CHEMISTRY

WORKBOOK

SECOND YEAR

ENGLISH MEDIUM

Board of Intermediate Education

Andhra Pradesh

Sri. V. Rama Krishna,
I.R.S. Secretary

PREFACE

"I hear and I forget – I see and I remember - I do and I understand – I think and I learn"

The Board of Intermediate Education, Andhra Pradesh, Vijayawada made an attempt to provide work books for the thirst time to the Intermediate students with relevant and authentic material with an aim to engage them in academic activity and to motivate them for self learning and self assessment.

These work books are tailored based on the concepts of "learning by doing" and "activity oriented approach" to sharpen the students in four core skills of learning – Understanding, Interpretation, Analysis and Application.

The endeavour is to provide ample scope to the students to understand the underlying concepts in each topic. The workbook enables the student to practice more and acquire the skills to apply the learned concept in any related context with critical and creative thinking. The inner motive is that the student should shift from the existing rote learning mechanism to the conceptual learning mechanism of the core concepts.

I am sure that these compendia are perfect tools in the hands of the students to face not only the Intermediate Public Examinations but also the other competitive Examinations.

My due appreciation to all the course writers who put in all their efforts in bringing out these work books in the desired modus.

--- V. Rama Krishna, I.R.S.
Secretary,
B.I.E., A.P., Vijayawada.

CHEMISTRY - WORKBOOK - II Year

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CHAPTER – I

SYNOPSIS :

1. Electron, proton and neutron are the important fundamental particles of an atom.

2. Rutherford proposed atomic nucleus based on the α -ray scattering experiment.

3. Light has dual nature. Wave nature has three main characteristics: wave length, wave and frequency.

4. Electromagnetic radiation has several regions. Visible region ranges between 3800A° and 7600A°.

5. Energy is viewed as 'quantum' by Planck, but Einstein generalised it as photon'.

6. Pattern of colours or lines obtained when light is resolved is called spectrum.

7. Hydrogen emission spectrum is a in a spectrum. has Lyman series in UV region. Balmer series in visible region, and other series in IR region.

8. Bohr's atomic theory states stationary shells and energy states of electron revolving around the nucleus.

9. Angular momentum (mvr) is an integral multiple of $h/2\pi$

10. Splitting of spectral lines in the applied electrical field is called Stark effect and splitting in the applied magnetic field, Zeeman effect.

11. Sommerfeld's elliptical orbits in addition to Bohr's circular shells, explains fine spectrum.

12. de Broglie proposed wave nature for all moving particles. Wave length of a moving particle is inversely proportional to its momentum.

13. Heisenberg's uncertainty principle states that it is impossible to predict the correct position and, correct velocity of moving tiny particle like electron.

14. Schrodinger's wave function denotes amplitude and denotes radial probability.

15. Orbital is space around the nucleus where the probability of finding electron is maximum (95%).

16. The shape of s-orbital is spherical, p-orbital is dumb-bell, d-orbital is double dumb-bell and f-orbital is tetra dumb-bell.

17. The space where is zero, is called nodal region or node. The plane where is zero, is called nodal plane.

18. Principal quantum number denotes energy, azimuthal quantum number shape and magnetic is quantum number special orientation of orbital.

19. Orbitals with same energy and shape, but different orientation are called degenerate orbitals.

20. Number of subshells in a given shell is n, number of orbitals is n^2 and maximum number of electrons filled is $2n^2$.

21. Pauli's exclusion principle states that no two electrons of an atom have all the four quantum numbers the same.

22. An orbital can hold a maximum of two electrons and these electrons must have opposite spins

23. The differentiating electron always enters into that orbital, with least energy among the available orbitals.

24. The sequence of energies of orbitals is Is < 2s < 2p < 3s < 3p < 4s < 3d < 4p <... This sequence is obtained from Moeller's diagram and also using (n+1) rule.

25. Hund's rule states that pairing starts only if all orbitals in the same sub-shell are singly filled with electrons.

26. Exactly half-filled or completely filled sub-shells give extra stability.

27. The electronic configuration of Cr (Z=24) is $3d^5$. $4s^1$. and that of Cu (Z = 29) is $3d^{10}4s^1$. These are called anomalous electronic configurations.

