



UNIVERSITI KUALA LUMPUR
ROYAL COLLEGE OF MEDICINE PERAK

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE : RCB10303
COURSE NAME : PHARMACEUTICAL ORGANIC CHEMISTRY I
PROGRAMME NAME : BACHELOR IN PHARMACEUTICAL
TECHNOLOGY (HONOURS)
DATE : 22 JUNE 2026
TIME : 2.30 PM - 4.30 PM
DURATION : 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read CAREFULLY the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer THREE (3) questions WITH AT LEAST ONE (1) question from question 3 or question 4.
5. Please write your answers on the OMR answer script and answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 12 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

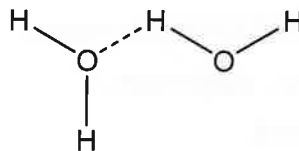
I) MULTIPLE CHOICE QUESTIONS (20 marks)

INSTRUCTION: Answer ALL questions.

Use the OMR sheet provided.

1. Define valence electrons in an atom.
 - A. Electrons in the nucleus.
 - B. Electrons in the inner shells.
 - C. Electrons in the outermost shell.
 - D. Paired electrons only.
 - E. Free electrons.
2. Select the molecule that contains a double covalent bond.
 - A. H_2
 - B. CH_4
 - C. O_2
 - D. NH_3
 - E. NaCl
3. Select the correct description of a polar molecule.
 - A. Molecule with equal sharing of electrons.
 - B. Molecule with no charge separation.
 - C. Molecule with slight positive and negative ends.
 - D. Molecule with only ionic bonds.
 - E. Molecule without covalent bonds.
4. Select the number of orbitals in a p subshell ($l = 1$).
 - A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5

5. Identify the type of intermolecular force present between the molecules shown below.



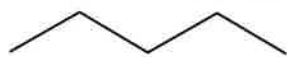
- A. Ionic bond
B. Covalent bond
C. Hydrogen bond
D. Metallic bond
E. Van der Waals force
6. Identify the compound that contains a quaternary carbon atom.
- A. $\text{CH}_3\text{—CH}_3$
B. $\text{CH}_3\text{—CH}_2\text{—CH}_3$
C. $\text{CH}_3\text{—CH(CH}_3\text{)—CH}_3$
D. $\text{C(CH}_3\text{)}_4$
E. $\text{CH}_2\text{=CH}_2$
7. Identify the type of functional group present in the compound shown below.



- A. Aldehyde
B. Alcohol
C. Ketone
D. Ester
E. Carboxylic acid
8. Identify the compound that belongs to the alkene homologous series.
- A. C_2H_6
B. C_3H_6
C. C_3H_8
D. C_4H_{10}
E. $\text{C}_2\text{H}_4\text{O}$

9. Select the compound that has the lowest boiling point.

A.



B.



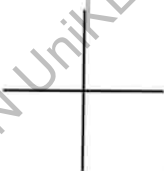
C.



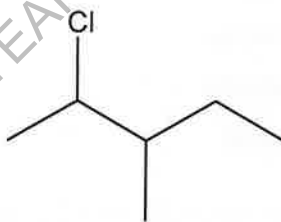
D.



E.



10. Identify the classification of the alkyl halide shown below.



- A. Primary alkyl halide
- B. Secondary alkyl halide
- C. Tertiary alkyl halide
- D. Vinyl halide
- E. Aryl halide

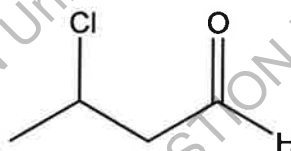
11. 3-Methyl-pentan-3-ol is a _____.

- A. ketone
- B. primary alcohol
- C. secondary alcohol
- D. tertiary alcohol
- E. quaternary alcohol

12. Identify the compound with the **HIGHEST** boiling point.

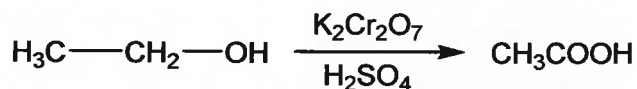
- A. Methanol
- B. Ethanol
- C. Propan-1-ol
- D. Propan-2-ol
- E. Butan-1-ol

13. Identify the IUPAC name for the following structure.



- A. 2-Chlorobutanal
- B. 2-Chlorobutanol
- C. 3-Chloropropanal
- D. 2-Chloropropanal
- E. 3-Chlorobutanal

14. Identify the type of reaction shown below.



- A. Carboxylation of alcohol
- B. Oxidation of aldehyde
- C. Carbocation of alcohol
- D. Hydrogenation of alcohol
- E. Hydrogenation of aldehyde

