

Immanuel Lutheran College (2006-2007)
S.7 Chemistry First Uniform Test

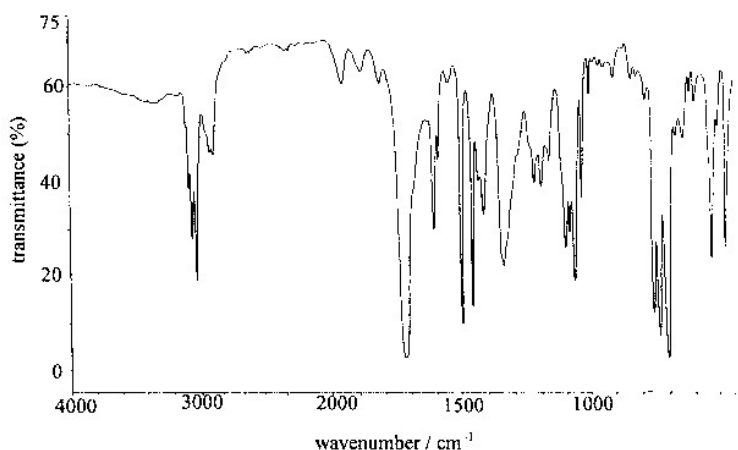
Class : _____ Name : _____ Class No. : _____

Attempt All questions
Total marks : 70 marks

Time allowed : 2 hours

Section A : This section carries 50 marks. Answer All questions in this section.

1. Compound X ($C_{15}H_{14}O$) is a white solid with a melting point of $32^{\circ}C$ and displays the following infra-red spectrum.

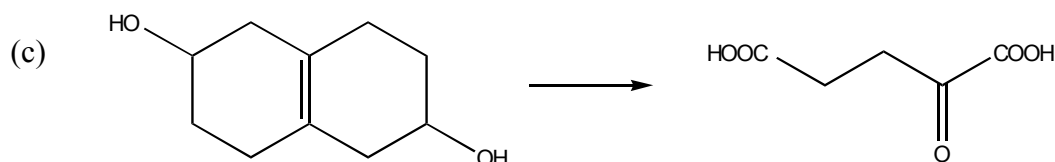
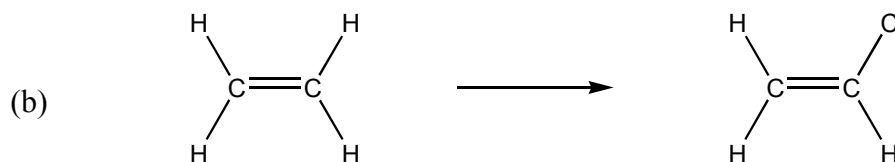
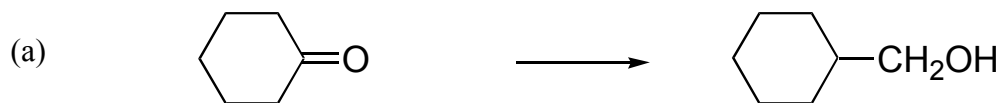


X gives a negative result when treated with Tollen's reagent but reacts readily with $LiAlH_4$ to give an achiral compound Y. Drastic oxidation of Y with potassium manganate(VII) gives an aromatic compound Z ($C_7H_6O_2$) with a pK_a value of 4.2, as the major product.

Deduce the structures of X, Y and Z.

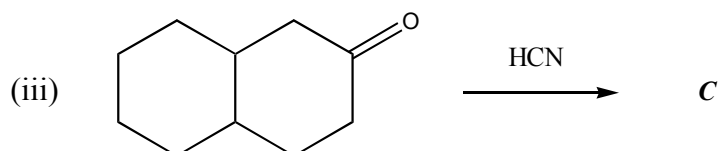
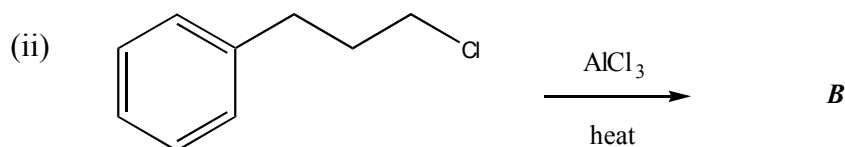
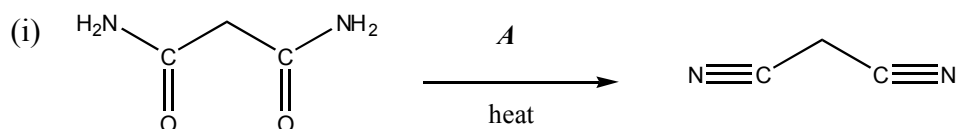
(6 marks)