28. Atoms or ions with unpaired electrons are paramagnetic. If 'n' is number of unpaired electrons magnetic moment 'μ' 1s given as $\mu = \sqrt{n(+2)}\ BM$

29. Atoms or ions with same electronic configuration are called isoelectronic species.

I. Very Short answer Questions :

1. How many protons and neutron are there in one atom of $^{13}_{6}C$
2. Calculate the number of electrons which will together weigh one gram
3. An ion with mass number 37 possesses one unit negative charge. If the ion contain 11.1% more neutrons than the electrons, write its symbol.
4. Find the number of protons, electrons and neutrons present in $^{14}_{7}N^{3-}$ (nitride).
5. What is the mass of one mole electrons in kg?
6. An isotope of $^{112}_{50}Sn$ contains 68 neutrons. What will be its mass number?
7. The nucleus of an element contains 17 protons and 18 neutrons . what is its (a) atomic number and (b) mass number ? write the complete symbol for the element.
8. What is ratio between the number of neutrons present in carbon isotopes with mass numbers 12 and 14?
9. How the colour of iron rod changes during the heating?
10. Which has the higher frequency, infrared light or ultraviolet light? Which has the greater energy ?
11. What is black body radiation ?
12. What is ? How is it taken?
13. What are : (a) absorption, (b) emission, (c) line and (d) band spectra
14. What is the shortest wave length line (in nanometers) in Lyman series of the hydrogen spectrum ?
15. Calculate the longest wave length spectral line in the Paschen series of hydrogen emission spectrum ?
16. Why dose the transition from n=3 to n=1 gives a spectral triplet
17. What is the ratio of the radii of the 3rd orbits of He^{+} and Li^{2+}
18. How many time the normal electrons of hydrogen atom revolve round the nucleus in one sec ?
19. What is the circumference of the second orbit of hydrogen atom ?
20. What is the length of the number axes in the L shell of hydrogen atom ?
21. How many spectral line can be obtained during the de-excitation of electron of hydrogen from 'O' shell to the most stable state ?
22. Calculate the energy required to remove an electron completely from n = 2 orbit. What is the longest wave length of light that can be used to cause this transition ?
23. What is the energy difference between the n = 2 and n = 3 levels for the hydrogen atom ?
24. What is the wave length of electron wave in the first orbit of hydrogen atom ?

25. How many waves are present in N shell of hydrogen atom ?

26. Calculate the wave length of atomic electron revolving in the third shell of hydrogen atom.

27. Heisenberg's uncertainty principle cannot be applied to stationary electron. Why ?

28. Calculate the radial distance between two peaks in the radial probability of 2s orbital.

29. How many peaks and nodes are present in the radial probability curve of 3s-orbital ?

30. s-Orbitals have no directíon. Comment.

31. How many nodal planes and nodal regions are present for 3p orbital?

32. How many unpaired electrons are present in each of the following ground state atoms : A) O and b) As

33. What is the maximum number of electrons that can be present in the M shell.

34. Write the electronic configurations of the following ions: a) H^-, b) Na^+ and c) S^{2-}

35. What is the total number of orbitals present in the shell with the principal quantum number, n = 3 ?

36. What is the lowest value of 'n' that allows 'g' orbitals to exist ?

37. How many unpaired electrons are present in ferrous ion? Calculate its net spin and magnetic moment

38. Which noble gas has same number of electrons both in ultimate and penultimate shells

39. Among cuprous and cupric, which has more stable configuration? Why?

40. Cu(g) $\xrightarrow{+e}$ Cu^+(g) Write the set of quantum numbers for the electron released in this process.

41. Write combination of quantum numbers is M shell.

42. What are the possible values of l and m for an electron with n =3

43. Write the configuration of Ni^{2+}. How many unpaired electrons are there in the ion ?

44. Predict the magnetic moment of Co^{3+} and Cu^{2+} ions.

45. Calculate their specific charges of fundamental particles.

46. How are number of fundamental particles calculated from atomic and mass numbers ?

47. How energy density in black body radiation depends upon temperature?

48. What is the longest wavelength line in Paschen series for hydrogen?

49. Define isotopic number. Calculate the isotopic numbers of hydrogen-3 and chlorine-37

50. Why the total energy of electron is negative ?

51. A Spectral triplet is obtained for the electronic transition from n = 3 to n=1. Why ?

52. Calculate the wavelength of an electron moving with a velocity which is equal to that of light

53. What is the maximum number of emission lines observed when the excited electron of hydrogen atom in n=6 drops to the ground state

54. How many waves will be made by a bohr electron in one complete revolution in the 2^{nd} excited state.

55. How does the five degenerate d-orbitals split into two groups in the applied field ?

56. Write the set of quantum numbers for all electrons of oxygen atom.

57. How many electrons in an atom. have n = 4, and $m_s = +1/2$?

58. Ferric iron is more stable than ferrous iron. Explain.

59. How many unpaired electrons are present in Ca^{2+}? What is its magnetic moment?

60. How many electrons of manganese atom in the ground state has magnetic quantum number zero ?

II Poblems :

