

1m/CHE-100 (Th) Syllabus-2023

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(Nov-Dec)

FYUP : 1st Semester Examination

MINOR

CHEMISTRY

Part-A (Theory)

(Introductory Chemistry—I)

CHE-100

Marks : 56

Time : 3 hours

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

UNIT—I

(Inorganic Chemistry—I)

(Marks : 18)

1. (a) Derive the de Broglie's equation for the wave-duality of electron. 2
- (b) Mention the important postulate of Bohr's atomic theory. 2

(2)

- (c) What do you understand by iso-electronic species? Name the species that will be isoelectronic with the following (atoms) ions : 2
- (i) F^-
- (ii) Ca^{2+}
- (d) Draw the shape of the following orbitals : 1
- (i) $2py$
- (ii) $3dx^2 - y^2$
- (e) Mention at least two limitations of Aufbau principle. 1
- (f) Explain why the electronegativity of element increases on moving from left to right in a periodic table. 1
- (g) The atomic radii decreases as we move from left to right in the second period. However the radii of Ne (10) is larger than F (9). Explain. 1

OR

2. (a) Write down the Schrödinger wave equation. Mention the significance of ψ and ψ^2 . 2
- (b) State Pauli's exclusion principle. What is its importance? 2

(3)

- (c) The first ionization enthalpy value (in kJ mol^{-1}) of group 13 elements are—

B	Al	Ga	In	Tl
801	577	579	558	589

How will you explain the deviation in the trend? 2

- (d) What is the effective nuclear charge felt by 1s electron of He atom? 1

- (e) Which of the following sets of quantum numbers are not allowed and why? 1

(i) $n=2$ $l=1$ $m=0$ $s=+\frac{1}{2}$

(ii) $n=2$ $l=2$ $m=-1$ $s=-\frac{1}{2}$

(iii) $n=2$ $l=1$ $m=+1$ $s=-\frac{1}{2}$

(iv) $n=3$ $l=2$ $m=+1$ $s=0$

- (f) Write the general outer electronic configuration of *p* block and *d* block elements. 1

- (g) What is meant by periodicity of element? 1

3. (a) State Fajans' rules. Explain why cation with smaller size have high polarizing power and anions with larger size have high polarizability. 2

(4)

- (b) Draw the molecular orbital diagram of O_2^- ion. Calculate its bond order. 2
- (c) Although both CO_2 and H_2O are triatomic molecule, their shape and dipole moment are not the same. Account for the observations. 2
- (d) Determine the geometry of the following molecules using VSEPR theory : 2
- (i) BF_3
- (ii) H_2O

OR

4. (a) What is lattice energy? What are the factors on which it depends? 2
- (b) Arrange the compounds CH_4 , CCl_4 and $CHCl_3$ in order of increasing dipole moment. Justify your answer. 2
- (c) Discuss the geometry of the following molecules on the basis of VSEPR theory. Mention the hybridization of the central metal atom. 2
- (i) BeF_2
- (ii) SF_6
- (d) What is Born-Haber cycle? Draw the Born-Haber cycle for the formation of $NaCl$ and mention the term involved. 2

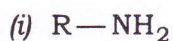
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UNIT—II

(Organic Chemistry—I)

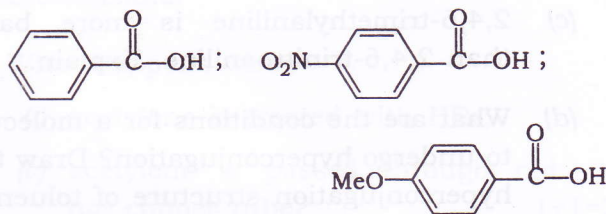
(Marks : 19)

5. (a) Draw the molecular orbital picture and give the hybridization, shape and bond angle of the following molecules : $1\frac{1}{2} \times 2 = 3$

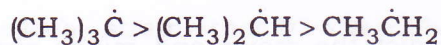


- (b) Arrange the following molecules in order of increasing acidity. Give reasons.

$1 + 1\frac{1}{2} = 2\frac{1}{2}$



- (c) Account for the stability order of the following free radicals : $1\frac{1}{2}$



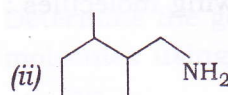
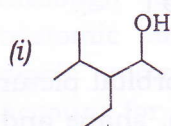
- (d) Why does methanol have higher boiling point than ethane? 1

(6)

OR

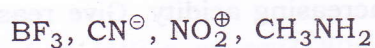
6. (a) Give the IUPAC names of the following :

1×2=2



- (b) Classify the following into electrophiles and nucleophiles :

2



- (c) 2,4,6-trimethylaniline is more basic than 2,4,6-trinitroaniline. Explain.

