

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86**

(For candidates admitted during the academic year 2023-24 & thereafter)

**B.Sc. DEGREE EXAMINATION, NOVEMBER 2024**

**BRANCH IV- CHEMISTRY**

**FIRST SEMESTER**

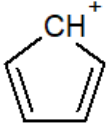

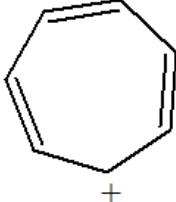
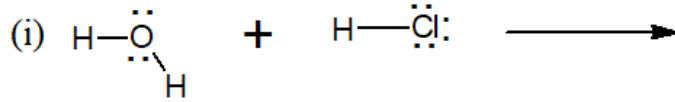
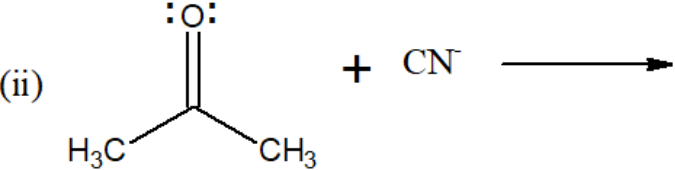
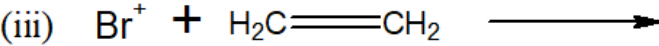
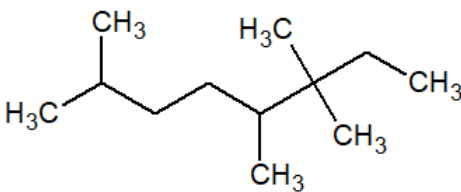
**COURSE : MAJOR CORE**  
**PAPER : GENERAL CHEMISTRY**  
**SUBJECT CODE : 23CH/MC/GC14**  
**TIME : 3 HOURS**

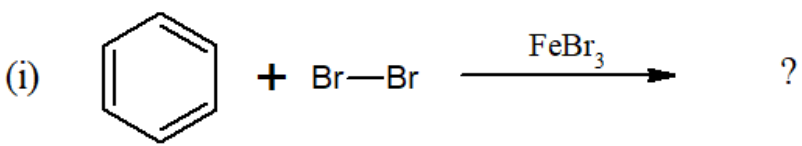
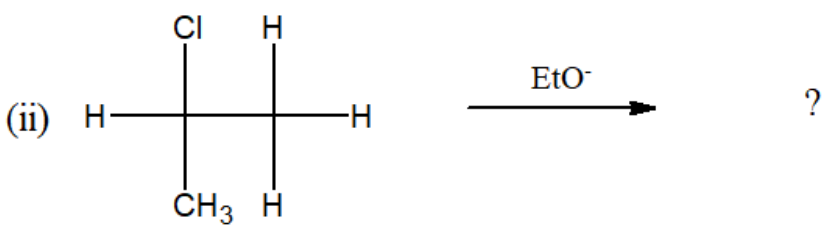
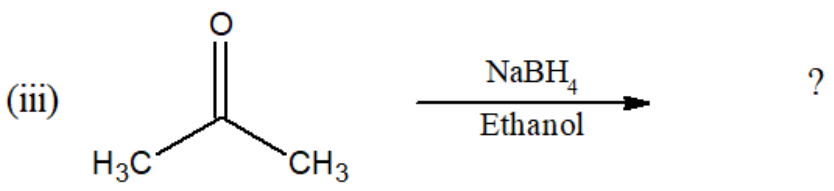
**MAX.MARKS :100**

