

THE OPEN UNIVERSITY OF SRI LANKA  
FACULTY OF HEALTH SCIENCES  
DEPARTMENT OF BASIC SCIENCES



BACHELOR OF PHARMACY HONOURS- LEVEL 04 - 2020/21  
BSU4340- PHARMACEUTICAL CHEMISTRY III  
NBT 01

DATE: 23<sup>rd</sup> NOVEMBER 2021

DURATION: 1.5 HOURS

TIME: 1.30 p.m. – 3.00 p.m.

REGISTRATION NO: .....

1. This question paper consists of 15 pages with 20 Multiple Choice Questions (Part A) and 04 Short Answer Questions (Part B).
2. Please fill the address sheet. (See last page)

**IMPORTANT INSTRUCTIONS TO CANDIDATES**

- Write your Registration Number in the space provided.
- Answer **ALL** questions.
- **Multiple Choice Questions (Part A):** Indicate answers in the answer sheet provided by placing a cross (X) in **INK** in the relevant cage.
- Answers in pencil will **NOT** be marked.
- **Short Answer Questions/ (Part B):** Write answers within the space provided.
- Do not remove any page/part of this question paper from the examination hall.
- Mobile phones and the electronic equipment are **NOT** allowed. Leave them outside.

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**ANSWER SHEET FOR PART A**

Q. No.	(a)	(b)	(c)	(d)
1.1				
1.2				
1.3				
1.4				
1.5				
1.6				
1.7				
1.8				
1.9				
1.10				
1.11				
1.12				
1.13				
1.14				
1.15				
1.16				
1.17				
1.18				
1.19				
1.20				



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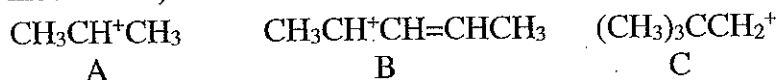
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**Part A – Multiple Choice Questions**

(20 marks)

1. Choose the most suitable answer and indicate with a 'X' in the answer sheet provided.

1.1 Rank the following carbocations in the order of increasing stability (least stable to the most stable).

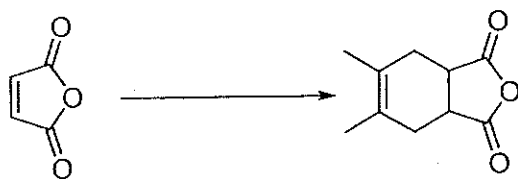


- a)  $A < B < C$       b)  $B < C < A$       c)  $C < A < B$       d)  $B < A < C$

1.2 Hydrogenation of cyclohexene releases 120 kJ/mol of heat. Which of the following most likely represents the observed heat of hydrogenation of 1,3-cyclohexdine?

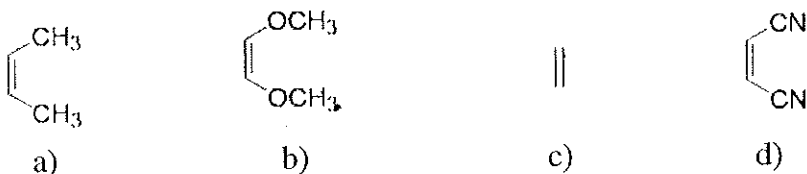
- a) 232 kJ/mol      b) 257 kJ/mol      c) 120 kJ/mol      d) 240 kJ/mol

1.3 What hydrocarbon reacts with the compound shown (on heating) to give the indicated product?

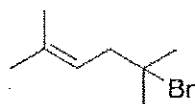
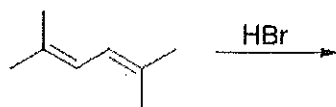


- a) 2,3-dimethyl-1-butene      b) 2,3-dimethyl-2-butene  
 c) 2,3-dimethyl-1,3-butadiene      d) 2,3-dimethyl-1-butyne

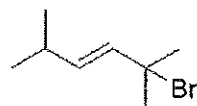
1.4 Which of the following dienophiles is the most reactive with buta-1,3-diene?



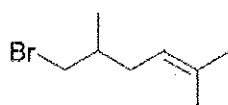
1.5 What is the 1,4-addition product of the reaction given below?



