

Roll. No.

Question Booklet Number

O.M.R. Serial No.

--	--	--	--	--	--	--	--

M.Sc. (SEM.-III) (NEP) (SUPPLE.) EXAMINATION, 2024-25

CHEMISTRY

(Solid State Chemistry)

Paper Code							
B	0	2	0	9	0	3	T

(Elective)

Question Booklet
Series

A

Time : 1 : 30 Hours

Max. Marks : 75

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.
4. Four alternative answers are mentioned for each question as - A, B, C & D in the booklet. The candidate has to choose the correct / answer and mark the same in the OMR Answer-Sheet as per the direction :

(Remaining instructions on last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, उसे तुरन्त बदल लें।
4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर- A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छानना है। उत्तर को OMR उत्तर-पत्रक में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

(शेष निर्देश अन्तिम पृष्ठ पर)

1. Which of the following solids are crystalline?
 - (A) Ionic solids
 - (B) Covalent solids
 - (C) Metallic solids
 - (D) All of the above
2. Relation between number of faces, edges and interfacial angles is : (f=faces, c=angles, e= edges) :
 - (A) $f = e - c + 2$
 - (B) $f = c - e + 2$
 - (C) $f = c + e + 2$
 - (D) None of these
3. Total number of symmetry elements in a cubic crystal is :
 - (A) 11
 - (B) 9
 - (C) 13
 - (D) 8
4. Intercepts made by a plane on the crystallographic axes (in terms of a, b & c) are 2a, 3b and 2c, the Miller indices will be :
 - (A) 2, 3, 2
 - (B) 3, 2, 3
 - (C) 3, 2, 2
 - (D) 2, 2, 3
5. The intercepts made on the crystallographic axes are a, -b, c the plane is labelled as :
 - (A) $(1\bar{1}1)$
 - (B) $(\bar{1}11)$
 - (C) $(11\bar{1})$
 - (D) 111
6. The Bragg's equation is : ?
 - (A) $d = 2n \lambda \sin\theta$
 - (B) $2n \sin\theta = d\lambda$
 - (C) $2d \sin\theta = n\lambda$
 - (D) None of the above
7. Which of the defects are point defects?
 - (A) Schottky defects
 - (B) Frenkel defects
 - (C) Metal excess and metal deficiency defects
 - (D) All of the above
8. The electrical neutrality is found in crystals having :
 - (A) Schottky defects
 - (B) Frenkel defects
 - (C) Metal excess and metal deficiency defects
 - (D) All of the above

9. A n-type conductor is obtained when an insulator has valency :
(A) Less than that of impurity
(B) More than that of impurity
(C) Equal to that of impurity
(D) None of the above
10. A p-type semiconductor is obtained when an insulator has valency :
(A) Less than that of impurity
(B) More than that of impurity
(C) Equal to that of impurity
(D) None of the above
11. When As or P is added to Si or Ge, the semiconductor obtained is :
(A) n-type
(B) p-type
(C) Both (A) and (B)
(D) None of the above
12. A superconductor is one which conducts electricity :
(A) without resistance
(B) with high resistance
(C) with low conductance
(D) None of the above
13. The superconductivity in materials has been found :
(A) Only at low temperture
(B) At any temperature
(C) At high temperature
(D) At moderate temperture
14. The coordination number of Na^+ and Cl^- in Na^+Cl^- crystal are :
(A) Both 8
(B) 6 and 8
(C) 8 and 6
(D) Both 6
15. The lattice energy of an ionic crystal is :
(A) Energy required to break one mole crystal lattice
(B) Energy required to produce one mole crystal lattice
(C) Due to decrease in potential energy during its formation from ions
(D) All of the above
16. An ionic solid is soluble in water when :
(A) Hydration energy > Lattice energy
(B) Hydration energy < Lattice energy
(C) Hydration energy = Lattice energy
(D) None of the above
17. The electrical conduction in n-type semiconductors is due to migration of:
(A) Electrons
(B) Positive holes
(C) Free electrons
(D) All of the above