2

- (d) What are the conditions for a molecule to undergo hyperconjugation? Draw the hyperconjugation structure of toluene.

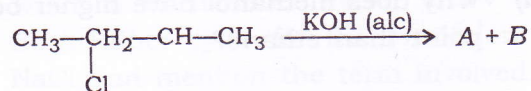
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7. (a) Give the method of preparation of alkanes by Würtz reaction. Give one of its limitations.

1½+½=2

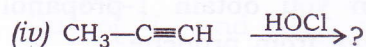
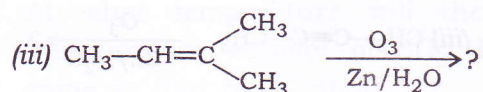
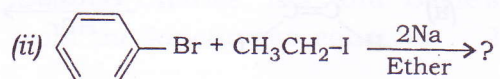
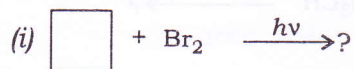
- (b) Predict the major and minor products of the following reaction :

1+1=2



(7)

- (c) Predict the correct products of the following reactions : 1×4=4



- (d) Give one method for the preparation of cyclohexane. 1

- (e) What happens when—

- (i) acetylene is treated with HBr;
(ii) acetylene is passed through red hot copper tube? 1+1=2

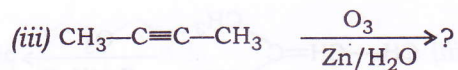
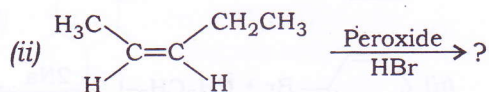
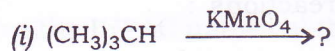
OR

8. (a) What are the limitations of the Baeyer's strain theory? Describe its modification. 1+1=2

- (b) What is cracking? What happens when *n*-hexane is heated at 500 °C? 1+1=2

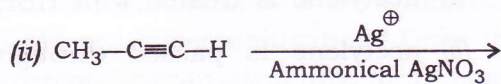
(8)

(c) Complete the following reactions : $1 \times 3 = 3$



(d) How can you obtain 1-propanol and 2-propanol from propene? 2

(e) Write the products of the following reactions : 2



(9)

UNIT—III

(Physical Chemistry—I)

(Marks : 19)

9. (a) Deduce Charles' law and Boyle's law from the kinetic gas equation. $1\frac{1}{2}+1\frac{1}{2}=3$
- (b) At what temperature will the root-mean-square velocity of SO_2 be the same as that of O_2 at 27°C ? 2
- (c) Out of N_2 and NH_3 , which one will have greater value for van der Waals' constants a and b ? 2
- (d) Derive the relation $n\lambda = 2d\sin\theta$, where the terms have their usual meanings. 3

OR

10. (a) Derive the van der Waals' equation of state for real gases. 3
- (b) Define the following : $1+1=2$
- (i) Liquefaction of gases
- (ii) Compressibility

- (c) The van der Waals' constants for two gases are as follows :

Gas	a (atm L ² mol ⁻²)	b (L mol ⁻¹)
X	1.39	0.0391
Y	3.59	0.0427

Which of them is more easily liquefiable and which has greater molecular size?

1+1=2

- (d) Discuss point defects in crystals. 3

11. (a) What is vapour pressure? What is the effect of temperature on vapour pressure? 1+1=2

- (b) "Water wets glass but mercury does not." Explain. 2

- (c) Derive the integrated rate expression for a first-order reaction. 3

- (d) Show that for a first-order reaction, the concentration of the reactant A after n -half-life times is given by

$$[A]_n = [A]_0 \left(\frac{1}{2}\right)^n$$
 $[A]_0$ is the initial concentration. 2

(11)

OR

12. (a) Define coefficient of viscosity. Mention its SI units. 1+1=2
- (b) What is surface tension? How does it vary with temperature? 1+1=2
- (c) What is meant by activation energy of a reaction? Explain how it is determined with the help of Arrhenius equation. 1+2=3
- (d) A first-order reaction is 40% complete in 50 minutes. Calculate the value of the rate constant. In what time will the reaction will be 80% complete? 1+1=2
