K1 level

1. CsCl has a --------structure

a) fcc b) bcc **c) simple cubic** d) hcp

2. _____ defect is due to shifting of an ion from its normal position to an interstitial position in the crystal.

a) Schottky b) Frenkel c) Intrinsic d) Extrinsic

3. In the laboratory, sodium chloride is made by burning the sodium in the atmosphere of chlorine which is yellow in colour. The cause of yellow colour is due to the

(a)Presence of Na+ ions in the crystal lattice

(b) Presence of Cl^- ions in the crystal lattice

(c) **Presence of electron in the crystal lattice**

(d) Presence of face centered cubic crystal lattice

4. Which one of the following has Frenkel defect?

(a) Sodium chloride (b) **Silver bromide** (c) Graphite (d)Diamond

5. $[SiO_4]^{4-}$ has ---------- structure

a) Square pyramidal b) square planar c) octahedral d) **tetrahedral**

5. The formula of normal Spinal is----------

(a)AB_2O_4 (b)ABO_2 (c)$A_2B_2O_4$ (d)ABO_4

6. Band theory predicts that magnesium is an insulator. However, in practice it acts as a conductor due to------

(a) Presence of filled 3s orbital

(b) overlap of filled 2p and filled 3s orbital

(c) overlap of filled 3s and empty 3p orbital

(d) presence of unfilled 3p orbital

7. $CaTiO_3$ has a peravskite crystal strucute. The coordination number of titanium in $CaTiO_3$ is,

(a) 9 **(b) 6** (c) 3 (d) 12

8. CaF_2 crystallizes in fluorite structure. The coordination number for the cation and anion is----

(a) 6, 6 (b) 6, 4 (c) 4, 6 **(d) 8, 4**

9. Metallic gold crystallizes in FCC structure with unit cell dimension of 4.00 Å.The atomic radius of gold is ----------

(a) 0.866 Å **(b) 1.414 Å** (c) 1.732 Å (d) 2.000 Å

10. The number of hexagonal faces that are present in truncated octahedron is -----

(a) 2 (b) 4 (c) 6 **(d) 8**

11. Which of the following structures represents the conjugate acid of HPO_4^{2-} ?

a) $H_2PO_4^-$ b) H3PO4 c) $H_4PO_4^+$ d) PO_4^{3-}

12**.** A buffer solution contains ethanoic acid and its conjugate base; the p*K*a of ethanoic acid is 4.74. At what pH does the solution buffer?

a) 3.0 b) 4.0 **c) 5.0** d) 6.0

13. An aqueous solution containing a concentration of 2.5 10^{-8} OH^- ions will have a pH of which of the following?

a) 6.40 b) 6.42 c) 7.40 d) 7.60

14. Which one of the following relationships is true in water at 25ºC?

a) $[H^+] = [H_2O]$ b) $[OH^-] = [H_2O^-]$ c) $K_w > 1 * 10^{-14}$ **d) $[H^+] = [OH^-]$**

15. Acids be defined as proton donors and bases are proton acceptors. This concept is

(a) Lewis **b) Bronsted-Lowry** c) Lux-flood d) Arrhenius

16. Which of the following can be regarded as soft acids?

(a) BF_3 and Sn^{4+}

(b) Cu^{2+} and Cd^{2+}

(c) SCN^- and H^-

(d) Na^+ and NH_3

17. Which of the following species is the strongest Bronsted – Lowry base in water?

(a) NH_3 (b) F^- **(c) NH_2^-** (d) CO_3^{2-}

18. BF_3isused as a catalyst in several industrial processes due to -------
(a) Strong reducing agent
(b) Weak reducing agent
(c) Strong Lewis acid character
(d) Weak Lewis acid character

19. Which anion is the weakest base?
(a) $C_2H_5O^-$ **(b) NO_3^-** (c) F^- (d) CH_3COO^-

20. Strongest super acid among the following is------

(a) Solution of HNO_3 inH_2SO_4
(b) Solution of HClO4inH_2SO_4
(c) Solution of SbF_5 in HF
(d)Solution of $SbCl_5$ in HCl