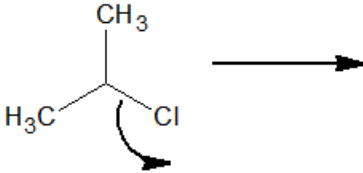
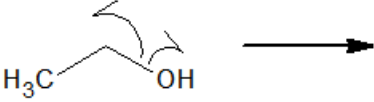
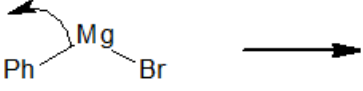
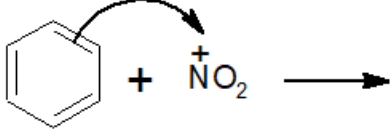
Q.No.	SECTION-A	CO	KL
	<b>MULTIPLE CHOICE QUESTIONS: (15 x 1 = 15 Marks)</b>		
1.	The maximum number of electrons that can be accommodated in the third shell (M-shell) is _____ a) 18    b) 8    c) 32    d) 2	CO1	K1
2.	The de Broglie wavelength is associated with _____ a) only particles with charge    b) all moving particles c) only light waves    d) only massive particles	CO1	K1
3.	The mathematical expression for Heisenberg's uncertainty principle is a) $\Delta x \cdot \Delta p \geq \frac{\hbar}{2}$ b) $\Delta E \cdot \Delta t \geq \frac{h}{2}$ c) $\Delta p \cdot \Delta t \geq \frac{h}{2}$ d) $\Delta x \cdot \Delta p \geq \frac{h}{2\pi}$	CO1	K1
4.	A normalized wave function satisfies the condition a) The integral of the square of the wave function over all space is zero b) The integral of the square of the wave function over all space is one c) The wave function is always positive d) The wave function is orthogonal to other wave functions	CO1	K1
5.	Which of the following pairs exhibit diagonal relationship in the periodic table? a) Na and Mg    b) Li and Mg    c) Be and Si    d) B and Al	CO1	K1
6.	Ionization energy generally increases across a period because: a) Atomic size increases. b) Nuclear charge decreases. c) Atomic size decreases and nuclear charge increases. d) Screening effect decreases.	CO1	K1
7.	A metal ion with low polarizability and high charge density is classified as a) A hard acid    b) A soft acid c) A hard base    d) A soft base	CO1	K1
8.	_____ is an example of Lux Flood acid. a) Al <sub>2</sub> O <sub>3</sub> b) SO <sub>3</sub> c) SiO <sub>2</sub> d) MgO	CO1	K1
9.	Which of the following is an electrophile? a) CN <sup>-</sup> b) Cl <sup>-</sup> c) NO <sub>2</sub> <sup>+</sup> d) NH <sub>3</sub>	CO1	K1

10.	_____ is an electrophilic substitution reaction a) Addition of HBr to propene                      b) Bromination of benzene c) Reaction of NH <sub>3</sub> with ethyl chloride        d) Hydrolysis of ethyl acetate	CO1	K1
11.	The cyclopropenyl cation is considered aromatic because it has a) 4 $\pi$ electrons.                                      b) 6 $\pi$ electrons. c) 2 $\pi$ electrons.                                      d) no $\pi$ electrons.	CO1	K1
12.	Which of the following is NOT true about the screening effect? a) It reduces the attractive force between the nucleus and outer electrons b) It is more significant for s-orbital electrons than d-orbital electrons c) It increases as we move down a group in the periodic table d) It remains constant as the atomic number increases in a period	CO1	K1
13.	For a given principal quantum number $n = 3$ , what are the possible values of the azimuthal quantum number ( $l$ )? a) 0, 1, 2, 3    b) 0, 1    c) 0, 1, 2    d) 0	CO1	K1
14.	The prefix name of -CONH <sub>2</sub> is _____ a) oxo    b) formyl    c) carbamoyl    d) mercapto		
15.	Identify the order of stability of the given intermediates.  <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>(i) <math>\text{H}_3\text{C}-\overset{\bullet}{\text{C}}(\text{CH}_3)-\overset{\text{H}_2}{\text{C}}-\text{CH}_3</math></p> </div> <div style="text-align: center;"> <p>(ii) <math>\text{C}_6\text{H}_5-\overset{\text{H}}{\overset{\bullet}{\text{C}}}-\text{CH}_3</math></p> </div> <div style="text-align: center;"> <p>(iii) <math>\text{H}_3\text{C}-\text{CH}_2-\overset{\bullet}{\text{C}}\text{H}_2</math></p> </div> </div> a) (ii) > (iii) > (i)                                      b) (iii) > (i) > (ii) c) (iii) > (i) > (ii)                                      d) (ii) > (i) > (iii)	CO1	K1
	<b>SECTION- B</b>		
	<b>FILL IN THE BLANKS:</b> <span style="float: right;"><b>(5 x 1 = 5 Marks)</b></span>	<b>CO</b>	<b>KL</b>
16.	The energy required to remove an electron from an atom in its gaseous state is called _____	CO2	K2
17.	An atom with atomic number 17 and mass number 35 will have _____ neutrons.	CO2	K2
18.	The time-independent Schrödinger equation is _____	CO2	K2
19.	The Compton shift depends on _____	CO2	K2
20.	The _____ effect involves the permanent shift of electron density through sigma bonds caused by differences in electronegativity.	CO2	K2

