The Open University of Sri Lanka

B.Sc. Degree Programme – 2013/14

Industrial Chemistry – CMU3232

Continuous Assessment Test III (CAT) - No Book Test

Duration: 1 hour

Date: 21.09.2014 **Time 1.00 p.m. - 2 00 p.m.**

Answer all the questions.

Registration Number: ..... Invigilator's signature: .....

No.	Marks
1	
2	
Total	
Average	
%	

1.a. i. What is the major component of edible fats and oils?

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ii. Name two other glycerides found in edible fats and oils

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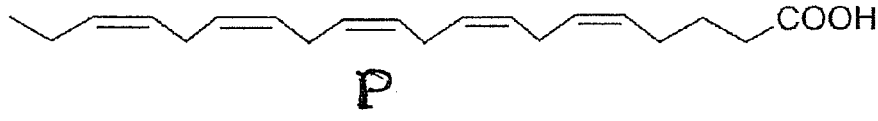
iii. Identify to which ω_x series the following fatty acid belongs to.



.....

iv. Write the short hand notations for compound **P** that use numbering

1. from methyl end

.....

2. from carboxylic acid end

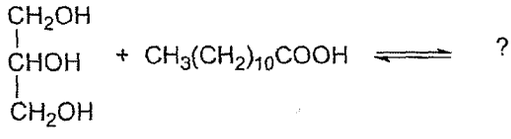
.....

v. Write the IUPAC name of compound **P**.

.....

(25 marks)

b. i. Give the structure(s) of monoglyceride that could be formed in the following reaction.



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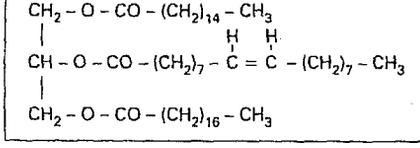
ii. Give the short hand representation for the following triglyceride.

	Palmitic acid residue Oleic acid residue Stearic acid residue

.....

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iii. Give the product(s) that you expect when the above triglyceride is heated with NaOH.

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(30 marks)

c. i. What is meant by the term "Autoxidation" of fatty acids? Give **two** factors that affect the rate of autoxidation.

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ii. Give **two** possible primary oxidation products from oleic acid.

$CH_3(CH_2)_7CH=CH(CH_2)_7COOH$

Oleic acid

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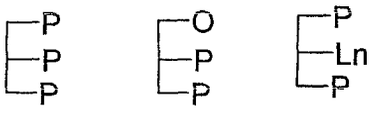
iii. Give **two** factors which affect the melting point of fats.

.....

.....

iv. Arrange the following triglycerides in the order of increasing melting point.



(a) (b) (c)

Where **P**- Pamitic acid- 16:0, **O** - Oleic acid- 18:1 (n-9), **Ln** – Linolic acid- 18:2 (n-6)

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v. Give reasons for your answer.

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(45 marks)

2.a. i. What does each of the following parameters tell about the quality of the oil?

Parameter	Quality of the oil
1. High iodine value	
2. High free fatty acid content	
3. High refractive index	

ii. What is meant by saponification value of an oil.

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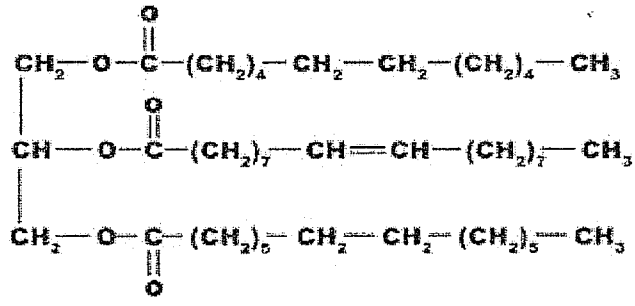
(20 marks)

b. A fat contains the following triglyceride as the main ingredient.



(A)

i. Estimate the saponification value of this fat. Molecular weight of the glyceride – 748 g/mol. [H =1; O=16; K=39]

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(20 marks)

c.i. What do you understand by the term "splitting "of fats?

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ii. Write a balanced chemical equation for splitting of fat (A) given in part **2 b.**

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(30 marks)

d.i. Give **two** value added products that could be obtained from Fatty acids.

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ii. What do you understand by the term "interesterification"?