21. Which of the following obey EAN rule
(a) $Mn_2(CO)_{10}$ (b) $V(CO)_6$ **(c) $Mo(CO)_7$** (d) $Fe(CO)_6$

22. Borazine is also known as an inorganic ----------
(a) Naphthalene (b) Anthracene **(c) Benzene** (d) None

23. Which one not forms an isopoly anion?
a) V b) Mo c) W **d) K**

24. $[SiO_4]^{4-}$has ---------- structure
a) Square pyramidal b) square planar c) octahedral **d) tetrahedral**

25.The C-H moiety is isoelectronic with
a) $B\text{-}H^-$ b) BH_2 c) BH_3 d) both a and b

26. W_4 $(OR)_{16}$ is an example of
(a) Dinuclear crystals (b)Trinuclear crystals **(c)Tetranuclear crystals** (d) None of the above

27. ---------- is called as 'Inorganic benzene'.
(a) Borazine (b) Carborane (c) Benzene (d) Phosphazene

28. What are known as clusters without ligands -----

(a) Zintl ions (b) Chevrel phases (c) High nuclearityclusters (d)None of the above

29. The number of bridging CO group in $Co_2(CO)_8$ is ----

(a) 0 (b) 1 **(c) 2** (d) 3

30. The M-M Bond order in $[ReCl_8]^{2-}$ is

(a) 1 (b) 2 (c) 3 **(d) 4**

31. Thermo nuclear fusion reaction occurs in

a) Nuclear reactor b) Atom bomb **c) Sun and stars** d) Sun

32. Liquid drop of model of a nucleus explains the phenomenon of nuclear

(a) fission (b)fusion (c)isomerism (d)internal conversion

33. Who observed that when the nucleus of uranium atom was bombarded with fast moving neutrons, it becomes so very unstable that it is immediately broken into two nuclei of nearly equal mass besides other fragments?

(a)Chadwick (b)Einstein (c)Rutherford (d)J.J. Thomson

34. When a radioactive substance is subjected to a vacuum, the rate of disintegration per second

(a)increases only if the products are gaseous (b)increase considerably (c)decreases **(d)is not affected**

35. Uranium gives stable isotope of----------

(a)radon (b)krypton **(c)polonium** (d)radium

36**.** Positron emission results from the transformation of one nuclear proton into a neutron. The isotope thus produced possesses

(a)intense radioactivity (b)higher nuclear charge (c)no radioactivity

(d)same mass number

37. Atom A possesses higher values of packing fraction than atom B. the relative stabilities of A and B are

(a) B is more stable than A (b)A is more stable than B

(c)A and B both are equally stable (d) Stability does not depend on packing fraction

38. The nucleus of radioactive element possesses

(a)zero binding energy (b)high potential energy

(c)high binding energy **(d)low binding energy**

39. Emission is caused by the transformation of one neutron into a proton. This results in the formation of a new element having

(a)lower nuclear charge (b)same nuclear charge

(c)nuclear charge lower by one unit **(d)nuclear charge higher by one unit**

40. A radioactive isotope has a halflife of 20 days. If 100 gms.of the substance is taken the weight of the isotope remaining after 40 days is

(a)2.5 gms (b)15 gms **(c)25 gms** (d)75gms

41. In a living organism the C^{14} concentration

(a) remains approximately constant (b) continually increases

(c)continually decreases (d) varies unpredictably during life time of the organism

42. The half-life of a radioactive element is 50 days. How long will it take for its activity reduces to 1/4 of its original value?

