

Registration Number:

Date & session:



ST JOSEPH'S UNIVERSITY, BENGALURU -27
BSc Chemistry – I SEMESTER
SEMESTER EXAMINATION: OCTOBER 2023
(Examination conducted in November/ December 2023)
CH 122: Chemistry- I
(For current batch students only)

Time: 2 Hours

Max Marks: 60

This paper contains **4** printed pages, **3** parts and **20** questions
NOTE: The periodic table is attached along with this question paper.

PART-A

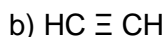
Answer any **SEVEN** of the following questions

(7 x 2 = 14)

1. Express the result of the following calculation to the appropriate number of significant figures.

$$\frac{3.24 \times 0.08666}{5.006}$$

2. State Hund's rule of maximum multiplicity.
3. What is the significance of ψ and $|\psi^2|$?
4. Give the equation for Heisenberg's uncertainty principle and explain the terms in it.
5. Define periodicity. What is the cause of periodicity in the properties of elements?
6. Why is the increase in ionic radius not so prominent as we move from K^+ to Rb^+ ?
7. Draw the orbital overlap picture of ethene. Indicate the hybridization of carbon in the molecule.
8. What are antiaromatic compounds? Give an example.
9. Give the conjugate base of the following acids.



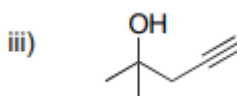
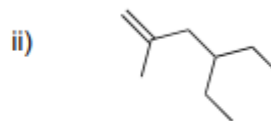
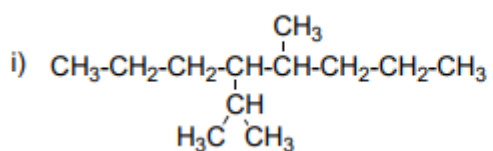
PART B

Answer any **SIX** of the following questions. Each sub question carries 3 marks. **(6 x 6 = 36)**

10. a) Is Na_2CO_3 a primary standard reagent? Mention the criteria in choosing a reagent as primary standard.
b) Sketch the titration curve for the titration of 0.1 M HCl and 0.1 M NaOH. Suggest an indicator for the above titration.

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11. a) The following replicate weighing were obtained for an analysis: 49.8, 50.2, 48.6, and 49.7 mg. Calculate the standard deviation for the above data.
 b) Differentiate between determinate and indeterminate errors.
12. a) Sketch the radial probability distribution curves for 2p and 3s orbitals and indicate the node(s) if any.
 b) Calculate the effective nuclear charge for 3d electron in scandium using Slaters rule.
13. Derive the Schrödinger wave equation for a particle confined in a 1-D box of length 'L' and solve it to obtain the expression for normalized wave equation.
14. a) Explain the variation in first ionization energy of elements across the second period with suitable reasons.
 b) Define electron affinity. Why is the electron affinity of chlorine more than that of fluorine and bromine?
15. a) Arrange F_2O , Br_2O , and Cl_2O in the order of increasing bond angles with explanation.
 b) Give the general formula of trioxides of group 15. Why does the acidic character of oxides of group 15 elements decrease as we go down the group?
16. a) What is inductive effect? Using the concept of inductive effect arrange the following in increasing order of acid strength and justify your choice of order.
 $CHCl_2COOH$, CH_3COOH , CCl_3COOH
 b) Give chemical equations for the following reactions:
 i) Dehydrohalogenation of alkyl halides with a bulky base.
 ii) Oxidation of an alkene with hot alkaline $KMnO_4$.
 iii) Hydrogenation of alkene in the presence of a catalyst.
17. a) Discuss the free radical mechanism of chlorination of methane.
 b) Give the IUPAC nomenclature for the following compounds.



PART C

Answer any **TWO** of the following questions.

(2 x 5 = 10)

18. a) A commercially sold con. HCl is 35 % HCl by mass. If the density of this commercial acid is 1.46 g/mL, calculate molarity of the solution.
- b) All elements of group 15, form pentahalides except N and Bi. Justify. (3+2)
19. a) Which of the following sets of quantum numbers are not allowed and why?
- i) $n=2, l=2, m=0, s=+1/2$
 - ii) $n=2, l=0, m=-2, s=-1/2$
 - iii) $n=3, l=2, m=+2, s=-1/2$
- b) Consider an electron and proton moving with same velocity. Choose the one which has higher de-Broglie wavelength. Give reason. (mass of proton = 1.67×10^{-27} kg; mass of electron = 9.11×10^{-31} kg) (3+2)
20. a) Outline the steps in the synthesis of propyne from propene.
- b) Of the two resonance structures of the acylium ion $R-\overset{+}{C}\equiv O:$ \longleftrightarrow $R-\overset{+}{C}=O:$ which structure is more stable, and why?

(3+2)

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											13 B Boron 10.81	14 C Carbon 12.01	15 N Nitrogen 14.01	16 O Oxygen 16.00	17 F Fluorine 19.00	18 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 131.29
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 [209]	85 At Astatine [209]	86 Rn Radon 222.02
87 Fr Francium 223.02	88 Ra Radium 226.03	89-103 Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [293]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown
57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium 144.91	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97			
89 Ac Actinium 227.03	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium 237.05	94 Pu Plutonium 244.06	95 Am Americium 243.06	96 Cm Curium 247.07	97 Bk Berkelium 247.07	98 Cf Californium 251.08	99 Es Einsteinium [254]	100 Fm Fermium 257.10	101 Md Mendelevium 258.1	102 No Nobelium 259.10	103 Lr Lawrencium [262]			