1. The wavelength of a blue light is 4800A°. Calculate the frequency and wave number of thislight ?
2. The vividh bharathi station of All India Radio Delhi broadcasts on a frequency of 1.368 kHz. Calculate the wave length of the electromagnetic radiation emitted by the transmitter. Which part of the electromagnetic spectrum does it belong ?
3. How many photons of light with a wave length of 4000 pm are to provide one joule of energy ?
4. How the colour of iron rod changes during the heating?
5. The threshold frequency of a metal is 1.11 x 10^{16} Hz. What is the maximum kinetic energy of the photo electron produced by applying a light of 15A° on the metal?
6. What is the ratio between the energies of two types of radiation whose wavelengths are 6000 A° and 2000A° respectively?
7. A 100 watt bulb emits electromagnetic radiation of wave length 400 nm. Calculate the number of photons emitted per sec by the bulb.?
8. The work function of a metal is 4.2eV. If the radiation of 2000A° falls on the metal, find the kinetic energy of the metal.?
9. Iodine molecule dissociates into atoms after absorbing light of 4500 A. If one quantum of radiation is absorbed by each molecule, calculate the kinetic energy of iodine atoms. Bond energy of I_2 is 240 $kJmol^{-1}$?
10. A near U.V. photon of 300nm is absorbed by a gas and then reemitted as two photons. If the wave length of one photon is 700 nm, find out the wave length of second photon
11. What are wave length of ultra ultra violet light of V = 5.5 x 10^{15} s^{-1}?

12. What is the frequency of microwave with a wave length of 4.33 x 10^{-3} m?
13. Calculate the wavelength, wave number and frequency of photon which has energy equal to 3 e V
14. What is the wave length in nanometers of radiation that has energy content 1.0x10^3 $kJmol^{-1}$? In which region of the electromagnetic spectrum this radiation is found.
15. The threshold wave length (λ_0) of sodium metal is 6500 A°. If uv light of wave length 360A° is used, what will be the kinetic energy of the photoelectron?
16. The minimum energy required for the photo emission of electrons from the surface of a metal is 4.95 x 10^{-19}. Calculate the critical frequency and the corresponding wave length of the photon required to eject the electron.
17. Calculate the wave number and wave length of H_β line in the Balmer series of hydrogen emission spectrum.
18. Calculate the wave number of the first spectral line in the lyman series of He^+ spectrum.
19. Hydrogen atoms are de-excited from N shell. Illustrate the spectral lines obtained in the emission.
20. The radius of the fourth orbit in hydrogen atom is 0.85 nm. Calculate the velocity of the electron in this orbit.
21. What is the ratio of the radii of the 3rd orbits of He^+ and Li^{2+}?
22. The ionisation energy of He^+ is 19.6 x 10^{-18} atom^{-1}, Calculate the energy of first stationary state of Li^{2+} ion.
23. Calculate the energy associated with the first orbit of He^+. What is the radius of this orbit?
24. The ionisation energy of hydrogen atom is 13.6 eV. What will be the ionisation energy of $He^+$and Li^{2+} ions ?
25. Calculale the wave length of an electron moving with a velocity of 2.05 x 10^7 ms^{-1},
26. If the kinetic energy of an electron is 4.55x10^{-25} J, find its wavelength (Planck's constant, h = 6.6 x 10^{-34} kgm^2 s^{-1} $m = 9.1\,X\,10^{-31}\,kg$)
27. Find the momentum of a particle whose de Broglie wavelength is 1A°
28. If the radius of first orbit in hydrogen atom is xA°, calculate the de Broglie wave length of electron in the third orbit ?
29. Find the number of waves made by a Bohr electron in one complete revolution in the 3rd orbit.?
30. A golf ball has a mass 40g and a speed of 45 ms^{-1}, If the speed can be measured with an accuracy of 29% calculate the uncertainty in position. ?
31. The uncertainity in the position and velocity of a particle are 10^{-10}m and 5.25 x 10^{-24} ms^{-1} What is the mass of the particle? (Value of Planck's constant is 6.6 x 10^{-34} Js)
32. Calculate the wavelength of an electron that has been accelerated in a particle accelerator through a potential difference of 100 million volts.

