

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME – 2014/15

INDUSTRIAL CHEMISTRY – LEVEL 5

CONTINUOUS ASSESSMENT TEST II (CAT) - No Book Test

DURATION – ONE HOUR



DATE: 19TH JULY 2015

TIME: 1.00 pm – 2.00 pm

Answer all the questions

Registration Number

Invigilator's signature:

| No. of questions | Marks |
|------------------|-------|
| 1. | |
| 2. | |
| Total | |
| Average | |
| % | |

1.a. i. What are fatty acids?

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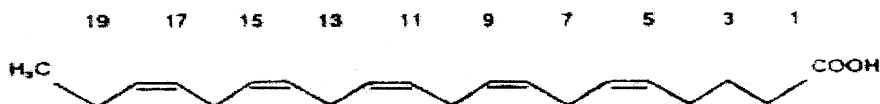
ii. Draw the fatty acid structure indicated by the shorthand notation given below.

22:1 (n-10)

.....
.....

20:4 ω_3

.....
.....
Consider the following fatty acid



iii. Write the short hand notation that use numbering from carboxylic acid.

.....

iv. Give its IUPAC name:

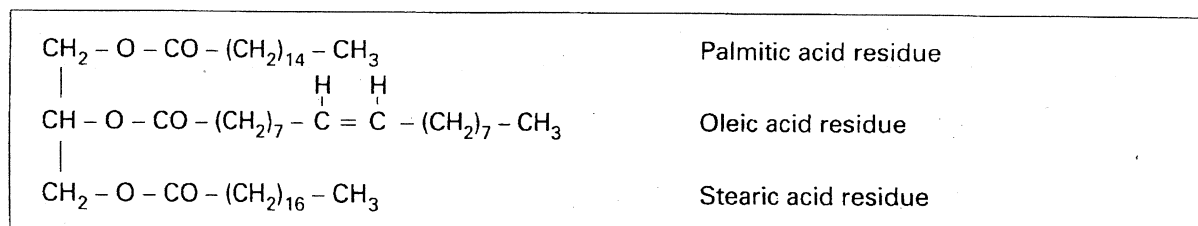
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(25 marks)

b. i. Draw the structure of triglyceride containing dodecanoic acid as the fatty acid.

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.....

Consider the following glyceride given below.



ii. Name this glyceride according to

- IUPAC – IUB

.....
.....

- α , β notation

.....
.....

(20 marks)

c. i. State **three** factors that affect melting point of fats

.....
.....
.....
.....

ii. Explain why the melting point of 18:1 (cis) fatty acid is 16.3 °C whereas the Melting Point of 18:1 (trans) is 43.7 °C.

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.....

(25 marks)

d. i. What is the purpose of partial hydrogenation of oils?

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.....
.....

iii. Essential oils are extracted from plant materials by various extraction methods. Give suitable extraction method for extracting essential oils from the following plant parts.

- (a) Cinnamon bark
- (b) Cumin seed
- (c) Orange rind

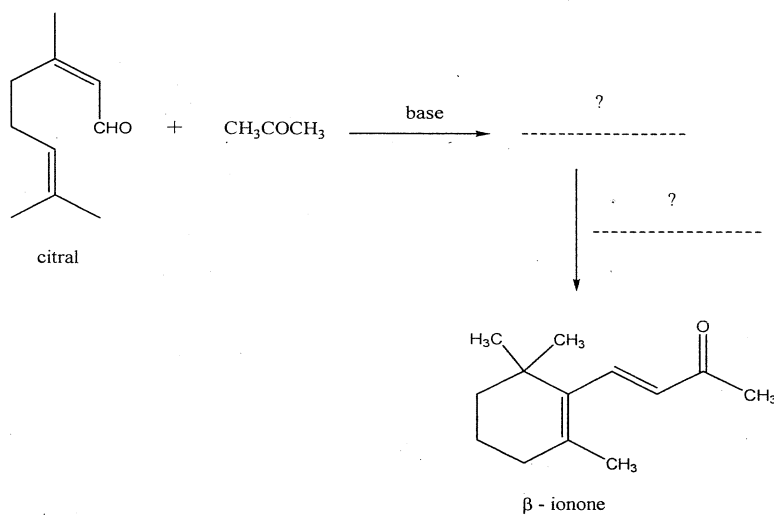
(16 marks)

c. i. Write down the natural isolates that could be isolated from the following essential oils.

- (a) Clove oil
- (b) Citronella oil
- (c) Pine turpentine oil

(12 marks)

ii. Citral is natural isolate that is extracted from lemon grass oil. Give the value added products of citral formed by the following chemical conversion.



(12 marks)

d. i. What is meant by the term "Refining process" of crude oils?

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.....



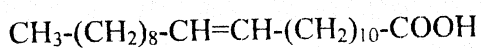
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B.Sc Degree Programme – 2014/15

Industrial Chemistry – Level 5

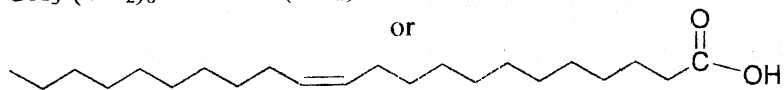
Answer guide to CAT (II)

Q-1 a. i) Fatty acids are long chain carboxylic acids with more than three carbon atoms in the chain and that carbon chain could be saturated or un saturated.

