



**ST. JOSEPH'S UNIVERSITY, BENGALURU -27**  
**B.Sc. (CHEMISTRY) – I SEMESTER**  
**SEMESTER EXAMINATION: OCTOBER 2022**  
 (Examination conducted in December 2022)  
**CH 121 – CHEMISTRY I**

**Time: 2 Hours****Max. Marks: 50**

This paper contains **3** printed pages, **3** parts and **17** questions.  
 The periodic table is attached along with this question paper.

**PART-A**Answer any **FIVE** of the following questions.**(2 X 5 = 10)**

1. Write the general outer electronic configuration of d-block elements.
2. State Modern Periodic law.
3. Define covalent radii.
4. How do you prepare an alkene by elimination reaction?
5. Give the Born interpretation of  $|\psi|^2$ .
6. Calculate the mass required to prepare 100 cm<sup>3</sup> of 0.2 M NaOH.
7. Mention any two criteria in selecting a reaction for titration.

**PART-B**Answer any **FIVE** of the following questions.**(5 X 6 = 30)**

8. Set up the Schrödinger wave equation for a particle confined in a 1D potential well of length 'L' and solve it to obtain the expression for normalized wave equation.
9. a) Calculate the effective nuclear charge for a 3d electron in iron according to Slater's rule.  
 b) State Hund's rule of maximum multiplicity. Apply this rule to write the electronic configurations of i) nitrogen atom and ii) Cu<sup>+</sup> ion. (3+3)
10. Give the differences between the following:  
 a) accuracy and precision  
 b) primary and secondary standard reagents (3+3)
11. The following results were obtained in the replicate determination of iron in a given sample 19.4, 19.5, 19.6, 19.8, 20.1, 20.3 ppm. Calculate mean, median and standard deviation.
12. a) What is electron affinity? Explain its variation down the group in halogen family.  
 b) Name the principle oxide of boron. Why are the oxides of boron weakly acidic? (3+3)
13. a) Write the structure of a molecule that is i) aromatic ii) anti-aromatic.

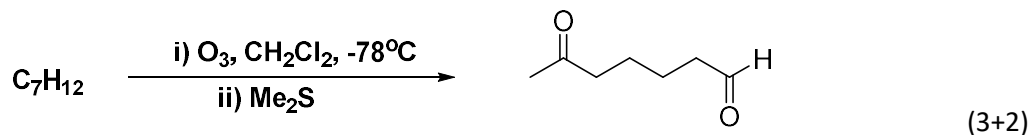
b) Give the structure(s) of the product(s) obtained when 2-bromo-butane reacts with potassium *tert*-butoxide (*t*-BuOK) in *tert*-butyl alcohol (*t*-BuOH) at 80 °C. Identify the major product. (3+3)

14. a) Explain the concept of resonance taking  $\text{CO}_3^{2-}$  as an example.  
b) What is steric effect? Explain the stability of *trans*- and *cis*-2-butene based on steric effect. (3+3)

### PART-C

Answer any **TWO** of the following questions. (5 X 2 = 10)

15. a) Arrange the following isoelectrons in their increasing order of atomic radii. Justify your answer.  $\text{O}^{2-}$ ,  $\text{N}^{3-}$ ,  $\text{F}^-$ ,  $\text{Na}^+$ ,  $\text{Mg}^{2+}$   
b) Why  $\text{SiO}_2$  exists as a solid while  $\text{CO}_2$  is gas at room temperature? (3+2)
16. a) Which would you expect to be the stronger acid? Explain your reasoning in each instance.  
i)  $\text{FCH}_2\text{COOH}$  or  $\text{ClCH}_2\text{COOH}$   
ii)  $\text{FCH}_2\text{COOH}$  or  $\text{FCH}_2\text{CH}_2\text{COOH}$   
b) Give the structure of an unknown alkene with the formula  $\text{C}_7\text{H}_{12}$  that undergoes ozonolysis to yield, after acidification only the following product.



17. a) Calculate the maximum number of electrons having  $n + \ell = 4$ .  
b) Calculate de-Broglie wavelength of an electron (mass =  $9.1 \times 10^{-31}$  kg) moving at 1% speed of light ( $h = 6.634 \times 10^{-34}$  kg  $\text{m}^2 \text{s}^{-1}$ ; speed of light =  $3.0 \times 10^8$   $\text{m s}^{-1}$ ). (2+3)

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# Periodic Table of the Elements

1 H Hydrogen 1.01																	2 He Helium 4.00
3 Li Lithium 6.94	4 Be Beryllium 9.01											5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
11 Na Sodium 22.99	12 Mg Magnesium 24.31											13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 51.99	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.63	33 As Arsenic 74.92	34 Se Selenium 78.97	35 Br Bromine 79.90	36 Kr Krypton 84.80
37 Rb Rubidium 84.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.95	43 Tc Technetium 98.91	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.6	53 I Iodine 126.90	54 Xe Xenon 131.25
55 Cs Cesium 132.91	56 Ba Barium 137.33	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.09	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (208.98)	85 At Astatine 209.99	86 Rn Radon 222.02
87 Fr Francium 223.02	88 Ra Radium 226.03	89-103 Actinides	104 Rf Rutherfordium D611	105 Db Dubnium D612	106 Sg Seaborgium D661	107 Bh Bohrium D641	108 Hs Hassium D691	109 Mt Meitnerium D681	110 Ds Darmstadtium D691	111 Rg Roentgenium D721	112 Cn Copernicium D721	113 Uut Ununtrium unknown	114 Fl Flerovium D891	115 Uup Ununpentium unknown	116 Lv Livermorium D291	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown
89 La Lanthanum 138.91	90 Ce Cerium 140.12	91 Pr Praseodymium 140.91	92 Nd Neodymium 144.24	93 Pm Promethium 144.91	94 Sm Samarium 150.36	95 Eu Europium 151.96	96 Gd Gadolinium 157.25	97 Tb Terbium 158.93	98 Dy Dysprosium 162.50	99 Ho Holmium 164.93	100 Er Erbium 167.26	101 Tm Thulium 168.93	102 Yb Ytterbium 173.06	103 Lu Lutetium 174.97			
Ac Actinium 227.03	Th Thorium 232.04	Pa Protactinium 231.04	U Uranium 238.03	Np Neptunium 237.05	Pu Plutonium 244.06	Am Americium 243.06	Cm Curium 247.07	Bk Berkelium 247.07	Cf Californium 251.08	Es Einsteinium D541	Fm Fermium 257.10	Md Mendelevium 258.1	No Nobelium 259.10	Lr Lawrencium D621			