

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86
(For candidates admitted during the academic year 2023 – 24)

B.Sc. DEGREE EXAMINATION, NOVEMBER 2024
BRANCH IV- CHEMISTRY
THIRD SEMESTER

COURSE : MAJOR CORE
PAPER : PHYSICAL CHEMISTRY - I
SUBJECT CODE : 23CH/MC/PC33
TIME : 3 HOURS

MAX.MARKS :100

Q.No.	SECTION-A Answer all questions (15x1=15 marks)	CO	KL
1.	The radius ratio in an ionic crystal lies between 0.732 -1.000, the coordination number is a) 4 b) 6 c) 8 d) 12	CO1	K1
2.	The number of atoms in a unit cell of a face centered cube is a) 2 b) 4 c) 6 d) 8	CO1	K1
3.	The pH of 0.001M HCl is a) 1 b) 4 c) 3 d) 0.001	CO1	K1
4.	The fraction of total molecules which is ionised in a solution of an electrolyte is known as a) dissociation constant b) mol fraction of the electrolyte c) degree of dissociation d) electrolyte constant	CO1	K1
5.	Acetic acid is a weak electrolyte because of a) Its molecular weight b) it exists as a dimer c) it is highly unstable d) it has low ionisation	CO1	K1
6.	For the plane that intersects the x-axis at 3, y-axis at 2 and z-axis at infinity the Miller index is a) (320) b) (211) c) (230) d) (101)	CO1	K1
7.	The substances which retain their magnetic field when removed from the magnetic field are called a) paramagnetic b) diamagnetic c) ferrimagnetic d) ferromagnetic	CO1	K1
8.	The net dipole moment of the molecule is a) sum of all individual bond moments b) product of all individual bond moments c) vector resultant of all the individual bond moments d) difference of all individual bond moments.	CO1	K1
9.	The hydrolysis constant K_h of a weak base and a strong acid is ----- to the dissociation constant K_b of the base a) directly propotional b) inversely proportional c) equal d) not equal	CO1	K1
10.	NaCN on hydrolysis produces a solution which has a) pH >7 b) pH=7 c) pH<7 d) pH =1	CO1	K1

11.	The solubility of an electrolyte of type AB_2 is s , the expressions for solubility product is a) $K_{sp} = s^2$ b) $K_{sp} = 4s^2$ c) $K_{sp} = 3s^3$ d) $K_{sp} = 4s^3$	CO1	K1
12.	The addition of HCl will not suppress the ionization of a) CH_3COOH b) H_2SO_4 c) H_2S d) C_6H_5COOH	CO1	K1
13.	The solubility of $Mg(OH)_2$ is $\sqrt{2}$ its solubility product is a) 8 b) $4\sqrt{2}$ c) $8\sqrt{2}$ d) $9\sqrt{2}$	CO1	K1
14.	Which of the following pairs of electrolyte will show common ion effect? a) $HCl + HNO_3$ b) $HCl + H_2S$ c) $HCl + H_2SO_4$ d) $HCl + NaCl$	CO1	K1
15.	In cubic close packed pattern of a metallic crystal, the coordination no is a) 12 b) 8 c) 6 d) 4	CO1	K1

SECTION- B			
	Answer all the questions Fill in the blanks	(15 x 1 = 15 Marks)	
		CO	KL
16.	Ostwald's dilution law is applicable for _____ electrolytes	CO2	K2
17.	Smectic liquid crystals have ----- structure	CO2	K2
18.	The paramagnetism is due to the presence of -----	CO2	K2
19.	Molecules or ions that can behave both as Bronsted acid and base are called -----	CO2	K2
20.	pK_w is represented as _____	CO2	K2
21.	Liquid crystals have ----- property of a solid	CO2	K2
22.	Example for Lewis acid is _____	CO2	K2
23.	The ionic product of water will increase when the temperature -----	CO2	K2
24.	The degree of hydrolysis of a weak base and a strong acid is given by the relation -----	CO2	K2
25.	The number of atoms present in body-centered unit cell is -----	CO2	K2
	Answer in a line or two	CO2	K2
26.	The pH of a solution is 3. Calculate the hydrogen ion concentration .	CO2	K2
27.	Give the expression for the solubility product of $Al(OH)_3$.	CO2	K2
28.	Calculate Miller indices of a crystal plane which is cut through the crystal axes $2a, -3b, -c$.	CO2	K2
29.	What is the expression for dipole moment?	CO2	K2
30.	Give the expression for Henderson's equation of basic buffer.	CO2	K2

SECTION- C				
Answer any 6 questions		(6 x 5 = 30 Marks)	CO	KL
31.	a) The solubility of BaSO ₄ is 2.33×10^{-4} gm/ml at 20 ° C. Calculate the solubility product of BaSO ₄ . b) What is law of rational index? (3+2)		CO3	K3
32.	Derive Bragg equation and describe the investigation of the internal structure of a solid by using Bragg method.		CO3	K3
33.	a) The dissociation constants of formic and acetic acid are 21.4×10^{-4} and 1.81×10^{-5} respectively. Find the relative strength of the acids b) Explain the Common ion effect with one example. . (3+2)		CO3	K3
34.	a) Calculate the pH of a 0.01 M solution of NH ₄ OH s, the Dissociation constant of NH ₄ OH is 1.8×10^{-5} . b) Explain the Buffer solution with one example. (3+2)		CO3	K3
35.	Describe the structure of ZnS		CO3	K3
36.	Explain the classification of liquid crystals according to molecular rearrangement.		CO3	K3
37.	Explain dipole moment of H ₂ O and CO ₂ .		CO3	K3

SECTION- D				
Answer any four questions		(4x 5 = 20 marks)	CO	KL
38.	Describe the measurement dipole moment of a substance using Clausius – Mussotti equation.		CO4	K4
39.	Derive Henderson-Hasselbach equation for an acidic buffer.		CO4	K4
40.	a) Calculate the pH at 25 ° C containing 0.1 M CH ₃ COONa and 0.03 M CH ₃ COOH .pK _a for CH ₃ COOH = 4.57. b) Discuss the buffer action of aqueous solution of ammonium acetate. (3+2)		CO4	K4
41.	a) Find the degree of dissociation of HF in 1M aqueous solution. The value of K _a is 7.2×10^{-4} . b) Give any 2 factors which influence the degree of dissociation. (3+2)		CO4	K4
42.	a) Differentiate between permanent and induced electric dipole moments. b) Identify cis and trans isomers using dipole moment. (3+2)		CO4	K4

	SECTION E	CO	KL
	Answer any two questions (2 x 10 = 20 Marks)		
43.	a) Describe the structure of NaCl b) Calculate the angle at which second-order diffraction will appear in a X-ray spectrophotometer when X-rays of wavelength 1.5 Å are used and the interplanar distance is 4.04 Å. (6+4) (OR) Elucidate the XRD pattern for simple and bcc lattice systems.	CO5	K5
44.	a) State and explain Lowry- Bronsted theory and Lewis's theory of acids and bases. b) Explain polyprotic acids with an example (7+3) (OR) a) Calculate the concentration of sodium formate (HCOONa) that must be present in a 0.01 M solution of formic acid to produce a pH of 3.80 K_a for formic acid is 1.8×10^{-4} b) Discuss the separation of basic ions into groups by using solubility product principle (4+6)	CO5	K5