33. A microscope using suitable photons is employed to locate an electron in an atom within a distance g 0.1A°. What is the uncertainity involved in the measurement of its velocity ?
34. Calculate the momentum of a particle which has a de Broglie wave length of 0.1 mm?
35. The wave length of a moving body of mass one-tenth of a milligram is 3.312 x 10^{-29}m. Calculate its kinetic energy?
36. A proton is moving with kinetic energy 5x10^{-27}J. What is the wavelength of de Broglie wave associated with it?
37. The uncertainty in the momentum of a particle is 2.2 x 10^{-4} g cms^{-1}. With what accuracy can its position be determined ?
38. The uncertainty in the position and velocity of a particle are 10^{-10} m and 5.27 x 10^{-24} ms^{-1} respectively . Calculate the mass of the particle. ?
39. Calculate the uncertainty in the velocity of an electron, if the uncertainty in its position is 100 pm. ?
40. A bulb emits light of wavelength 4500A° . The bulb is rated as 150 watt and 8% of the energy is emitted as light. How many' photons are emitted per sec?
41. The work function for Cs atom 1S 1.9 eV. Calculate threshold wave length. If cesium metal is irradiate with a wave length of 500 nm. calculate the velocity of the ejected electron.?
42. What is the minimum energy of photons which causes photoelectric effect with platinum metal? The threshold frequency of the metal platinum is 1.3 x 1015 s^{-1}
43. The energy of the electron in the first Bohr orbit of H is -2.18 x 10^{-11} erg. Calculate the charge of electron ?
44. Calculate the wave number for the 1ongest wavelength transition in the Balmer series of atomic hydrogen emission spectrum ?
45. The wave length of a certain line in Balmer series is 4341A° To what value of 'n' does this transition correspond ?
46. Calculate the wavelength of an electron moving with a velocity which is equal to that of light ?
47. The kinetic energy of an electron is 4.35 x 10^{-28} kJ. Calculate the Broglie"s wavelength.
48. Calculate the product of uncertainties of displacement and velocity of a moving electron ?
49. Calculate the wavelength of carbondioxide molecule whose velocity is 440ms^{-1}
50. The mass of an electron is 9.1 x 10^{-31} kg. If its kinetic energy is 3.0 x 10^{-25} J, calculate its wavelength ?
51. Yellow light emitted from a sodium lamp has a wavelength (λ) of 580 nm. Calculate the frequeney (v) and wave number ($\bar{v}$) of the yellow light.?
52. Find energy of each of the photons which
    (i) correspond to light of frequency 3 x10^{15} Hz.
    (ii) have wavelength of 0.50 Å

53. Calculate the wavelength, frequency and wave number of a light wave whose period is 2.0x 10^{-10} s.
54. What is the number of photons of light with a wavelength of 4000 pm that provide 1J of energy?
55. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionise the sodium atom. Calculate the ionisation energy of sodium in kJ mol^{-1}
56. A 25 watt bulb emits monochromatic yellow light of wavelength 0.57 μm. Calculate the rate of emission of quanta per second.
57. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800 Å. Calculate threshold frequency (v_0) and work function (w_0) of the metal.
58. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2 ?
59. How much energy is required to ionize a H-atom if the electron occupiesn=5 orbit? Compare your answer with the ionization enthalpy of H-atom (energy required to remove the electron from n = orbit).
60. What is the maximum number of emission ines when the excited electron of a H-atom in n= 6 drops to the ground state?
61. (i) The energy associated with the first orbit in the hydrogen atom is -2.18 x 10^{-18} J $atom^{-1}$ What is the energy associated with the fifth orbit?

    (ii) Calculate the radius of Bohr's fifth orbit for hydrogen atom.
62. Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen.
63. Calculate the wavelength of an electron moving w velocity of 2.05x 10^7 ms^{-1} Solution.
64. The mass of an electron is 9.1x 10^{-31} kg If its KE 3.0 x 10^{-25} J, calculate its wavelength.
65. An element with mass number 81 contains 31.7% more neutrons as compared to protons. Assign the atomic symbol.
66. An ion with mass number 37 possesses one unit of negative charge. If the ion contains 11.1% more neutrons than the electrons, find the symbol of the ion.
67. An ion with mass number 56 contains 3 units of positive charge and 30.4% more neutrons than the electrons. Assign the symbol to this ion.
68. Nitrogen laser produces a radiation at a wavelength of 337.1 nm. If the number of photons emitted is 5.6 x 10^{24} calculate the power of this laser.
69. The ejection of the photoelectron from the silver metal in the photoelectric effect experiment can be stopped by applying the voltage of 0.35 V when the radiation 256.7 nm is used. Calculate the work function for silver metal.
70. If the photon of the wavelength 150 pm strikes an atomand one of its inner bound electrons is ejected out with a velocity of 1.5x 10^7 ms^{-1} calculate the energy with which it is bound to the nucleus.

71. Calculate the wavelength for the emission transition if it starts from the orbit having radius 1.3225 nm and ends at 211.6 pm. Name the series to which this transition belongs and the region of the spectrum.
72. Dual behaviour of matter proposed by de-Broglie led to the discovery of electron microscope often used for the highly magnified images of biological molecules and other type of materials. If the velocity of the electron in this microscope is 1.6 x $10^6\ ms^{-1}$, calculate de-Broglie wavelength associated with this electron.
73. Similar to electron diffraction, neutron diffraction microscope is also used for the determination of the structure of molecules If the wavelength used here is 800 pm, calculate the characteristic velocity associated with the neutron (mass of neutron = 1.675x 10^{-27} kg.)
74. If the velocity of the electron in Bohr's first orbit is 2.19x $10^6\ ms^{-1}$, calculate the de-Broglie wavelength associated with it ?
75. Wavelengths of different radiations are given below
    λ(A) = 300 nm, λ (B) = 300 μm, λ (C) =3 nm, λ (D) = 30 Å
    Arrange these radiations in the increasing order of their energies.
76. Table-Tennis ball has a mass 10 g and a speed of 90 m/s. If speed can be measured within an accuracy of 4% what will be the uncertainty in speed and position?
77. Calculate the energy and frequency of the radiation emitted when an electron jumps from n =3 to n = 2 in a hydrogen atom.