15. Hydrogenation of pentanal will produce _____.

- A. propanol
- B. butanal
- C. pentanol
- D. butan-2-ol
- E. hexanol

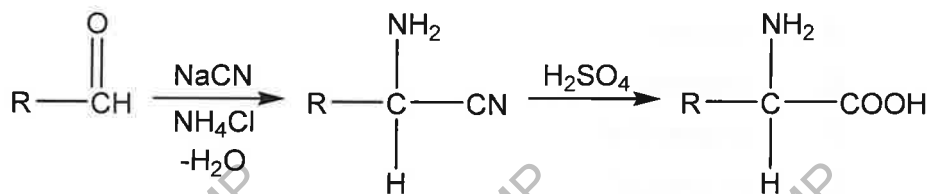
16. Oxidation of propanone produces _____.
A. ethanol
B. ethanal
C. propanol
D. propan-2-ol
E. no product
17. Saponification is a soap-producing reaction between ester and base to form carboxylate salt and _____.
A. alkane
B. alcohol
C. aldehyde
D. carbon dioxide
E. carbohydrates

18. Identify the IUPAC name for the following structure.



- A. Methylanniline
B. 4-Methylanniline
C. 4-Aminebenzene
D. Aminobenzylamine
E. 4-Aminobenzylamine

19. Select the name of the reaction shown below.



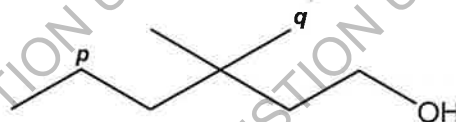
- A. Grignard reaction
B. Strecker synthesis
C. Koop synthesis
D. Claisen synthesis
E. Friedel-Crafts reactions
20. Choose the **CORRECT** statements regarding amines.
- I. Amines are relatively weak bases.
II. Amines are soluble in water.
III. Lower amines are gaseous and low-boiling liquids.
IV. Amines are soluble in benzene and ether.
- A. I and III
B. II and III
C. I, II, and III
D. I, II, and IV
E. I, II, III, and IV

II) SHORT ANSWER QUESTIONS (20 marks)

INSTRUCTION: Answer ALL questions in the answer booklet provided.

Each question carries TWO (2) marks.

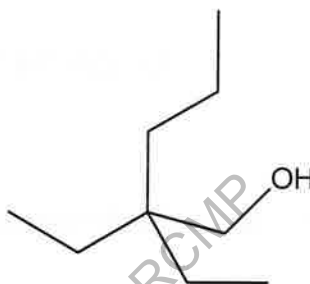
1. State **TWO (2)** characteristics of a homologous series.
2. Classify the carbon atoms 'p' and 'q' as primary, secondary, or tertiary carbon.



3. Illustrate the condensed structural formula of 5-methylhex-2-yne.



4. Write the molecular formula for the compound shown below.



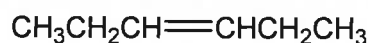
5. Circle and name **TWO (2)** functional groups present in the structure shown below. (Redraw the structure).



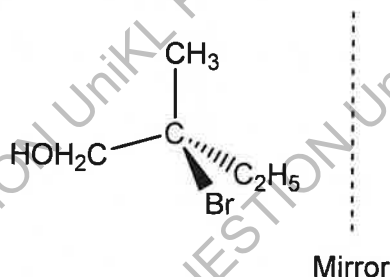
6. Describe chain isomerism.
7. State the type of isomerism between the following pair of compounds.



8. Draw **TWO (2)** skeletal formulas of structural isomers of $\text{C}_4\text{H}_{10}\text{O}$.
9. Draw the *cis*- and *trans*-isomers of the following compound.



10. Draw the enantiomer of the chiral molecule shown below.



SECTION B: MODIFIED ESSAY QUESTIONS (Total: 60 marks)

INSTRUCTION: This section consists of FOUR (4) questions.

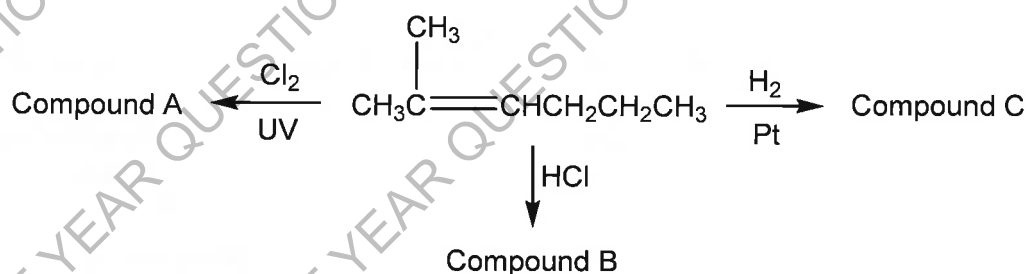
You are required to answer THREE (3) questions in the answer booklet provided.

Questions 1 and 2 are COMPULSORY.

Answer EITHER Question 3 OR 4.

Question 1

- (a) Answer the questions based on the following reaction.



