



# UNIVERSITY OF NAIROBI

SECOND SEMESTER EXAMINATIONS 2014/2015

FIRST YEAR EXAMINATIONS FOR THE DEGREES OF BACHELOR OF SCIENCE  
IN ENGINEERING

FME 152 : MECHANICAL ENGINEERING

FCE 182 : CIVIL ENGINEERING

FEB 106 : ENVIRONMENTAL AND BIOSYSTEMS ENGINEERING

CHEMISTRY II

DATE: APRIL 27, 2015

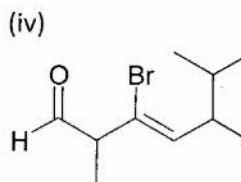
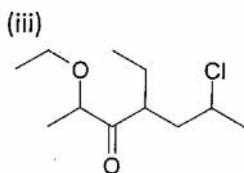
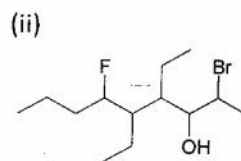
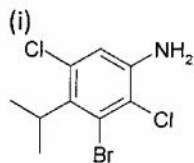
TIME: 8.30 A.M. – 10.30 A.M.

INSTRUCTIONS:

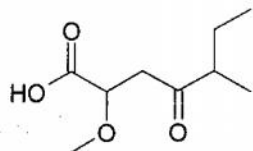
*Attempt all Questions*

Q1.(a) Name the following compounds using IUPAC nomenclature

(2 Marks each: Total: 10 Marks)



(v)



Q2 (a) Define the following terms **(2 Marks each: Total: 10 Marks)**

- (i) Crown ether
- (ii) Phosphate builder
- (iii) Coking (as applied to the petroleum industry)
- (iv) Thermoset plastics
- (v) Octane rating

(b). Differentiate between the following terms: **(2 Marks each: Total: 10 Marks)**

- (i) Cracking and reforming (as applied to petroleum industry)
- (ii) Hydrogen bond and Polar covalent bond
- (iii) Mesophilic and Thermophilic (as applied to anaerobic digestion)
- (iv) Addition and Condensation polymers
- (v) Galvanic and Electrolytic cell

Q3 (a) An organic compound has the following percentage composition: C= 40%, H = 6.66%, O = 53.33%. Find its molecular formula (Relative atomic mass of C=12, H=1, O=16 and Relative molecular mass of the compound = 180).

**(5 Marks)**

(b) 11.6 g of butane is subjected complete combustion in oxygen. Determine the mass of:

a) Oxygen required (2 Marks)

b) Carbon dioxide and water produced (2 Marks each)

Q4. (a) A sample of glucose,  $C_6H_{12}O_6$  weighing 5.00g was burned with excess oxygen in a bomb calorimeter. The temperature of the bomb calorimeter with a heat capacity of  $32.4 \text{ KJ/}^\circ\text{C}$  rose by  $2.40^\circ\text{C}$ .

Determine the heat of combustion of glucose in  $\text{KJ/mol}$ . (5 Marks)

(b) The table shows four fuels and their various properties.

Property	A	B	C	D
Heat of combustion ( $\text{kJ mol}^{-1}$ )	10 000	5460	1370	285
Boiling point ( $^\circ\text{C}$ )	300	126	78	-253
Density ( $\text{g mL}^{-1}$ )	0.78	0.69	0.78	n/a
Average molar mass ( $\text{g mol}^{-1}$ )	210	114	46	2

Which fuel provides the greatest amount of energy in  $\text{KJ/g}$ ? *Clearly show how you derived your answer.* (5 Marks)

(c) Write down 4 sources of energy which are *non-fossil*: (4 Marks)

(d) List down 4 attributes of an ideal fuel. (4 Marks)

Q5. (a) Explain how you can be able to distinguish between the following functional groups using chemicals found in the chemistry laboratory. Clearly indicate expected colour change where qualitative test will be used.

(i) Carboxylic acid and a phenol **(2 Marks)**

(ii) Aldehyde and a ketone **(2 Marks)**

(iii) Alcohol and an ester **(2 Marks)**

(b) An engineering student on an expedition near Ngamia 1 site in Turkana found a liquid, which she suspected to be hydrocarbons. With the help of a fully labeled diagram of the setup explain how she would determine the boiling point given that the only quantity of liquid in her possession is 0.5ml. **(6 Marks)**

**[TOTAL MARKS: 70]**