

2026/FYUG/EVEN/SEM/
CHMDSM 251/252T/122

FYUG Even Semester Exam., 2026

CHEMISTRY

(4th Semester)

Paper Code : CHMDSM 251/252-T

(Fundamentals of Chemistry)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

*The figures in the margin indicate full marks
for the questions.*

UNIT—I

1. Answer any *two* of the following questions :

2×2=4

- (a) Define diagonal relationship in periodic table with suitable examples.
- (b) How would you prepare boric acid from diborane?
- (c) Define allotropy. Give example of one three-dimensional polymeric allotrope of carbon.

1+1=2

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(Turn Over)



2. Answer any one of the following questions : 10

(a) (i) Why does Li have dissimilarities with other alkali metals? 2

(ii) Taking suitable examples, explain relative stability of different oxidation states of group 13 and group 14 elements. 4

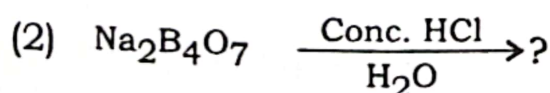
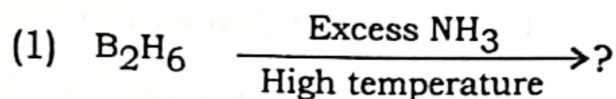
(iii) What is catenation? Discuss bonding in B_2H_6 . 1+3=4

(b) (i) Draw the structure of boric acid. Explain its acidic character. Mention two uses of boric acid. 1+1+1=3

(ii) What are silicones? How are cross-linked silicones prepared? 1+2=3

(iii) Write a short note on 'zeolites'. 2

(iv) Write the products of the following reactions : 1×2=2



UNIT—II

3. Answer any *two* of the following questions :

2×2=4

(a) What are extensive and intensive properties? Give one example of each.

(b) State zeroth law of thermodynamics. What is its most important application?

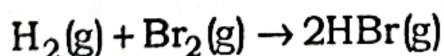
1+1=2

(c) Distinguish between isothermal and adiabatic processes.

4. Answer any *one* of the following questions : 10

(a) (i) Define bond energy for a diatomic molecule. How does bond energy data help to calculate the enthalpy change of a reaction? 1+2=3

(ii) Calculate the enthalpy change for the following reaction :



Given that the bond energies of H—H, Br—Br and H—Br are 435 kJ mol⁻¹, 192 kJ mol⁻¹ and 364 kJ mol⁻¹ respectively. 4

(iii) What is Joule-Thomson effect? Justify that during this process, enthalpy of the system remains constant. 1+2=3

- (b) (i) State and explain Hess' law of constant heat summation. 3
- (ii) Derive Kirchhoff's equation thermodynamically. 3
- (iii) What is standard enthalpy of formation? Discuss in detail the variation of enthalpy of a reaction with temperature. 1+3=4

UNIT—III

5. Answer any *two* of the following questions : 2×2=4

- (a) State and explain Raoult's law for volatile solutes.
- (b) Define triple point of water.
- (c) Explain the term 'degrees of freedom' with a suitable example as used in phase rule.

6. Answer any *one* of the following questions : 10

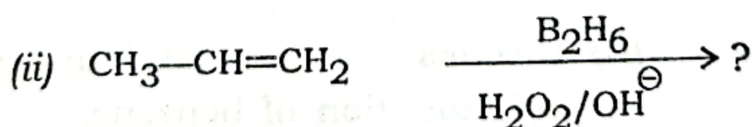
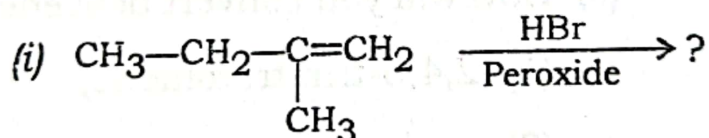
- (a) (i) How are non-ideal solutions classified into different types? Briefly explain the behaviour of each type graphically giving reason with a suitable example in each case. 3+6=9
- (ii) What are azeotropes? 1

- (b) (i) State phase rule. Explain the terms used. 1+2=3
- (ii) What do you understand by phase diagram? Draw a labelled phase diagram of sulphur system and discuss its salient features. 1+6=7

UNIT—IV

7. Answer any *two* of the following questions : 2×2=4

- (a) Write the equations to show Kolbe synthesis of alkanes.
- (b) Complete the following reactions : 1×2=2



- (c) Write the products of ozonolysis of acetylene.