	<b>MATCH THE FOLLOWING:</b>	<b>(5 x 1 = 5 Marks)</b>	<b>CO</b>	<b>KL</b>
21.	Ernest Rutherford	A. Artificial radioactivity	CO2	K2
22.	Thomson	B. eigen values real	CO2	K2
23.	Hermitian operator	C. screening effect	CO2	K2
24.	Slater rule	D. plum pudding model	CO2	K2
25.	Irène Joliot-Curie	E. Nuclear Model	CO2	K2
	<b>ANSWER IN ONE OR TWO LINES:</b>	<b>(5 x 1 = 5 Marks)</b>	<b>CO</b>	<b>KL</b>
26.	What is hyperconjugation?		CO2	K2
27.	What are isobars?		CO2	K2
28.	What is photo electric effect?		CO2	K2
29.	What is tautomerism?		CO2	K2
30.	What is levelling effect?		CO2	K2
	<b>SECTION-C</b>		<b>CO</b>	<b>KL</b>
	<b>Answer any SIX of the following:</b>	<b>(6 x 5 = 30 Marks)</b>		
31.	a) How did the Davisson-Germer experiment confirm the wave nature of electrons? (3 Marks) b) Consider $\frac{d}{dx} e^{kx}$ . Determine whether $e^{kx}$ is an eigenfunction and if so, find its eigenvalue. (2 Marks)		CO3	K3
32.	Discuss with an example the general trends that are observed for atomic radii and ionization energy as you move down a group in the periodic table.		CO3	K3
33.	a) Determine whether the isotope ${}^{56}_{26}\text{Fe}$ (iron-56) is stable based on its neutron-to-proton (n/p) ratio. (3 Marks) b) Give any two applications of HSAB. (2 Marks)		CO3	K3

34.	<p>Apply Huckels rule and find out whether the given compounds are Aromatic/ Anti aromatic / Non-aromatic:</p> <div style="display: flex; justify-content: space-around; align-items: center;">    </div>	CO3	K3
35.	<p>a) Draw the curved arrow notation for the following reactions: (3 x 1 = 3 marks)</p> <p>(i) </p> <p>(ii) </p> <p>(iii) </p> <p>b) Apply lowest sum rule and give the IUPAC name for the given compound: (2 marks)</p> <div style="text-align: center;">  </div>	CO3	K3
36.	Discuss the postulates of quantum mechanics.	CO3	K3
37.	Discuss the stability of carbocations. What factors influence their stability? Provide examples of primary, secondary, and tertiary carbocations.	CO3	K3

<b>SECTION-D</b>		<b>CO</b>	<b>KL</b>
	<b>Answer any FOUR of the following :</b> (4 x 5 = 20 Marks)		
38.	a) Calculate the mass defect and binding energy for U-235. One U-235 atom has a mass of 235.043924 amu. (3 Marks) b) What is Compton effect? (2 Marks)	CO4	K4
39.	What is the trend in electronegativity across the p-block elements, and how does this affect their reactivity?	CO4	K4
40.	Discuss the shape and characteristics of d orbitals. How many d orbitals are there for a given principal quantum number, and what are their shapes?	CO4	K4
41.	a) Write the structural formulae for the following: (2 x 1 = 2 Marks) (i) 2-Methyl-2-penten-1-ol (ii) 3-Methylpentan-2-one b) Distinguish between inductive and electromeric effect. (3 Marks)	CO4	K4
42.	State Soddy's radioactive displacement law. How does it describe the changes in atomic and mass numbers during alpha and beta decay?	CO4	K4
<b>SECTION – E</b>		<b>CO</b>	<b>KL</b>
	<b>Answer any TWO of the following :</b> (2 x 10 = 20 Marks)		
43.	a. Predict the product and identify the name for the following reactions: (3 x 2 = 6 Marks)  (i)  ?  (ii)  ?  (iii)  ?  b. Analyse the radioactive disintegration of 4n and 4n+1 series. (4 Marks)	CO5	K5
<b>(OR)</b>			

	<p>a) What is the Geiger–Nuttall rule, Discuss the characteristics of <math>\alpha</math>, <math>\beta</math> and <math>\gamma</math> rays (2+5 Marks)</p> <p>b) Determine the Effective Nuclear Charge for a 1s Electron in Lithium (Li). Atomic number of Li is 3 (3 Marks)</p>	CO5	K5
44.	<p>a) How did Bohr's theory explain the line spectrum of hydrogen? (7 Marks)</p> <p>b) Explain Bronsted Lowry concept of acids and bases (3 Marks)</p> <p style="text-align: center;"><b>(OR)</b></p> <p>a) Identify the missing species and type of nuclear reactions in the following: (3 x 2 = 6 Marks)</p> <p>(i) <math>{}^{11}_{6}\text{C} \rightarrow \text{_____} + {}^{0}_{+1}e + \nu</math></p> <p>(ii) <math>{}^{238}_{92}\text{U} \rightarrow \text{_____} + {}^{4}_{2}\alpha</math></p> <p>(iii) <math>{}^{2}_{1}\text{H} + {}^{3}_{1}\text{H} \rightarrow \text{_____} + {}^{1}_{0}n</math></p> <p>b) Evaluate the intermediates formed in the given reactions: (4 x 1 = 4 Marks)</p> <p>(i) </p> <p>(ii) </p> <p>(iii) </p> <p>(iv) </p>	CO5	K5