III. BITS
EXERCISE -I

Fundamental particles

1. Which of the following is not a fundamental particle?
   1) Proton 2) Neutron
   3) Alpha particle 4) Electron

2. A neutral atom (At.no. >1) has (AFMC)
   1) electron and proton
   2) neutron and electron
   3) neutron, electron and proton
   4) neutron and proton

3. The study of discharge of electricity through gases lead to the discovery of
   1) Structure of the atom 2) Nucleus
   3) Spectral lines 4) Electron

4. Electron is a particle having a (CPMT)
   1) negative charge of one unit and zero mass
   2) positive charge of one unit and zero mass
   3) negative charge of one unit and a mass of about 9.1×10^{-31} kg
   4) negative charge of one unit and a mass of about 1.67×10^{-27} kg .

5. The value of e/m for an electron is
   1) 1.78×10^{8} c/g 2) 1.6724×10^{-24} c/g
   3) 0.005486 c/g 4) 1.00866 c/g

6. Charge of electron is
   1) 1.602×10^{-10} Coulomb
   2) 4.8×10^{-10} coulomb
   3) 1.602×10^{-19} e.s.u
   4) 4.8×10^{-10} e.s.u

7. The e/m of proton is
   1) 1.78×10^{8} c/g 2) 9.57×10^{4} c/g
   3) 19.14×10^{4} c/g 4) 0.478×10^{4} c/g

Atomic number and mass number

8. Atomic number is equal to the (AFMC)
   1) number of neutrons in the nucleus
   2) number of protons in the nucleus
   3) sum of protons and neutrons
   4) atomic mass of the element.

9. Values of A and Z can be
   1) negative 2) fractional
   3) zero 4) whole number

10. The number of protons, electrons and neutrons in $^{80}_{35}Br$ are respectively
    1) 35, 35, 80 2) 35, 35, 45
    3) 80, 80, 35 4) 45, 45, 35

11. Which one of the following is an isobar of $_{6}C^{14}$?
    1) $_{6}C^{13}$ 2) $_{6}C^{12}$ 3) $_{7}N^{14}$ 4) $_{7}N^{15}$

12. Number of protons in the nucleus of carbon atom is
    1) 7 2) 8 3) 4 4) 6

13. The number of nucleons in chlorine–37 is
    1) 17 2) 20 3) 54 4) 37

14. The nucleus of an atom contains
1) Electrons and protons
2) Protons and neutrons
3) Electrons and beta particles
4) Protons and alpha particles

15. The isotopes of neutral atoms of an element differ in
1) Atomic number
2) Mass number
3) Number of electrons
4) Chemical properties

16. The nucleus of tritium consists of
1) 1 proton + 1 neutron
2) 1 proton + 3 neutrons
3) 1 proton + zero neutrons
4) 1 proton + 2 neutrons

17. Sodium ion is isoelectronic with
1) Mg^{2+} 2) Al^{3+} 3) Ne 4) N^{3-}

18. An atom differs from its ion in
1) Nuclear charge
2) Mass number
3) Number of electrons
4) Number of neutrons

19. In C^{14} isotope the number of neutrons would be
1) 6 2) 14 3) 8 4) 10

20. The number of neutrons in the dipositve zinc ion (Mass no. of Zn = 65)
1) 35 2) 33 3) 65 4) 67

21. Rutherford's alpha ray scattering experiment showed for the first time that the atom has
1) Nucleus 2) Proton
3) Electron 4) Neutron

22. The radius of the atom is of the order of
1) 10^{-10} cm 2) 10^{-13} cm (PMT)
3) 10^{-15} cm 4) 10^{-8} cm

23. When alpha particles are sent through a thin metal foil, most of them go straight through the foil because
1) Alpha particles are much heavier than electrons
2) Alpha particles are positively charged
3) Most part of the atom is empty
4) Alpha particles move with high velocity

Nature of light

24. Identify the incorrectly matched set

SET - A	SET - B
1) Wavelength(λ)	Nanometre
2) Frequency (υ)	Hertz
3) Wave number ($\bar{\upsilon}$)	$metre^{-1}$
4) Velocity (C)	ergs

25. Einstein was awarded Noble Prize for
1) General theory of relativity
2) The equation, $E = mc^2$
3) Enunciation of quantum theory
4) Explanation of photoelectric effect

