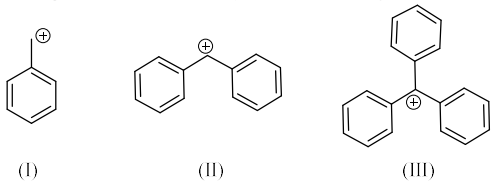
BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BSc. **SEMESTER: I**
BRANCH: CHEMISTRY **SESSION: MO/2023**

SUBJECT: CH121 BASIC CHEMISTRY-I

TIME: 3 HOURS **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Utilizing the appropriate concepts of kinetic theory of gases, prove that $< \varepsilon_x >= \frac{1}{2}kT$, where the terms have their usual meaning. Show that the Van dar Walls equation for gas could be expressed in terms of the Virial Equation.	[3+2]	2	2
Q.1(b)	Starting from the Maxwell's distribution of speed, derive the expressions for most probable and root mean square speeds.	[2.5+2.5]	2	2
Q.2(a)	Determine the double bond equivalence of the following molecules with probable structure. C_4H_6, $C_3H_4Cl_2$, C_3H_6O Compare the stability of following carbocations  (I) (II) (III)	[3+2]	2	3
Q.2(b)	Draw the π-molecular orbitals of ethylene and 1,3-butadiene and identify the HOMO and LUMO in both the molecules. Explain the greater stability of benzene than its open chain analog 1,3,5-hexatriene.	[3+2]	2	2
Q.3(a)	Graphically illustrate the angular shapes of s, p, d_{xy}, d_z^2 and f_z^3 orbitals.	[5]	3	2
Q.3(b)	How does a nodal region (in the wave function) effect chemical bonding and energy ordering of the concerned orbitals? Show and discuss the salient features of the radial distribution function for the 2s orbital.	[3+2]	3	2
Q.4(a)	What is viscosity? Explain the Newton's law of viscosity. What will be the unit and dimension of viscosity coefficient.	[1+2+2]	4	2
Q.4(b)	Derive the Poiseuille's equation for the flow rate of liquid.	[5]	4	1
Q.5(a)	Draw neat energy profile diagrams with proper labeling for exothermic and endothermic reactions. Also, in diagram show how rate of the reactions can be altered using positive catalyst.	[3+2]	5	2
Q.5(b)	What are singlet and triplet carbenes? Explain their formation, shape and addition reaction across a double bond.	[2+3]	5	2

:::::11/12/2023 M:::::