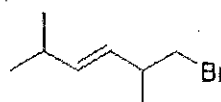
a)



b)



c)



d)

1.6 Which of the following statements is **NOT** correct regarding benzene?

- Each C atom in the benzene ring is  $sp^2$  hybridized
- It is a planar molecule
- The reactivity of the benzene reflects the presence of carbon-carbon double bonds
- Benzene undergoes electrophilic substitution reactions with reactive electrophiles

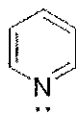
1.7 Which of these conditions is **NOT** a requirement for aromaticity?

- The molecule must be planar to allow overlap of the 2p orbitals
- There must be  $(4n)$   $\pi$  electrons, where  $n$  is a positive integer
- The molecule must be cyclic
- There must be  $(4n + 2)$   $\pi$  electrons, where  $n$  is a positive integer

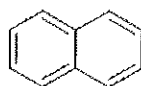
1.8 Which of the following compounds is anti-aromatic?



a)



b)



c)



d)

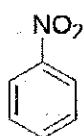
1.9 When considering electrophilic aromatic substitution reactions, the halogen substituents are described as,

- Ortho/para* directing and activating
- Ortho/para* directing and deactivating
- Meta* directing and activating
- Meta* directing and deactivating

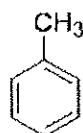
1.10 Which of the following statements is **INCORRECT** about electrophiles?

- Most electrophiles are positively charged or neutral species having vacant orbitals
- The electrophiles are attacked by electron rich nucleophiles
- Electrophiles are Lewis acids
- Electrophiles are Lewis bases

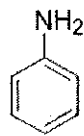
1.11 Which of the following compounds is the most reactive in electrophilic substitution?



a)



b)

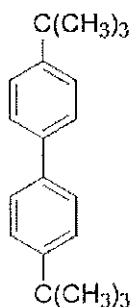
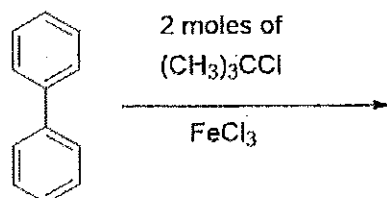


c)

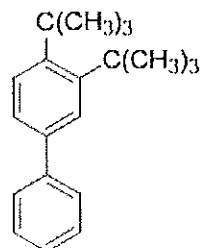


d)

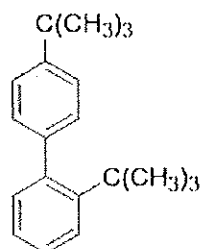
1.12 What is the major product of the reaction given below?



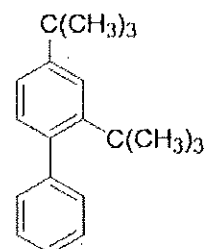
a)



b)

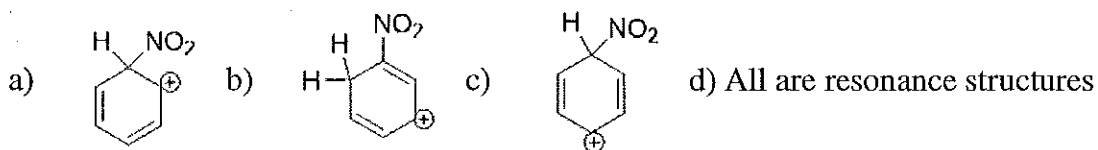


c)



d)

1.13 Which of the following resonance structures is **NOT** an intermediate in the nitration of benzene?

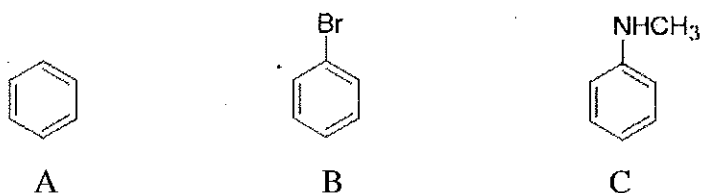


1.14 Among the following groups, which ones are *o*, *p*-directing?

(i)-OCH<sub>3</sub>    (ii)-NO<sub>2</sub>    (iii)-Br    (iv)-CN    (v)-CH<sub>3</sub>