26. In electromagnetic radiation, which of the following has greater wavelength than visible light?
1) U.V. rays 2) I.R. rays
3) Gamma rays 4) X-rays

27. Which of the following is not an electromagnetic radiation?
1) Gamma rays 2) Alpha rays
3) Radio waves 4) X-rays

28. The energy of a photon is inversely proportional to its
1) Wavelength 2) Frequency
3) Wave number 4) Velocity

29. The value of Planck's constant is
1) 6.626×10^{-27}Js 2) 6.626×10^{-34}Js
3) 6.023×10^{23}Js 4) 1.602×10^{-19}Js

30. Which of the following properties of a wave is independent of the other?
1) Wave number 2) Wave length
3) Frequency 4) Amplitude

31. The radiation with highest wave number
1) Microwaves 2) X - rays
3) I.R. - rays 4) Radiowaves

32. Which of the following relates to photon both as wave motion and as a stream of particles?
1) $E = mc^2$ 2) Photoelectric effect
3) Diffraction 4) $E = h\nu$

33. The metal best used in photoelectric cells is
1) Na 2) Mg 3) Al 4) Cs

34. The energy required to emit an electron from the surface of a metal is called
1) Activation energy 2) Threshold energy
3) Critical energy 4) Kinetic energy

35. Kinetic energy of photoelectrons is independent on --------- of incident radiation.
1) Wavelength 2) Wave number
3) Frequency 4) Intensity

36. The energy required to overcome the attractive forces on the electrons, w, of some metal is listed below. The number of metals showing photoelectric effect when light of 300nm wavelength falls on it is (M-2013)

Metal	w(eV)
Li	2.4
Na	2.3
K	2.2
Mg	3.7
Cu	4.8
Ag	4.3
Fe	4.7
Pt	6.3
W	4.72

1) 6 2) 8 3) 5 4) 4

37. The frequency associated with photon of radiation having a wavelength of $6000A^0$ is
1) 5×10^{14} Hz 2) 5×10^{10} Hz
3) 5×10^{12} Hz 4) 5×10^{15} Hz

38. (A) : The energy of ultraviolet radiation is greater than the energy of intrared radiation
(R) : The velocity of ultraviolet radiation is greater than he velocity of infrared radiation
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true but R is not the correct explanation of A
3) A is true and R is false
4) R is true and A is false

39. (A) : Red coloured light can't eject the electrons from the metal surface of potassium
(R) : The frequency of red light is less than threshold frequency of potassium metal
1) Both A and R are true, and R is correct explanation of A
2) Both A and R are true, and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

40. Energy of a photon with a wave length of 450 nm is
1) 4.36×10^{-12} ergs 2) 4.36×10^{-13} ergs
3) 4.36×10^{-20} ergs 4) 4.36×10^{-11} ergs

41. The wave length of light having wave number 4000 cm^{-1} is
1) 2.5 μm 2) 250 μm
3) 25 μm 4) 25nm

Spectra

42. Line spectrum is characteristic of
1) Atoms 2) Molecules
3) Any substance in solid state
4) Any substance in liquid state

43. The spectrum obtained from incandescent solids is
1) Continuous 2) Line
3) Band 4) Absorption

44. The wavelenghts of which series lie in the ultraviolet region? (CEE UP)

1) Lyman 2) Balmer
3) Paschen 4) Brackett

45. When electron jumps from 5th energy level to 1st energy level, to which series the spectral line belongs?

1) Balmer 2) Lyman
3) Paschen 4) Pfund

46. When the electron in the 'H' atom jumps from the fifth orbit to the second orbit, the spectral line emitted is found in ---- region.

1) Visible 2) Ultraviolet
3) Near IR 4) Far IR

47. The first spectral line in the Pfund series of Hydrogen spectrum is given by (R_H = Rydberg constant) (M-2012)

1) $\frac{9R_H}{400}$ 2) $\frac{56R_H}{36}$ 3) $\frac{11R_H}{900}$ 4) $\frac{7R_H}{144}$

48. (A) : Emssion spectrum produced due to the transition of an electron from M shell to L shell is

(R) : The ratio of energy and frequency of a photon is 6.625×10^{-27} erg-sec

1) Both A and R are true, and R is correct explanation of A
2) Both A and R are true, and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

49. If the difference in the wave numbers of the first (lowest) two lines of a series of hydrogen atomic spectrum is 5331.7 cm^{-1}, they belong to the (R_H = 109680 cm^{-1}) (M-2012)