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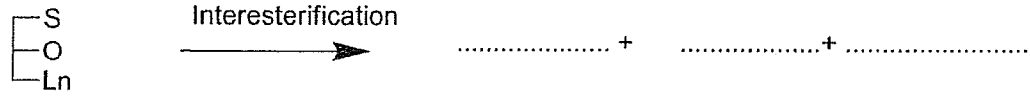
i. What physical property of natural oil would change due to interestification?

.....

ii. Give three products that could form from the following reaction.



(30 marks)

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B.Sc. Degree Programme - 2013/14

Industrial Chemistry – CMU3232 – Level 5

Answer guide for CAT III

1.a. i Triglyceride

ii. Phospholipids and Glycolipids

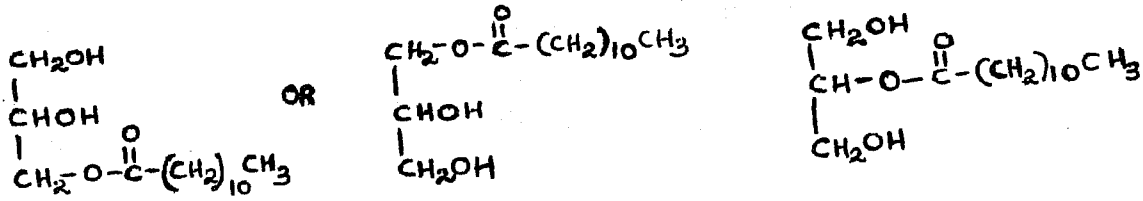
iii. (n-3) or ω_3

iv. 1. 20:5(n-3)

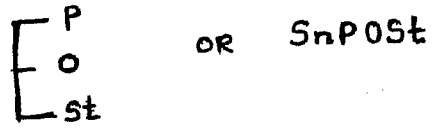
2. 20:5(5c, 8c, 11c, 14c, 17c)

v. (5z, 8z, 11z, 14z, 17z)-5, 8, 11, 14, 17-eicosapentaenoic acid

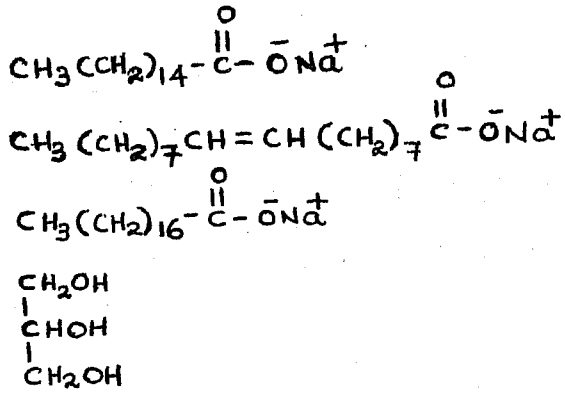
b. i.



ii.



iii.

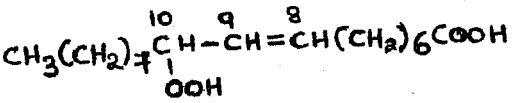


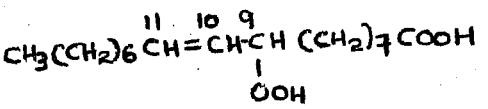
c. i. Oxidation of double bond present in fatty acids of glycerides by atmospheric oxygen.

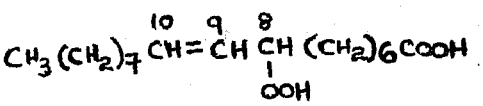
- Concentration of oxygen present
- Degree of unsaturation of lipids
- Exposure to light Temperature of storage
- Presence of antioxidants and peroxides
- Nature of packing materials

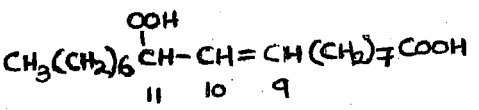
} Any two

ii.









} Any two

iii. Degree of unsaturation

hydrocarbon chain length of fatty acids

iv. Refer page no: 35

2.a. i. High iodine value – High Unsaturation

High Free acid - Poor quality oil/ incomplete refined/undergone hydrolysis/ adulteration

High Refractive index – Adulterated; high unsaturated fatty acids.

ii. It is the number of milligrams of potassium hydroxide required to saponify 1 g of the sample.