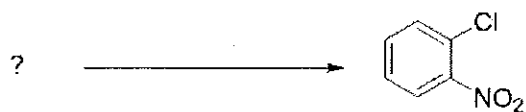
a) (i), (iii), and (v)    b) (i) and (v)    c) (ii) and (iv)    d) (ii), (iii), and (iv)

1.15 Rank the following in terms of increasing reactivity toward nitration.



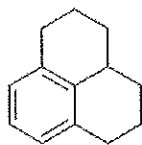
a) A < B < C    b) B < A < C    c) C < B < A    d) C < A < B

1.16 The best reactants for the following reaction are:



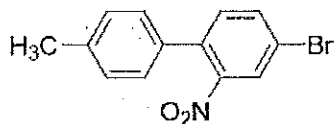
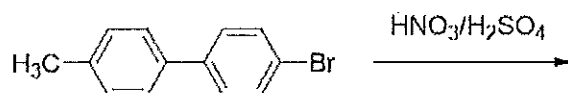
a) C<sub>6</sub>H<sub>5</sub>Cl + HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>    b) HCl + NO<sub>2</sub>  
c) C<sub>6</sub>H<sub>5</sub>NO<sub>2</sub> + Cl<sub>2</sub>, FeCl<sub>3</sub>    d) C<sub>6</sub>H<sub>5</sub>NO<sub>2</sub> + HCl

1.17 How many benzylic hydrogens are present in the structure shown below?

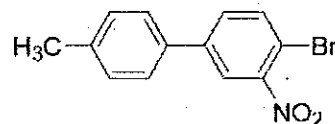


- a) 3      b) 5      c) 6      d) 8

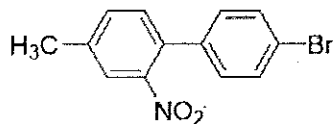
1.18 What is the major product of the following reaction?



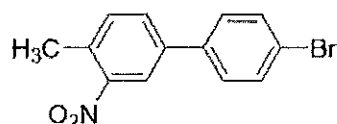
a)



b)



c)

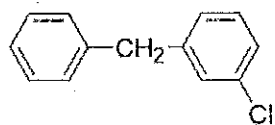






d)

1.19 Which of the following sequences of reactions would convert toluene to 4-bromo-3-nitrobenzoic acid (note: here 'bromination' refers to treatment with  $\text{FeBr}_3/\text{Br}_2$ ).

- a) nitration, bromination,  $\text{KMnO}_4$  oxidation  
 b)  $\text{KMnO}_4$  oxidation, bromination, nitration  
 c) bromination, nitration,  $\text{KMnO}_4$  oxidation  
 d) bromination,  $\text{KMnO}_4$  oxidation, nitration

1.20 Which sequence of steps best describes the synthesis of compound shown below?



- a)   $\xrightarrow[\text{FeCl}_3]{\text{Cl}_2}$   $\xrightarrow[\text{AlCl}_3]{\text{C}_6\text{H}_5\text{COCl}}$   $\xrightarrow[\text{HCl}]{\text{Zn(Hg)}}$
- b)   $\xrightarrow[\text{AlCl}_3]{\text{C}_6\text{H}_5\text{CH}_2\text{Cl}}$   $\xrightarrow[\text{FeCl}_3]{\text{Cl}_2}$
- c)   $\xrightarrow[\text{FeCl}_3]{\text{Cl}_2}$   $\xrightarrow[\text{AlCl}_3]{\text{C}_6\text{H}_5\text{CH}_2\text{Cl}}$
- d)   $\xrightarrow[\text{AlCl}_3]{\text{C}_6\text{H}_5\text{COCl}}$   $\xrightarrow[\text{FeCl}_3]{\text{Cl}_2}$   $\xrightarrow[\text{HCl}]{\text{Zn(Hg)}}$



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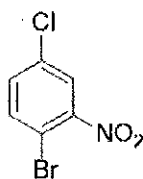
Part B –Short Answer Questions

(80 marks)

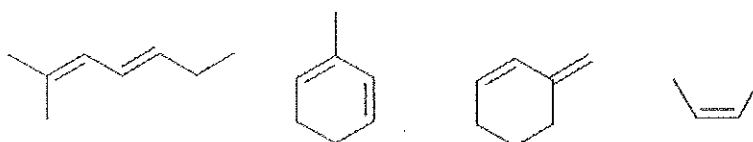
Write answers in the space provided.