1) Lyman series 2) Pfund series
3) Balmer series 4) Paschaen series

50. Brackett series is produced when the electrons from outer orbits jump to (BHU)

1) Third orbit 2) Second orbit
3) Fourth orbit 4) Fifth orbit

51. The equation corresponding to the wave number of spectral lines in Pfund series is

1) $R\left[\frac{1}{4^2}-\frac{1}{5^2}\right]$ 2) $R\left[\frac{1}{3^2}-\frac{1}{4^2}\right]$
3) $R\left[\frac{1}{2^2}-\frac{1}{3^2}\right]$ 4) $R\left[\frac{1}{5^2}-\frac{1}{6^2}\right]$

52. The n_1 value in Balmer series is

1) 2 2) 1 3) 3 4) 0

53. The value of Rydberg constant is

1) 109677 cm^{-1} 2) 109700 cm^{-1} s^{-1}
3) 10968 cm^{-1} 4) 10970 m

54. A spectral line with λ = 4938A^0 belongs to the - series of Hydrogen atom

1) Lyman 2) Balmer 3) Parchen 4) Pfund

55. Among the first lines of Lyman, Balmer, Paschen and Brackett series in hydrogen atomic spectra, which has higher energy?

1) Lyman 2) Balmer
3) Paschen 4) Bracket

56. What are the values of n_1 and n_2 respectively for H_β line in the Lyman series of hydrogen atomic spectrum?

1) 3 and 5 2) 2 and 3
3) 1 and 3 4) 2 and 4

57. The fourth line of the Balmer series corresponds to the electronic transition between two orbits of the H atom, Identify the orbits.

1) 3 and 1 2) 5 and 1
3) 5 and 2 4) 6 and 2

58. Hydrogen spectrum gave a series of lines at $\frac{5R}{36}$, $\frac{3R}{16}$ and $\frac{21R}{100}$ cm^{-1} (R=Rydberg const in cm^{-1}). These lines belong to (TSM-2015)

1) Paschen series 2) Balmer series
3) Lyman series 4) Pfund series

59. The wave length of first member of Balmer series of a hydrogen atom is nearly (The value of Rydberg constant R = $1.08 \times 10^7 m^{-1}$)

1) 4400A° 2) 5500A°
3) 6600A° 4) 7700A°

60. The wave length of H_δ line of Balmer series of a hydrogen atom is nearly ($R = 1.08 \times 10^7 m^{-1}$)

1) 4090A° 2) 5400A°
3) 6800A° 4) 7200A°

61. The first emission line of hydrogen atomic spectrum in the Balmer series appears at (R=Rydberg constant)

1) $\frac{5R}{36}\ cm^{-1}$ 2) $\frac{3R}{4} cm^{-1}$
3) $\frac{7R}{144} cm^{-1}$ 4) $\frac{9R}{400} cm^{-1}$

62. What is the wave length of H_b line in Balmer series of hydrogen spectrum? (R = Rydberg constant)

1) 36/5R 2) 5R/36 3) 3R/16 4) 16/3R

Bohr's theory

63. The first use of quantum theory to explain the structure of atom was made by

1) Planck 2) Einstein
3) Bohr 4) Heisenberg

64. Bohr's theory is applicable to

1) Li^{+2} 2) Li^+
3) He^+ 4) Both 1 and 3

65. Bohr's theory is not applicable to

1) H 2) He^+ 3) Li^{2+} 4) H^+

66. If the electron of a hydrogen atom is present in the first orbit, the total energy of the electron is

1) $\frac{-e^2}{r}$ 2) $\frac{-e^2}{r^2}$ 3) $\frac{-e^2}{2r}$ 4) $\frac{-e^2}{2r^2}$

67. (A) : The angular momentum of an electron in hydrogen atom is $1.75\frac{h}{2\pi}$.

(R) : According to Bohr, the angular momentum of an electron in hydrogen atom is qunatised.

1) Both A & R are true and R is the correct explanation of A
2) Both A & R are true but R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

68. The ratio of ground state energy of Li^{2+}, He^+ and H is (M-2014)

1) 9 : 4 : 1 2) 1 : 2 : 3
3) 3 : 2 : 1 4) 1 : 4 : 9

69. The angular momentum of an electron present in the excited state of hydrogen is $1.5h/\pi$. The electron is present in

1) Third orbit 2) Second orbit
3) Fourth orbit 4) Fifth orbit

70. According to Bohr's theory, the angular momentum of electron in 5th orbit is

1) 2.5 h/π 2) 25 h/π
3) 1.0 h/π 4) 10 h/π

71. The angular momentum of a revolving electron in an orbit is equal to

1) $\frac{nh}{2\pi}$ 2) $\frac{h}{2\pi}$ 3) $\left(\frac{nh}{2\pi}\right)^2$ 4) $\frac{n\pi}{2h}$

72. Energy of an electron in n^{th} Bohr orbit is given as

1) $-\frac{n^2h^2}{4\pi^2 mZe^2}$ 2) $-\frac{2\pi^2Z^2me^4}{n^2h^2}$
3) $-\frac{2\pi Ze^2}{nh}$ 4) $-\frac{n^2h^2}{2\pi^2Z^2me^4}$