8. Answer any *one* of the following questions : 10

- (a) (i) Starting with ethyne, how can you prepare 1-bromopentane? 2

(ii) Identify the products of the following reactions and discuss the mechanism : 3×2=6

(1) Addition of Br₂ to *cis*-2-butene

(2) Ethyl bromide reacts with metallic sodium in presence of dry ether

(iii) How will you show that acetylene is more acidic than ethylene? 2

(b) (i) In organic synthesis, Friedel-Crafts acylation is more preferred than alkylation. Explain with an example. 3

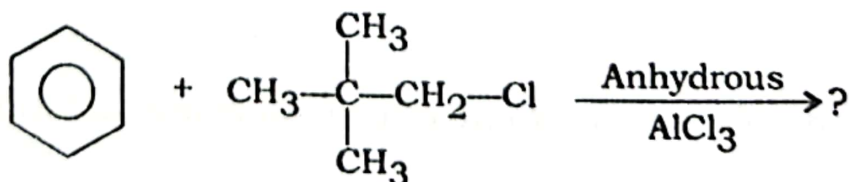
(ii) How will you convert benzene into—

(1) 2,4,6-trinitrotoluene;

(2) *p*-nitrobromobenzene? 1½+1½=3

(iii) Discuss the mechanism of sulphonation of benzene. 3

(iv) Predict the product of the following reaction : 1



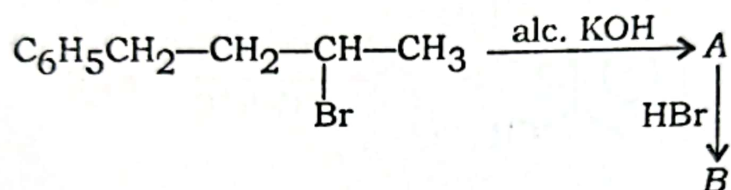
UNIT—V

9. Answer any *two* of the following questions :

2×2=4

(a) Explain why allyl halides are more reactive than vinylhalides in nucleophilic substitution reaction.

(b) Complete the following reaction :



(c) When 4-chlorotoluene is treated with sodamide in liq. NH_3 , the product consists of a mixture of 4- and 3-toluidine. Propose a suitable mechanism to explain the observation.

10. Answer any *one* of the following questions : 10

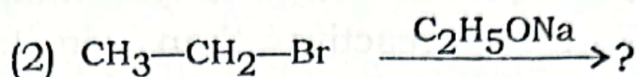
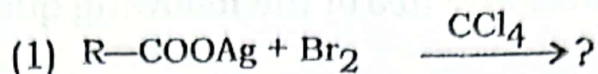
(a) (i) Discuss the mechanism of $\text{S}_{\text{N}}1$ reaction with a suitable example. How does solvent polarity influence $\text{S}_{\text{N}}1$ mechanism?

3+1=4

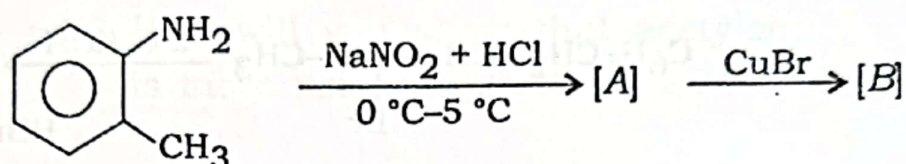
(ii) Explain the term 'β-elimination' by taking a suitable example.

2

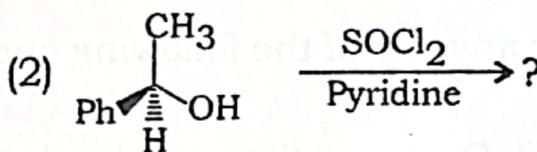
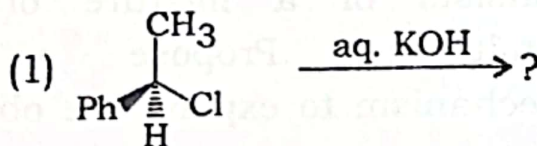
(iii) Write the products of the following reactions : 1×2=2



(iv) Identify A and B of the following : 1×2=2



(b) (i) Predict the products of the following reactions with appropriate mechanisms : 3×2=6



(ii) Explain Saytzeff and Hofmann elimination reaction with suitable examples. 1½+1½=3

(iii) Give one example of Williamson synthesis. 1

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