18. The electrical conduction in p-type semiconductors is due to migration of:
- Electrons
 - Positive holes
 - Free electrons
 - All of the above
19. A crystal having metal-excess defect acts as :
- n-type semiconductor
 - p-type semiconductor
 - Superconductor
 - Insulator
20. A crystal having metal-deficiency defect acts as :
- n-type semiconductor
 - p-type semiconductor
 - Superconductor
 - All of the above
21. Intrinsic semiconductors are due to :
- Schottky defects
 - Frenkel defects
 - Both Schottky and Frenkel defects
 - None of the above
22. Extrinsic semiconductors are obtained because of :
- Schottky and frenkel defects
 - Point defects
 - Metal excess and metal deficiency defects
 - None of the above
23. Which is the less close pack structure?
- Body-centred cubic arrangement
 - Face-centred cubic arrangement
 - Primitive cubic close arrangements
 - None of the above
24. Schottky defects are due to :
- Combined effect of cation vacancy and an interstitial
 - Combined effect of cation and anion vacancies
 - Metal excess centres
 - None of the above
25. The rate of solid-solid reaction depends on :
- Diffusion of product from reactants
 - Diffusion of reactants into each other
 - Surface area of reactants
 - All of the above
26. The reaction : $\text{ZnO} + \text{Al}_2\text{O}_3 \rightarrow \text{ZnAl}_2\text{O}_4$ is an example of :
- Solid-solid reaction
 - Solid-liquid reaction
 - A gas phase reaction
 - None of the above

27. An extrinsic semiconductor is :
 (A) p-type
 (B) n-type
 (C) Both n-type and p-type
 (D) None of the above
28. The superconductor is a :
 (A) Perfect conductor
 (B) Perfect diamagnet
 (C) Poor conductor
 (D) All of the above
29. Fullerenes are :
 (A) Clusters containing metal and large number of C-atoms
 (B) Clusters containing large number of C-atoms
 (C) Both (A) and (B)
 (D) None of the above
30. A superconductor can be used for :
 (A) Lossless transmission of power
 (B) Generating strong magnetic field
 (C) Making memory element in a computer
 (D) All of the above
31. Number of Bravais Lattices are :
 (A) Seven
 (B) Fourteen
 (C) Forty Three
 (D) Nine
32. Which of the following statement is not true for crystalline solids?
 (A) They have sharp melting point
 (B) They cannot be cleaved
 (C) They have definite arrangement of constituent
 (D) They are anisotropic
33. Size of crystals depend upon :
 (A) Temperature
 (B) Pressure
 (C) Rate of its formation
 (D) None of these
34. Crystals of a substance have :
 (A) Definite geometry
 (B) Definite size
 (C) Different interfacial angle
 (D) Different center of symmetry
35. Crystals can be divided into the following crystal systems :
 (A) 5
 (B) 7
 (C) 14
 (D) 32
36. In a crystal, the number of centre of symmetry would be :
 (A) 1
 (B) 2
 (C) 3
 (D) 4
37. In a unit of NaCl crystal lattice, the number of molecules present are :
 (A) 1
 (B) 2
 (C) 3
 (D) 4