(a)100 days (b)75 days (c)50 days (d)25 days

43. The age of most ancient geological formation is estimated by

(a)Uranium lead method (b)Radium-silicon method

(c)Carbon 14 dating method (d)Potassium-Argon method

44. If half life period of radium is 1580 years, its average life period will be

(a)1275 years (b)2175 years **(c)2275 years** (d)2400 years

45. Which of the following moves fastest when produced during radioactive?

(a) α – particle (b) β – particle **(c) γ – ray** (d) positron

46. Uranium gives stable isotope of----------

(a)radon (b)krypton **(c)polonium** (d)radium

47. Positron emission results from the transformation of one nuclear proton into a neutron. The isotope thus produced possesses

(a)intense radioactivity (b)higher nuclear charge (c)no radioactivity

(d)same mass number

48. Atom A possesses higher values of packing fraction than atom B. the relative stabilities of A and B are

(a)B is more stable than A (b)A is more stable than B

(c)A and B both are equally stable (d)Stability does not depend on packing fraction

49. The nucleus of radioactive element possesses

(a)zero binding energy (b)high potential energy

(c)high binding energy **(d)low binding energy**

50. Emission is caused by the transformation of one neutron into a proton. This results in the formation of a new element having

(a) lower nuclear charge (b) same nuclear charge

(c) nuclear charge lower by one unit **(d) nuclear charge higher by one unit**

K2 Level

1. Define coordination number.
2. Explain radius ratio rule.
3. Write an example for impurity semiconductors.
4. Write a note on Frenkel defect.
5. What are intrinsic Semiconductors?
6. Define limiting radius ratio rule.
7. Write any two examples of crystals having Schotty defects.
8. What are intrinsic Semiconductors?
9. What are the types of holes present in close packed structures?
10. What is Meissner effect?
11. What is Arrehenius concept?
12. Define Bronsted-Lowry concept.
13. Describe levelling solvents.
14. Define Lux-flood concept.
15. What isCady-Elseyconcept.
16. ExplainUsanovich concept.
17. OutlinePearson concept.
18. What isHSAB principle?
19. Write an example foroxyhalide solvent.
20. DescribeLevelling effect.
21. Using Wade's rule, determine the structural framework for
    i) $B_6H_6^{2-}$ ii) $C_2B_4H_8$
22. What is phosphonitrilic compound?
23. Define catenation.
24. List any two properties of cages?
25. Draw the Borazine structure.
26. How is S_4N_4 prepared? Draw the structure.
27. Write a note on carborane.
28. Defineheterocatenation.
29. What is isopolyanions?
30. What is a chevral phase?
31. What is nuclear reactor Coolant?
32. Define packing fraction.
33. What isn/p ratio?
34. Describe binding energy and exchange forces
35. ExplainQ – value.
36. What iscoulombic barrier?

37. What isspallation reaction?

38. Definefissile and fertile isotopes.

39. Describe theStellar energy production.

40. What isprojectile capture reaction?

41. What is Radio Isotope?

42. What isneutron activation analysis?

43. What is the use of cyclotron?

44. Where scintillation counters is used?

45. Definetracer technique.

46. DefineHot-atomchemistry.

47. Write down two merits of nuclear energy.

48. What is the drawback in using nuclear energy?

49. What iscarbon dating?

50. Define isotopic dilution analysis.

K3 Level

1. Examine point defects? How are Frenkel and Schottky defects created?
2. Catogorize non-stoichiometric defects? Does schottky defect lead to non-stoichiometry?
3. Elaborate super conductivity andMeissner effect.
4. Classifyschottky and frenkel defect.
5. Examine the crystal structure of wurtzite and antifluorite.
6. Test how does the band theory explain the conductivity of semi-conductors?
7. Listout the crystal structure of rutile and zinc blende.
8. Analyze ccp and hcp structures.
9. Examine n and p type impurity semiconductors.
10. Examineilmenite and spinels structures.
11. Compare Arrehenius concept and Bronsted-Lowry concept.
12. Examine the role of levelling solvents in a chemical reaction.
13. Examine the solvent system concept and Lux-flood concept.
14. Examine Cady-Elsey concept and its applications
15. Outline HSAB principle and explain Acid and base strength of HSAB.
16. List out the role ofNon aqueous solvents in chemical synthesis.
17. Test the role of liquid ammonia as a non aqueous solvent.
18. Test the role of liquid HF as a nonaqueous solvent over liquid ammonia.
19. Test the role of liquid N_2O_4, liquid SO_2in non aqueous media.
20. Conclude oxyhalide solvent and merit over other non aqueous solvents.
21. Write the preparation & properties of diborane.
22. Using Wade's rule, determine the structural framework for

    i) $B_6H_6^{2-}$ ii) $C_2B_4H^{8-}$

23. How different types of phosphazenes synthesized?
24. Explain the structure and bonding on Boranes.
25. How does $(SN)_x$ behaves like a one dimensional conductor?
26. Compare the properties of Borzines and Benzenes on the basis of their structures.
27. Write an account of structure of Phosphonitriles with example.
28. Explain bonding in diborane on the basis of Molecular orbital theory.

