BINDURA UNIVERSITY OF SCIENCE EDUCATION
CHEMISTRY DEPARTMENT

MASTER OF SCIENCE DEGREE IN CHEMISTRY

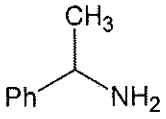
COURSE: MCH503: ORGANIC CHEMISTRY

3 HOURS AUG 2024

ANSWER ANY FOUR QUESTIONS. EACH QUESTION CARRIES 25 MARKS

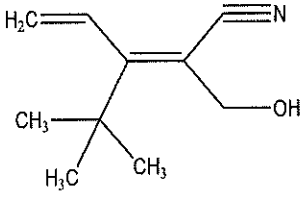
1. a) What do you understand by the phrase *enantiomeric resolution*? **[2 marks]**

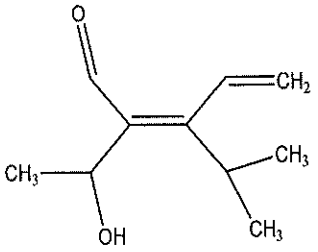
b) 1-phenylethylamine has the structure shown below.



Describe how you would resolve a racemic mixture of 1-phenylethylamine. **[10 marks]**

c) Workout names of the compounds below.

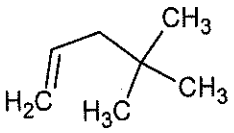




[4 marks]

d) Discuss tannins under the following headings;
(i) Structure **[2 marks]**
(ii) Detection methods **[5 marks]**
(iii) Application in education **[2 marks]**

2. a) Predict the normal C-13, DEPT-90, and DEPT-135 spectra of a molecule, whose structure appears below. **[10 marks]**



b) Propose mechanisms to account for the formation of fragments corresponding to m/z 74, 71, 59 and 43 in the mass spectrum of methyl butyrate ($C_5H_{10}O_2$). **[5 marks]**

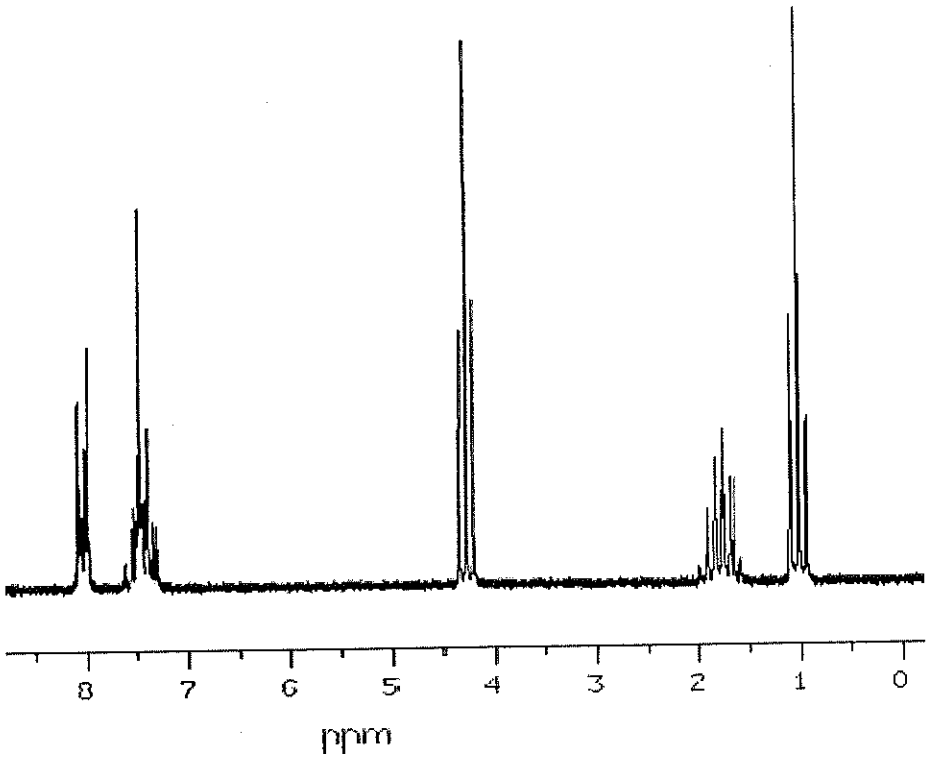
c) Explain why tetramethylsilane (TMS) is used as reference compound in both ^{1}H- and ^{13}C-NMR spectroscopy. **[5 Marks]**

d) Predict the chemical shifts in ^{13}C NMR spectra of the compound below; $H_2C{=}CHCO_2CH_2CH_3$ **[5 marks]**