38. NaCl crystal is :
 (A) Monoclinic
 (B) Tetragonal
 (C) Cubic
 (D) Orthorhombic
39. The number of elements of symmetry for a cubic crystal is :
 (A) 1
 (B) 7
 (C) 14
 (D) 23
40. The simplest crystalline symmetry for a solid is :
 (A) Cubic
 (B) Monoclinic
 (C) Triclinic
 (D) Tetragonal
41. Which of the following is not a crystalline solid?
 (A) Glass
 (B) Sugar
 (C) NaCl
 (D) Sulphur
42. Which one of the following is a crystalline solid?
 (A) Rubber
 (B) Sulphur
 (C) Glass
 (D) Plastics
43. When $a \neq b \neq c$ and $\alpha \neq \beta \neq 90^\circ$, then unit cell is :
 (A) Tetragonal
 (B) Sulphur
 (C) Glass
 (D) Plastics
44. The plane which will be absent in the simple cubic system is :
 (A) 100
 (B) 110
 (C) 111
 (D) 200
45. Cesium chloride (CsCl) crystallizes in a bcc lattice. The number of atoms in the unit cell is :
 (A) 1
 (B) 2
 (C) 4
 (D) 6
46. Sodium Chloride (NaCl) crystallizes in a fcc lattice. The number of atoms in the unit cell is :
 (A) 2
 (B) 4
 (C) 6
 (D) 8
47. The structure of KCl as determined by X-ray study is :
 (A) simple cubic
 (B) bcc
 (C) fcc
 (D) rhombic

48. In sodium chloride crystal, each chloride ion is surrounded by :
- (A) 4Na^+
 (B) 6Na^+
 (C) 6Cl^-
 (D) 8Na^+
49. For body centred cubic lattice, standard ratio for d_{100} , d_{110} and d_{111} plane is :
- (A) $1 : \frac{1}{\sqrt{2}} : \frac{1}{\sqrt{3}}$
 (B) $1 : \frac{1}{\sqrt{2}} : \frac{2}{\sqrt{3}}$
 (C) $1 : \sqrt{2} : \frac{1}{\sqrt{3}}$
 (D) $\frac{1}{\sqrt{2}} : \frac{1}{\sqrt{3}} : \frac{2}{\sqrt{3}}$
50. The number of atoms per unit cell in a simple cubic, fcc and bcc arrangement are respectively :
- (A) 8, 14, 9
 (B) 1, 4, 2
 (C) 1, 2, 4
 (D) 4, 1, 2
51. CaO and NaCl have the same crystal structure and nearly the same ionic radii. If U is the lattice energy of NaCl, the approximate lattice energy of CaO is :
- (A) $4U$
 (B) U
 (C) $2U$
 (D) $U/2$
52. In a simple cubic structure there is :
- (A) 6–6 coordination
 (B) 8–8 coordination
 (C) 4–4 coordination
 (D) 6–4 coordination
53. Tetragonal crystal system has the following unit cell dimensions :
- (A) $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$
 (B) $a = b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$
 (C) $a = b \neq c$ and $\alpha = \beta = 90^\circ$, $\gamma = 120^\circ$
 (D) $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$
54. Space lattice of CsCl is :
- (A) Simple cubic
 (B) Face centred cubic
 (C) Body centred cubic
 (D) Hexagonal closed packed
55. In the crystal of CsCl, the nearest neighbours of each Cs^+ ion are :
- (A) 6Cl^- ions
 (B) 6Cs^+ ions
 (C) 8Cl^- ions
 (D) 8Cs^+ ions

56. X-rays of wavelength 0.134 nm gave a first order diffraction from the crystal surface when the value of θ was found to be 10.5° . If $\sin 10.5^\circ = 0.1822$, the distance between the planes in the crystal parallel to the surface is :
- (A) 3.68 nm
(B) 0.368 nm
(C) 0.0368 nm
(D) 3.68×10^{-9} nm
57. The cohesive forces in molecular crystals are :
- (A) Vander Walls forces
(B) Atomic forces
(C) Ionic forces
(D) Metallic forces
58. If a plane makes intercepts a, b and c, then Miller Indices will be :
- (A) 110
(B) 101
(C) 111
(D) 011
59. The covalent crystals are held together by :
- (A) Strong forces
(B) Weak forces
(C) Vander Walls forces
(D) Atomic forces
60. The vapour pressure of ionic solids is generally :
- (A) Low
(B) High
(C) Moderate
(D) None of these
61. Which of the following defects is generally found in sodium chloride and cesium chloride?
- (A) Frenkel defect
(B) Interstitial defect
(C) Schottky defect
(D) None of the above
62. In a solid lattice, a cation has left a lattice site and is present in interstitial position, the lattice defect is :
- (A) Schottky defect
(B) Frenkel defect
(C) Vacancy defect
(D) Interstitial defect
63. In Frenkel defect :
- (A) Some of the lattice sites are vacant
(B) An ion occupies interstitial position
(C) Some of the cations are replaced by foreign ions
(D) None of the above

