**CHUKA UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY**

**CHEM 446: CHEMISTRY OF NATURAL PRODUCTS**

**STREAMS: BSc. CHEM** **TIME: 2 HOURS**

**DAY/DATE: WEDNESDAY 20/12/2023** **8.30 A.M. – 10.30 A.M.**

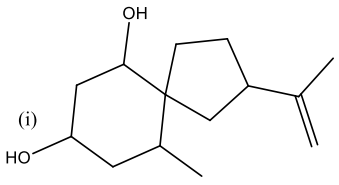
**INSTRUCTIONS**

- Answer question **One** (Compulsory) and any other **Two** questions

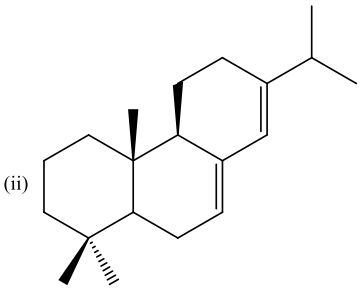
**QUESTION ONE [30 MARKS]**

(a) Differentiate between primary metabolites and secondary metabolites (**2 marks**)

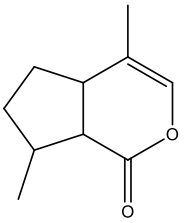
(b) Identify the isoprene unit(s) in the following compounds (**6 marks**)




(i)



(ii)

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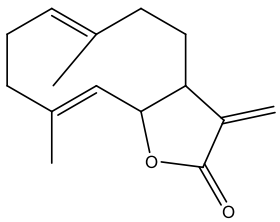
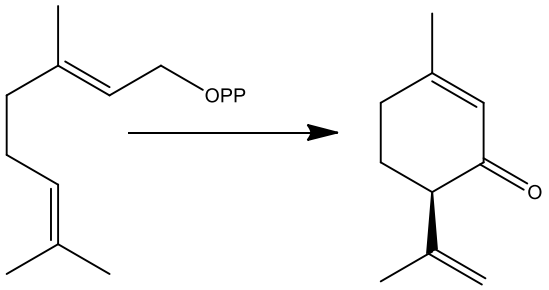



(iv)

(c) Explain, with the use of relevant examples, four ecological functions of terpenoids (**4 marks**)

(d) Suggest a reasonable biosynthetic pathway for isopiperitenone from geranyl diphosphate (GPP) (**6 marks**)



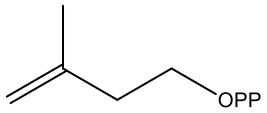

GPP Isopiperitenone

(e) Explain two biological functions of lipids in plants and animals (**2 marks**)

(f) A volatile plant product, **M**, $C_8H_{14}O$, has strong IR absorption at 1717 $cm^{-1}$. It possess $^1H$ NMR signals at $\delta_H$ 1.65 (3H, s), 2.15 (3H, s), 2.4 (4H, m) and 5.20 (1H, t). On ozonolysis, compound M gives, among other products, propanone, and on treatment with iodine and alkali it gives triiodomethane (iodoform). Deduce the structure of compound **M** (**10 marks**)

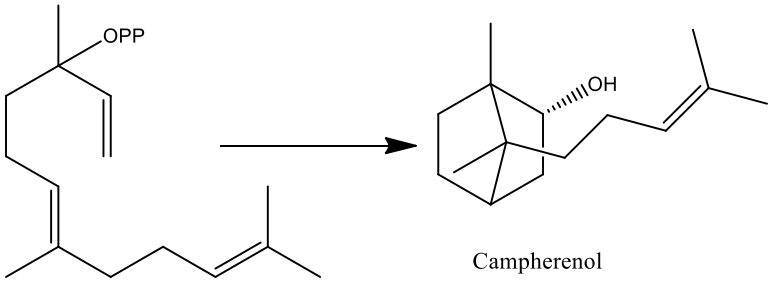
## QUESTION TWO [20 MARKS]

(a) Describe the formation of isopentenyl diphosphate (IPP) through the acetate/mevalonate pathway (**10 marks**)




IPP

(b) Design a stepwise biosynthesis of campherenol from nerolidyl pyrophosphate (NPP) (**6 marks**)




NPP Campherenol

(c) Explain, with suitable examples, four commercial uses of terpenes (**4 marks**)

**QUESTION THREE [20 MARKS]**

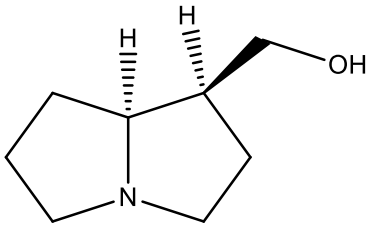
(a) Describe the extraction and separation of mono-and sesqui-terpenoids from plant materials (**6 marks**)

(b) Describe a stepwise biosynthesis of octanoic acid (8:0) from acetylCoA (**8 marks**)

(c) Explain, with suitable examples, the commercial uses of alkaloids (**6 marks**)

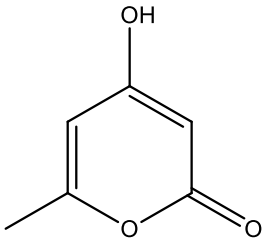
**QUESTION FOUR [20 MARKS]**

(a) Describe the stepwise biosynthesis of the alkaloid, laburnine, from ornithine (**8 marks**)




Laburnine

(b) Describe the stepwise biosynthesis of the polyketide, 2-pyrone, from acetyl-SCoA (**6 marks**)




2-pyrone

(c) Describe how alkaloids are isolated from plant materials (**6 marks)**

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