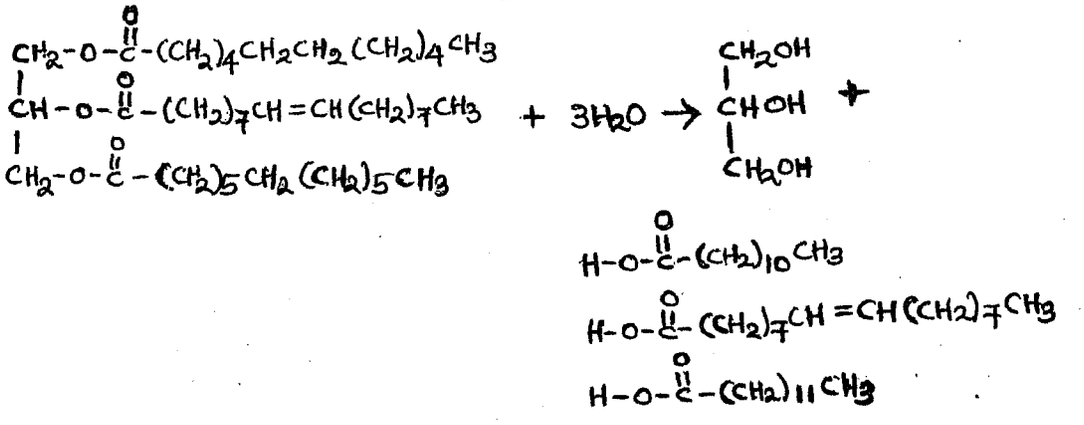
b. i. To saponify a triglyceride, 3 moles of KOH needed. I.e. One mole of Fatty acid reacts with 3 moles of KOH.

i.e. 748 g mol-1 needs 3x56g mol-1 of KOH.

1 g will require $\frac{3 \times 56\ g\ mol^{-1}}{748\ g\ mol^{-1}} \times 1\ g = 0.224\ g\ KOH$

Saponification value – $0.224\ g \times \frac{1000\ mg}{g} = 224\ \boldsymbol{mg\ KOH}$

ii)



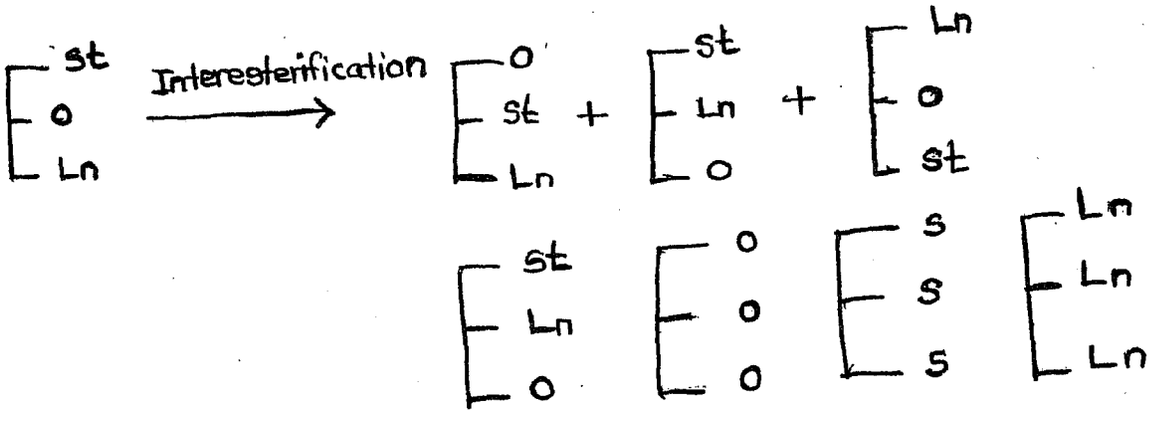
c. i. Value added products from fatty acids are soap and Biofuels.

ii. Interesterification – refer page no. 111

- Interesterification is a chemical reaction that induces the rearrangement of fatty acids within and between triacylglycerides.
- Interesterification is an acyl – rearrangement reaction on the glycerol molecule.

ii. Melting point

iii.



b. (ii) Splitting is the hydrolysis of fat/oil into fatty acids and glycerol.