1 a). Draw the structure of (2Z, 4Z)-3-methyl-2,4-hexadiene. (03 marks)

Provide the IUPAC Name of the following aromatic compound. (03 marks)

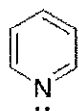
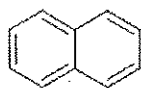


Which of the following is/are in the *s-cis* conformation (circle them)? (02 marks)

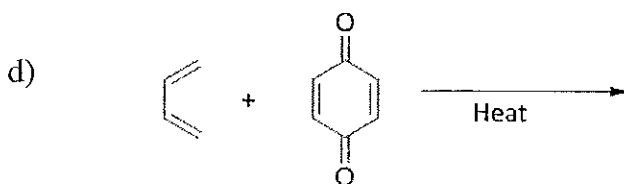
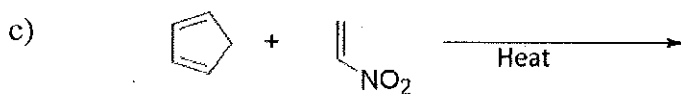
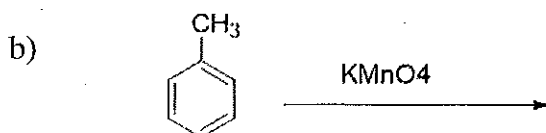
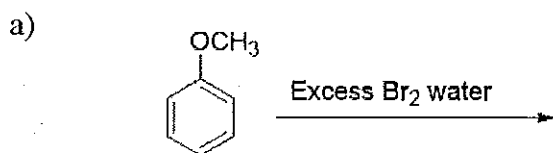


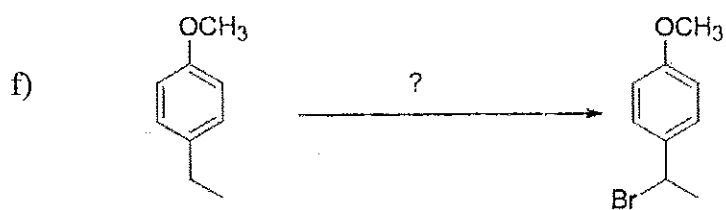
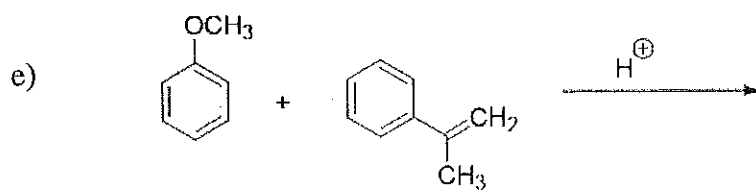
b). Designate the following compounds as aromatic, anti-aromatic, or non-aromatic giving reasons. Assume all the molecules given here are planar. (12 marks)