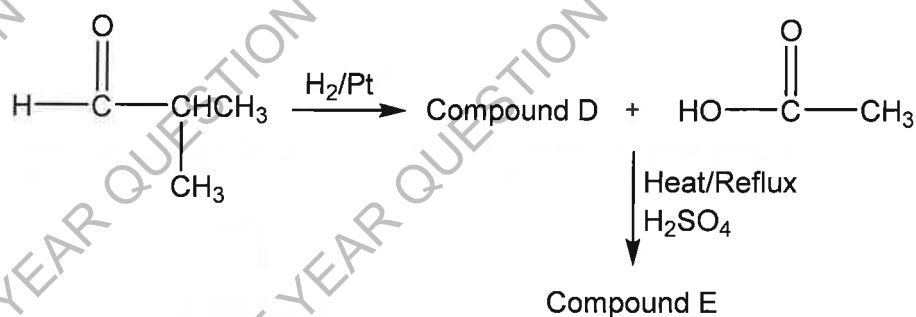
- i. Draw the structural formula of compounds A, B, and C. (6 marks)
- ii. Write the IUPAC names of compounds A and C. (4 marks)
- iii. State the type of reaction involved in the formation of compounds A and C. (2 marks)
- iv. Write the complete combustion equation of compound C. (4 marks)
- v. Illustrate the stepwise free radical mechanism (initiation, propagation, termination) for the chlorination of compound A under UV light. (4 marks)

Question 2

- (a) A student has found 3 bottles of chemicals in a cupboard, which used to be butanal, butan-1-ol, and 2-methylpropan-2-ol. The labels were missing from the bottles. Explain the test to distinguish these chemicals so that the student can label the chemical bottles correctly.

(10 marks)

- (b) Answer the question based on the following reaction.



- i. Draw the structure and provide the IUPAC name of compound D.
- ii. Draw the structure and provide the IUPAC name of compound E.
- iii. Provide the uses of compound E.

(4 marks)

(4 marks)

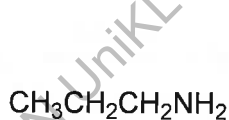
(2 marks)

Question 3

- (a) Explain the basicity of amines.

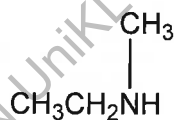
(5 marks)

- (b) Compounds F, G, and H are isomeric amines with formula C_3H_9N (MW: 59). Deduce and arrange the following amines F, G, and H in decreasing boiling point. Justify.



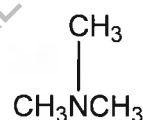
1-Propanamine

F



N-Methylethanamine

G



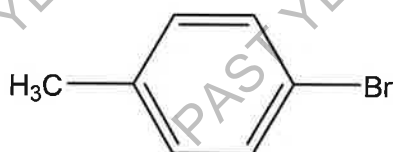
N,N-Dimethylmethanamine

H

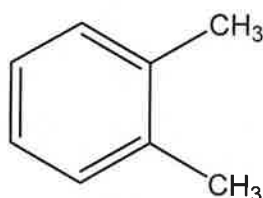
(5 marks)

- (c) Write the IUPAC name for the following compounds.

i.



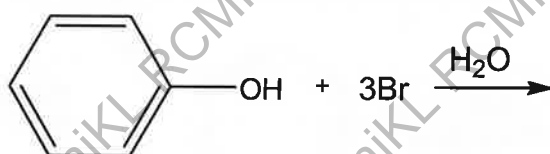
ii.



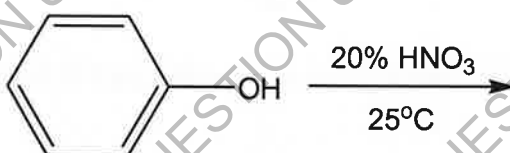
(4 marks)

- (d) Draw the products for the following reactions.

i.



ii.



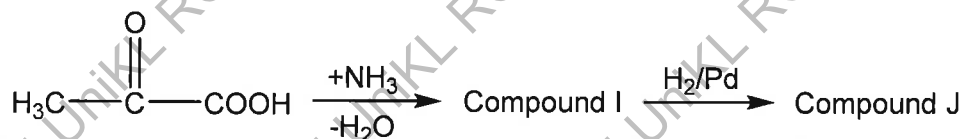
(6 marks)

Question 4

- (a) Discuss the physical properties of phenol.

(6 marks)

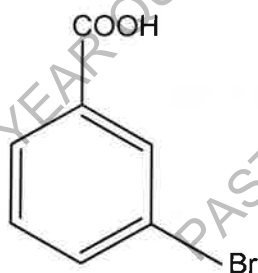
- (b) Draw the structure of compounds I and J based on the following reaction.



(4 marks)

- (c) State the IUPAC name for the following compounds.

i.

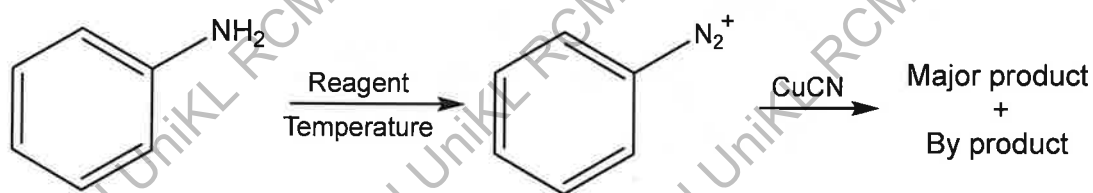


ii.



(4 marks)

- (d) Answer the question based on the following reaction.



- i. State the reagent and temperature for the first part of the reaction.

(2 marks)

- ii. Draw the major product and by-product for the reaction.

(4 marks)

END OF EXAMINATION PAPER