2. Show how you would carry out the following multi-step conversions. For each step, give the reagent(s), conditions, and structure of the intermediate.



(10 marks)

3. (a) Identify **A**, **B** and **C** in the following reactions. **B** and **C** are major organic products of the respective reactions.



(3 marks)

- (b) (i) Outline a mechanism for the reaction in (a)(iii).

- (ii) Will the product obtained be optically active? Explain.

(3 marks)

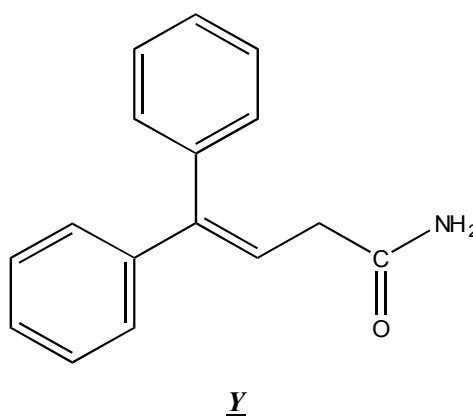
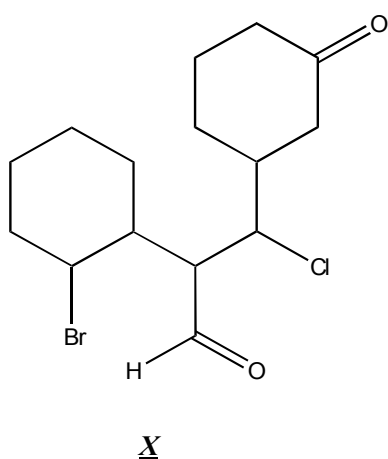
- (c) An impure sample of propanone was found to contain impurities other than carbonyl compounds.

- (i) Outline a scheme by which you can isolate pure propanone from the sample.

- (ii) Describe how you would show that the isolated substance is really propanone.

(6 marks)

4. (a) (i) Give a systematic name to each of the following compounds.



- (ii) On a copy of structure **X**, indicate all the asymmetric carbon centres.

- (iii) On a copy of structure **Y**, indicate all the sp^3 hybridized carbon centres.

(4 marks)

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4. (b) Consider the substances listed below:

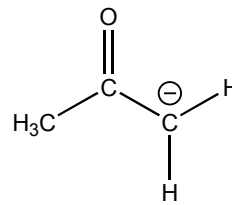
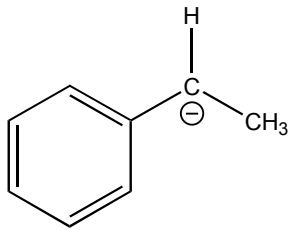
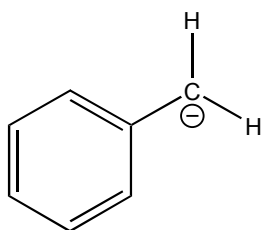
benzoic acid	propanone	triiodomethane
ethyl benzoate	but-1-ene	phenylamine
1-bromohexane	polyethene	propan-1-ol

For each of the descriptions from (i) to (v) below, choose from the above list, one substance which best fits the description.

- (i) a colourless and flammable gas
- (ii) a colourless liquid with a fruity smell
- (iii) a colourless, water immiscible, flammable liquid
- (iv) a colourless liquid which is immiscible with water but miscible with dilute hydrochloric acid.
- (v) a white solid which is soluble in NaOH(aq) but only slightly soluble in water.

(5 marks)

5. (a) Arrange carbanions, **D**, **E** and **F** in order of decreasing stability. Explain your order.