64. Amorphous substances are isotropic because :
- They have same value of any property in all directions
 - They have different values of physical properties in different directions
 - They have definite geometrical shape
 - None of the above
65. For an ionic crystal of formula AX, the radius ratio lies between 0.732 and 0.414. Its co-ordination number is :
- 4
 - 6
 - 8
 - 12
66. The permitted co-ordination number in an ionic crystal is 6 the arrangement of anions around the cation will be :
- Plane triangular
 - Tetrahedral
 - Octahedral
 - Body Centred cube
67. In a crystal, the atoms are located at the positions where potential energy is :
- Maximum
 - Zero
 - Minimum
 - Infinite
68. Potassium crystallizes in a bcc structure. The co-ordination number of potassium in potassium metal is :
- 2
 - 4
 - 6
 - 8
69. NaCl is an example of :
- Covalent solid
 - Metallic solid
 - Ionic solid
 - Molecular solid
70. Which of the following defects results in decrease of density of crystal ?
- Schottky defect
 - Frenkel defect
 - Interstitial defect
 - Impurity defect
71. Which of the following is a non-crystalline solid?
- Rubber
 - ZnS
 - HgS
 - PbI
72. Semiconductors which exhibit conductivity due to the flow of excess negative electrons are called :
- n-type conductors
 - good conductors
 - p-type conductors
 - None of the above

73. In p-type semiconductors, the conductivity is due to :
 (A) Negative holes
 (B) Positive holes
 (C) Mobile electrons
 (D) Valence electrons
74. Silicon and Germanium in the pure state are :
 (A) Non-conductors
 (B) Good conductors
 (C) Metallic conductors
 (D) Metal complexes
75. When an arsenic atom is introduced in place of silicon in a crystal lattice, the conductivity :
 (A) Increases
 (B) Decreases
 (C) Remains the same
 (D) Sometimes increases and sometimes decreases
76. Which is incorrect for a hexagonal crystal system ?
 (A) $a = b = c$
 (B) $a = b \neq c$
 (C) $\alpha = \beta = 90^\circ, \gamma = 120^\circ$
 (D) None of these
77. The co-ordination number of body centred cubic lattice is :
 (A) 2
 (B) 4
 (C) 6
 (D) 8
78. In cubic closed packed (ccp) pattern of a metallic crystal, the co-ordination number is :
 (A) 12
 (B) 8
 (C) 6
 (D) 4
79. If P-N junction diode is in reverse bias, then :
 (A) The direction of applied voltage is same as the direction of barrier potential
 (B) The direction of applied voltage is opposite as the direction of barrier potential
 (C) AC voltage is applied across P-N junction diode
 (D) None of these
80. What does a semi conductor diode do?
 (A) Oscillator
 (B) Amplifier
 (C) Rectifier
 (D) Modulator
81. What causes current to flow across a junction diode when it is reversed biased?
 (A) Diffusion of charges
 (B) Nature of material
 (C) Drift of charges
 (D) Both drift and diffusion of charges