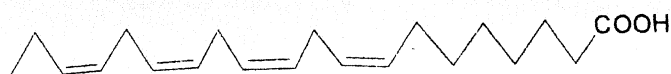
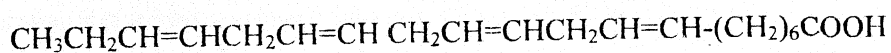
ii) **22:1(n-10)**



or



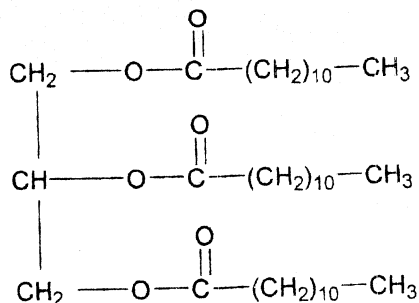
20:4 ω₃



iii) 20:5 (5C, 8C, 11C, 14C, 17C)

iv) 5Z,8Z,11Z,14Z,17Z-(5,8,11,14,17)-eicosapentaenoic acid

b.i)



ii) **IUPAC-IUB**

1-hexadecanoyl-2-octadeca-9-enoyl-3-octadecanoyl-sn-glycerol or

1-palmitoyl-2-oleoyl-3-stearoyl-sn-glycerol

α,β notation

β-oleoyl-α-palmitoyl stearin

- c. i) -structure of fatty acids-(*cis-trans* isomerism & chain length)
 -positions occupied by fatty acids in the glycerides.
 - Polymorphism
- ii). *Cis* acid will have bent structure whereas *trans* acid is linear. Hence *trans* acid will be easily packed in the solid. When structure is bent it is not tightly packed. therefore *trans* acid need more energy to break up molecules. so melting point is higher than *cis* acids.
- d. i) To obtain fat of required properties such as softness and plasticity.
- ii). $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{CO}_2\text{H}$ *trans*
 $\text{CH}_3-(\text{CH}_2)_6-\text{CH}=\text{CH}-(\text{CH}_2)_8\text{CO}_2\text{H}$
 $\text{CH}_3-(\text{CH}_2)_8-\text{CH}=\text{CH}-(\text{CH}_2)_6-\text{CO}_2\text{H}$

Q2. a.i). Acid value is the milligrams of KOH required to neutralize the Free Fatty acid Present in one gram of fats or oils.

- ii). Oil has degraded and high water content,
 Citric acid would have been added as chelator.

iii).a.

| | | |
|-------------|---|---|
| | Number of KOH used for neutralization = | $\frac{0.1 \text{ mole} \times 50.0 \text{ ml}}{1000 \text{ ml}}$ |
| | = | $5 \times 10^{-3} \text{ mole}$ |
| Mass of KOH | = | $5 \times 10^{-3} \text{ mole} \times 56.1 \text{ g mol}^{-1}$ |
| | = | $0.28 \text{ g or } 280 \text{ mg}$ |
| Acid value | = | $\frac{280 \text{ mg}}{25 \text{ g}}$ |
| | = | 11.2 mg/g oil |

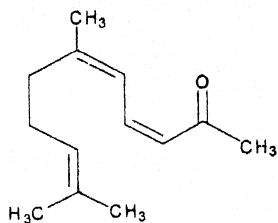
b.

| | | |
|---------------------------------|---|--|
| Free fatty acid as lauric acid | = | $\frac{0.1 \text{ mole} \times 50.0 \text{ ml} \times 200.3 \text{ gmol}^{-1}}{1000 \text{ ml} \times 25 \text{ g}}$ |
| | = | 0.04 |
| % Free fatty acid in the sample | = | $0.04 \times 100\%$ |
| | = | 4.00 |

- b.i). Essential oils are derived from aromatic plants and are comprised of Hydrocarbon and their oxygenated derivatives of volatile mono-sesquiterpenes.
- ii). As flavor, preservatives, fragrance, perfumery, cosmetics, toiletry & pharmaceutical
- iii). (a) Distillation (b) Hydrodiffusion (c) expression

- c.i. (a) Eugenol (b) Geraniol (c) α -pinene

ii).



And H^+

- d.i). It is a process which removes effectively undesirable impurities with minimum loss of quality as well as the quantity of oil and the natural antioxidants.
- ii). Major steps involved in the refining process of crude essential oil.
- Degumming-hot water /steam passed through warm oil. It removes gum + phospholipids.
- Neutralization-NaOH is used to neutralize. Free fatty acids are removed, pigments, Sulphur compounds also removed.
- Winterization-warm with kieselgur filter aid wax will be removed.
- Bleaching-fuller's earth or activated charcoal or a bleaching agent is used. Coloring matters will be removed.
- Deodorization-Steam distillation under vacuum or reduced pressure. It removes volatile odor imparting compounds.
- Distillation-Vacuum distillation, Removes impurities.