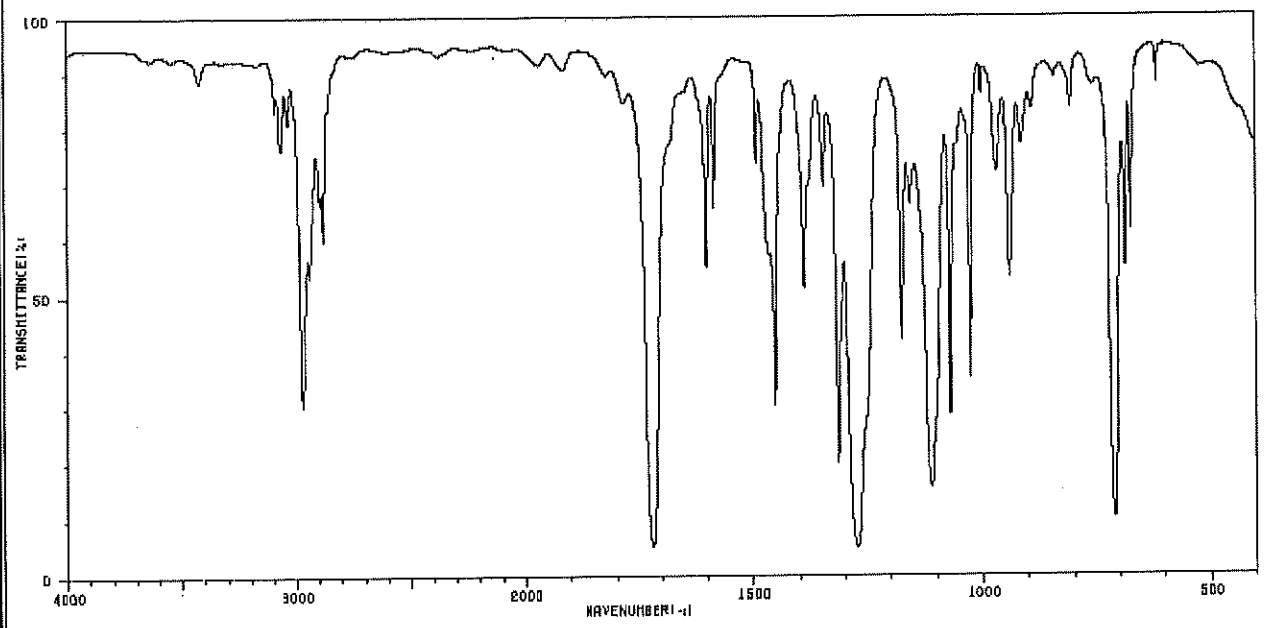
3. Determine the structure of the compound $C_{10}H_{12}O_2$, given the information below;

^{13}C NMR (δ, ppm): 11, 22, 67, 128, 130, 131, 133, 167

^{1}H NMR:



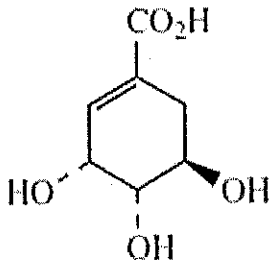
IR:



[25 marks]

4. a) Mechanistically account for the biosynthesis of shikimic acid from phosphoenolpyruvate (PEP) and D-erythrose-4-P (E4P).

[10 marks]

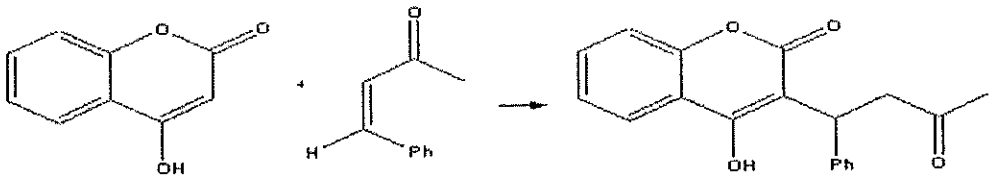


shikimic acid

b) Illustrate details of the conversion of acetyl CoA to isopentenyl pyrophosphate. **[10 marks]**

c) Why are phenolic acids important in our diet? **[5 marks]**

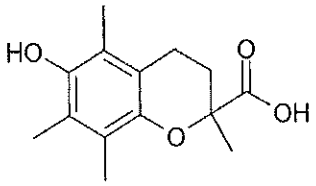
5. a) Warfarin is a Coumarin that can be used as rat poison. It is synthesized in the laboratory using the reaction below. Draw a mechanism for the reaction.



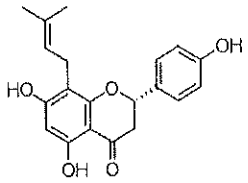
[15 marks]

b) Suggest possible applications of the compounds shown below in industry.

(i)



(ii)



[2 x 5 marks]

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