82. Conditions under which a transistor may function as an amplifier :
- (A) The emitter-base junction is forward biased and the base-collector junction is reverse biased
 - (B) No bias voltage is required
 - (C) Both junctions are forward biased
 - (D) Both junctions are reverse biased
83. If doping in the p-region is higher than N-region :
- (A) depletion layer will move towards P
 - (B) depletion layer will move towards N
 - (C) depletion layer will remain unchanged
 - (D) None of these
84. What is forbidden energy gap ?
- (A) The energy required for an electron to move from the bottom to the top surface of a solid
 - (B) The energy required to set an electron free from the valence band and start conduction
 - (C) The innermost orbit electrons
 - (D) The energy of outermost orbit electrons
85. How are solids classified based on band theory?
- (A) Only by their melting points
 - (B) By the presence or absence of energy bands
 - (C) As insulators, semiconductors or conductors based on their energy band structure and gap
 - (D) By the density of their atoms
86. Which of the following is a characteristic of a conductor in terms of energy bands?
- (A) A completely filled valence band and an empty conduction band
 - (B) A very large forbidden energy gap
 - (C) A conduction band that is partially filled or overlaps with the valence band
 - (D) A very small band gap
87. Band theory predicts that magnesium in an insulator. However in practice it acts as a conductor due to :
- (A) Overlap of filled 3s and empty 3p orbital
 - (B) Presence of unfilled 3p orbital
 - (C) Presence of filled 3s orbital
 - (D) Overlap of filled 2p and filled 3s orbital

88. For elements having energy gap more than 5eV acts as :
- (A) Semiconductors
 - (B) Insulators
 - (C) Superconductors
 - (D) Conductors
89. Forbidden energy gap in an atom is the gap between :
- (A) 2nd and valence band
 - (B) Valence band and conduction band
 - (C) 1st and 2nd band
 - (D) 1st and valence band
90. In terms of energy bands insulators have :
- (A) Full conduction band
 - (B) Very small energy gap
 - (C) Full valence band
 - (D) Moderate energy gap
91. The energy which any electron possesses at 0°K is :
- (A) Fermi Level
 - (B) Valence Energy
 - (C) Exergy
 - (D) Conduction Energy
92. A photo conductive device's main characteristic is that its:
- (A) Voltage varies with light intensity
 - (B) Capacitance varies with light intensity
 - (C) Resistance varies with light intensity
 - (D) Inductance varies with light intensity
93. Photoconductivity in material is directly proportional to :
- (A) Forward current
 - (B) The reverse current
 - (C) The intensity of the incident light
 - (D) The capacitance of the device
94. Which of the following is a common material used to manufacture photoconductive cells ?
- (A) Gallium arsenide (GaAs)
 - (B) Cadmium sulphide (CdS)
 - (C) Germanium (Ge)
 - (D) Silicon (Si)

95. The dark current in a photodiode (a photo conductive device) is :
- (A) The current generated when light of sufficient intensity is applied
 - (B) The current that flows even when no light is incident on the device
 - (C) The current that flows in the forward biased region
 - (D) The current that is proportional to the light intensity
96. What is the main contribution to photoconduction ?
- (A) The creation of electron-hole pairs by photons
 - (B) The absorption of photons by the valence band
 - (C) The movement of electrons from donor energy levels to acceptor energy levels
 - (D) The increase in acceptor energy levels due to incident light
97. A photoconductive cell is used for :
- (A) High frequency application
 - (B) Medium frequency application
 - (C) Low frequency application
 - (D) All of the above
98. The recombination of free electrons and holes in a forward biased diode produces :
- (A) Heat
 - (B) Light
 - (C) Radiation
 - (D) All of the above
99. The depletion region's width is :
- (A) Directly proportional to the doping
 - (B) Inversely proportional to the doping
 - (C) Independent of doping
 - (D) None of the above
100. The LED emits light when it is :
- (A) Reverse biased
 - (B) Unbiased
 - (C) Forward biased
 - (D) None of these

Rough Work / रफ कार्य

Example :

Question :

Q.1 (A) ● (C) (D)

Q.2 (A) (B) ● (D)

Q.3 (A) ● (C) (D)

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination, candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager & cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)

प्रश्न 2 (A) (B) ● (D)

प्रश्न 3 (A) ● (C) (D)

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ०एम०आर० उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ०एम०आर० उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैल्कुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण: प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्नपुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरिज की दूसरी प्रश्नपुस्तिका प्राप्त कर लें।