(3 marks)

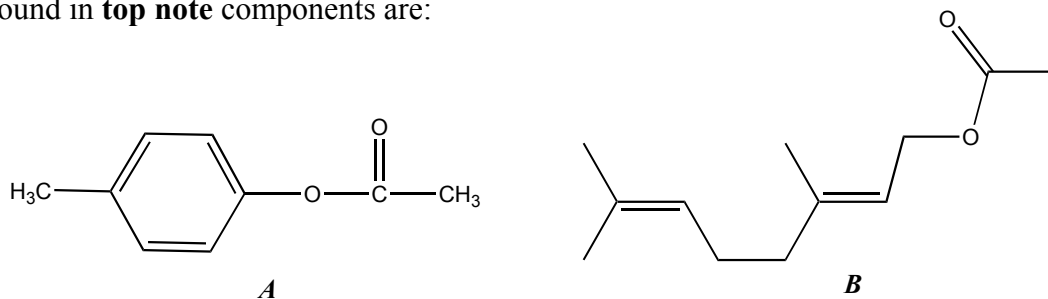
(b) The reaction of 4-methylpentane-1,4-diol with HBr gives 4-bromo-4-methylpentan-1-ol as the major product.

- (i) Draw the structure of 4-methylpentane-1,4-diol.
- (ii) Give, with the aid of a suitable mechanism, reasons for the formation of the product.

(4 marks)

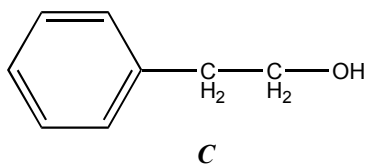
5. (c) Perfumes normally contain three groups of components called the **top note**, the **middle note** and the **end note**.

(i) The **top note** components of a perfume form vapours most easily. Two compounds found in **top note** components are:

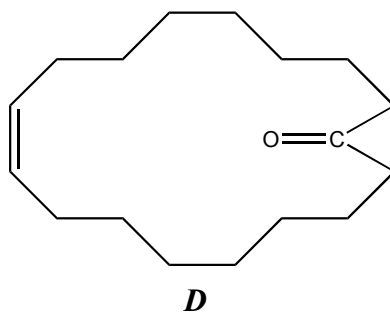


- (1) With reference to the structure of these compounds, why are they likely to have pleasant smells ?
- (2) Describe a chemical test which would distinguish between these two compounds and give the result of the test.

(ii) The **middle note** compounds form vapours less readily than the **top note** compounds. A typical compound of the **middle note** is



- (1) Give the systematic name of *C*.
 - (2) Explain why *C* is less volatile than *A* and *B*.
- (iii) The **end note** of a perfume has a long lasting odour which stays with the user. An example of an **end note** compound is:



Draw the structure of the alcohol which would be formed by

- (1) the reduction of *D*;
- (2) the oxidation of *D*.

(6 marks)

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Section B : This section carries **20** marks.

Marks will be allocated approximately as follows :

chemical knowledge	50%
organization	30%
presentation (including proper use of English)	20%

Equations, suitable diagrams and examples are expected where appropriate.

The examiners are looking for the ability to analyze, to evaluate and to express ideas clearly.

6. Write an essay on isomerism.

Illustrate your answers with organic compounds all bearing the same formula, $C_5H_{10}O_2$, and correctly named according to the IUPAC convention.

Compare the physical properties and chemical properties of isomers of the same kind.

(20 marks)

End of Paper

**Characteristic Infra-red Absorption Wavenumber Ranges
(Stretching modes)**

Bond	Compound type	Wavenumber range / cm^{-1}
C=C	Alkenes	1610 to 1680
C=O	Aldehydes, ketones, carboxylic acids, esters	1680 to 1750
C≡C	Alkynes	2070 to 2250
C≡N	Nitriles	2200 to 2280
O-H	Acids(hydrogen-bonded)	2500 to 3300
C-H	Alkanes, alkenes, arenes	2840 to 3095
O-H	Alcohols, phenols(hydrogen-bonded)	3230 to 3670
N-H	Amines	3350 to 3500