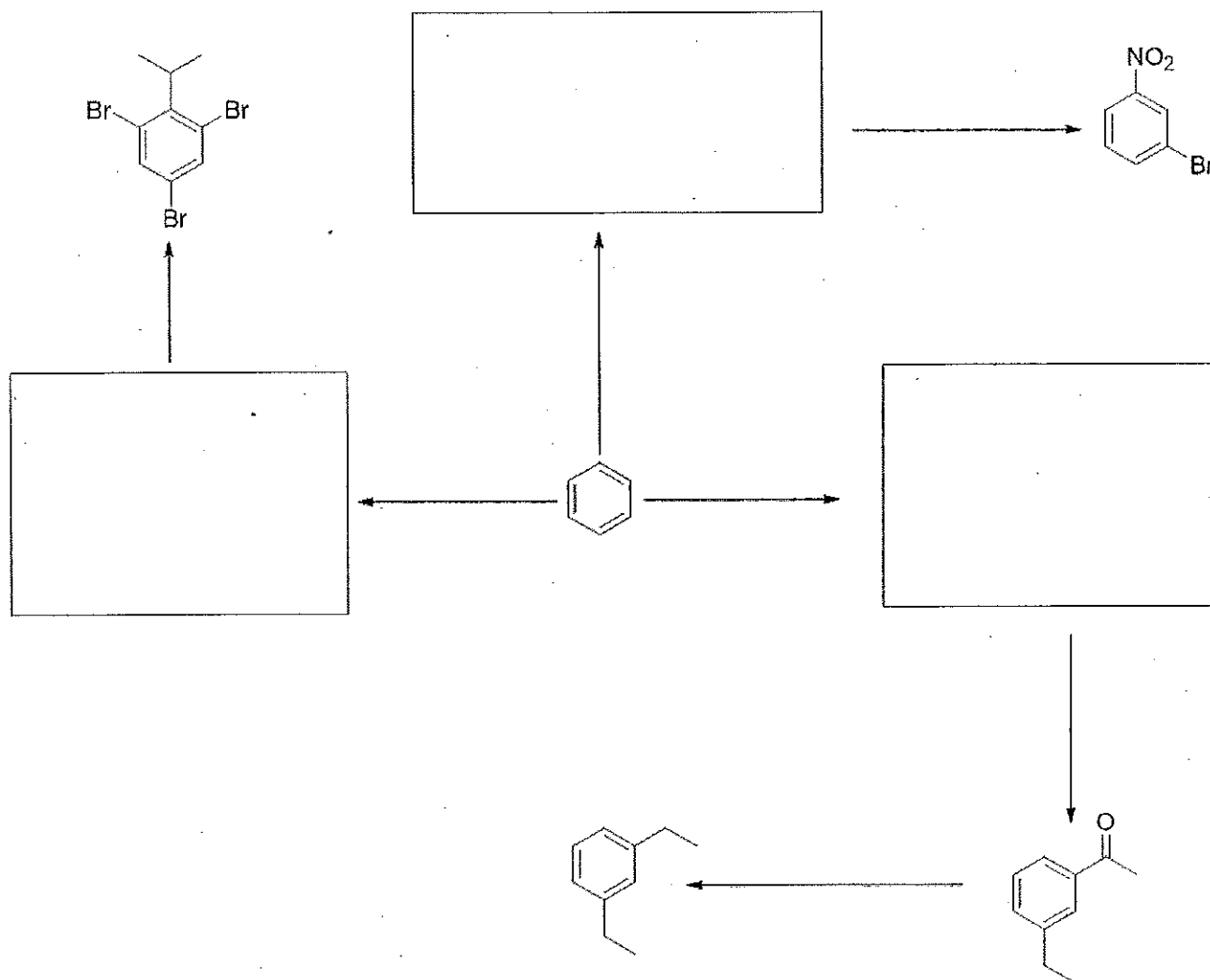


2. Give the structures of the major products of the following reactions (a-e). Provide the missing reagent in f). (20 marks)

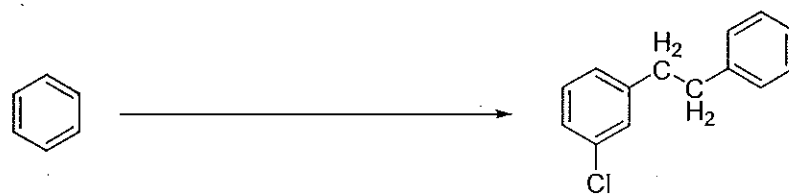
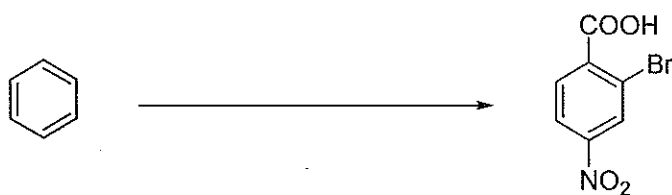




3. a) Using benzene as the only starting material, outline a probable synthesis route for each of the listed compounds showing all reagents, conditions and intermediate products clearly. (10 marks)



b) Giving necessary reagents and conditions, show how you would carry out the following multistep transformations. (12 marks)



4. a) 2,4-Hexadiene is a conjugated diene. Addition of one mole of HBr to 2,4-hexadiene gives a mixture of 4-bromo-2-hexene and 2-bromo-3-hexene as the major products. A smaller percentage of 5-bromo-2-hexene is also formed. Explain this by providing suitable mechanisms. (Draw all chemical structures and use arrows to show electron movements). (13 marks)

- b) Write all possible resonance structures that represent the delocalization of the following carbocation? (5 marks)

