 227.4 and -985.2 kJ mol^{-1} Respectively   (4 marks)

d) Describe the structure of benzene in terms of:
   i)   the bonds between carbon atoms and hydrogen atoms,
   ii) the bonds between carbon atoms.   (6 marks)

Question FIVE

a) Define heat of combustion? Describe the laboratory equipment used to measure the heat combustion of fuels and foodstuff.   (5 marks)

b) Explain why substance MTBE (methyl-*tert*-butyl ether) is sometimes added to petrol fuel. Name the substance previously added to petrol fuel for the same purpose and state why its use was discontinued.   (5 marks)

c) Give example of three solid fuels and their used.   (6 marks)

d) Name two Nitrogen compounds found in crude oil and draw its structure.

(4 marks)