29. Write the synthesis of following (a) Borazine (b) Bromine derivative of borazine.

30. Explain the structural differences between closoborane, nido-borane and arachnoboranes.

31. Define the terms half-life period, average life period and radioactive decay constant of radioactive nuclei.

32. Account for the Stability of nuclei.

33. Explain the Shell model of atomic nuclei.

34. Describe stellar energy? Give its fusion reaction.

35. Write a short note on packing fraction.

36. Account for nuclear cross section?

37. Outline mass defect with equation.

38. Explain the disposal of nuclear waste and its safety measures.

39. Deduce binding energy? Account for the stability of ${}_2He^4$.

40. Write a short note on Q value and reaction threshoulds.

41. Complete the following reactions. (i) 13Al27 + 2He4 →_____+ 0 n1

(ii) 7N14 +_____→6C14+1H1

42. What is the Half-life period of Radiocarbon Dating?

43. Describe in short the principle and working of Betatron.

44. Explain Electron Captureand Internal Conversion.

45. Radioactive Actinum (Ac) mass number 227 and atomic number 89 undergoes a series of disintegrations leading to the formation of Lead (Pb) of mass number 207 and atomic number 82.
46. How many α and β – emissions are involved?

47. Discuss neutron activation analysis.

48. Discuss radioactive tracer technique.

49. Explain with a diagrammatic sketch the structure of cyclotron for particle acceleration.

50. Explain the stability of atomic nuclei in terms of neutron - proton (n/p) ratio.

51. Describe the construction and working of a cyclotron. Discuss its limitations.

52. Describe the construction and working of a G.M counter. Draw the voltage characteristics of this counter.

53. What is Radioisotope? Discuss about the Radiocarbon Dating.

54. Describe in short the principle and working of Betatron.

55. Explain the types of nuclear reactions with examples.

K4 Level

1. Discuss about free electron and band theories in metallic state.
2. Evaluate how the band theory explains the conductivity of semi-conductors?
3. Assess non-stoichiometric defects. Does schottky defect lead to non-stoichiometry?
4. Explain free electron theory in detail.
5. Analyze super conductivity, messier effect and BCS theory.
6. Describe the electrical properties of solids and semiconductors using band theory.
7. Examine the role of liquid ammonia as a non aqueous solvent. Write down the reactions.
8. Deduce Theories of Hardness and Softness.
9. Conclude HSAB principle - Acid and base strength of HSAB, limitations and applications of HSAB.
10. Deduce the best chemical reactions that can be performed using liquid ammonia, liquid HF, liquid N_2O_4 and liquid SO_2as solvents.
11. Discuss the various trend and factors affecting the acid base behaviour.
12. Conclude isopoly acidandheteropoly acid.
13. Discuss the Structure and bonding of any two cage compounds.
14. Discuss the structure, bonding and classification of metal clusters.
15. Explain the structure and bonding in carboranes and metallocenecarboranes.
16. Discuss the catenation and heterocatanation property of chains with suitable example.
17. Give any five applications of tracer isotopes in medicine.
18. Discuss radioactive decay and equilibrium.
19. Explain nuclear fission and fusion with example
20. Illustrate liquid drop model for nuclear structure proposed by Bohr.
21. Examine radioactive disintegration and α, β, γ emission with suitable examples.
22. Describe the applications of radioisotopes in medicine and agriculture.
23. Discuss in detail about the detection and measurement of radioactivity using G.M counter and scintillation counter with a neat sketch.
24. Explainthe application of radioactive isotopes in carbon dating.
25. Explain the principle and working of cyclotron and synchrotron.
26. Discuss the applications of tracer radioisotopes.