73. The energy of the electron when it is at an infinite distance from the nucleus is

1) Infinity 2) Zero
3) Minimum 4) Can not be predicted

74. According to Bohr's theory, when ever the electron drops from a higher energy level to a lower energy level, the frequency of radiation emitted is related to the energy change as

1) $\lambda = \frac{h}{mv}$ 2) $mvr = \frac{nh}{2\pi}$
3) $\upsilon = \frac{\Delta E}{h}$ 4) $\upsilon = \frac{h}{\Delta E}$

75. In an atom when an electron jumps from K-shell to M-shell

1) Energy is absorbed 2) Energy is emitted
3) Energy is neither absorbed nor emitted
4) Sometimes energy is absorbed and some times emitted

76. The expression for radius of a Bohr orbit in hydrogen atom is

1) $\frac{nh}{2\pi mr}$ 2) $\frac{n^2h^2}{4\pi^2me^2}$

3) $-\frac{2\pi^2me^4}{n^2h^2}$ 4) $\frac{n^2}{4\pi^2mhe^2}$

77. As the electron moves away from the nucleus its potential energy --- and kinetic energy ---

1) Decreases, increases
2) Increases, increases
3) Decreases, decreases
4) Increases, decreases

78. Identify the correctly matched set from the following lists

LIST - A	LIST - B
I) Energy	a) $\frac{2\pi ze^2}{nh}$
II) Velocity	b) $-\frac{2\pi^2mz^2e^4}{n^2h^2}$
III) Rydberg constant	c) $\frac{2\pi^2mz^2e^4}{h^3c}$
IV) Radius	d) $\frac{n^2h^2}{4\pi^2mze^2}$
	e) $-\frac{4\pi^2mz^2e^4}{n^2h^2}$

1) I – e, II – a, III – c, IV – d
2) I – b, II – a, III – c, IV – d
3) I – e, II – b, III – e, IV – d
4) I – b, II – a, III – d, IV – c

79. Bohr's model can explain

1) The spectrum of hydrogen atom only
2) Spectrum of an atom or ion containing one electron only
3) The spectrum of hydrogen molecule
4) The solar spectrum

80. Splitting of spectral lines under the influence of strong magnetic field is called (AFMC)

1) Stark effect 2) Zeeman effect
3) Photoelectric effect 4) None of these

81. Radius of tenth Bohr orbit of the hydrogen atom is.

1) 0.53A° 2) 5.3A°
3) 53A° 4) 5.3 × 5A°

82. Radius of 3rd Bohr orbit is

1) 6.529A° 2) 2.116A°
3) 4.761A° 4) 8.464A°

83. Velocity of the electron in the 1st Bohr orbit

1) 2.18×10^8 cm/sec 2) 2.18×10^8 m/sec
3) 2.18×10^{16} cm/se 4) 36559×10^8 cm/sec

84. The energy that is needed to remove an electron from the 1st Bohr orbit of Hydrogen atom is

1) 2.72 ev 2) 40.8 ev
3) 13.6 ev 4) 54.4 ev

85. The speed of an electron in the inner most orbit of the hydrogen (Bohr radius = 52.9 pm; $m_e = 9.11 \times 10^{-31}$ kg) is

1) 2.19×10^4 m.s^{-1} 2) 2.19×10^6 m.s^{-1}
3) 2.19×10^7 m.s^{-1} 4) 2.19×10^8 m.s^{-1}

86. The energy of an electron present in Bohr's second orbit of hydrogen atom is

1) –1312 J atom^{-1} 2) – 328 kJ mol^{-1}
3) – 328 J mol^{-1} 4) – 164 kJ mol^{-1}

de-Broglie's theory

87. The de-Broglie's equation treats an electron to be

1) a particle 2) a wave
3) ray 4) both (1) and (2)

88. Wave length of the wave associated with a moving electron (BHU)

1) Decreases with increase in speed of electron
2) Increases with increase in speed of electron
3) Remains same irrespective of speed of electron
4) is zero.

89. The uncertainity principle and the concept of wave nature of matter were proposed by ---- and ------ respectively

1) Pauli, Hund 2) Heisenberg, Aufbau
3) Heisenberg, de Broglie
4) Heisenberg, Planck

90. Bohr's postulate that $mvr = \frac{nh}{2\pi}$ is proved mathematically by

1) Pauli's exclusion principle
2) de Broglie wave nature of the electron
3) Heisenberg's uncertainity principle
4) Sommerfield theory

91. The momentum of a particle of wave length 1A° is

1) 6.625×10^{-27} g. cm.s^{-1}
2) 6.625×10^{-19} g. cm.s^{-1}
3) 6.625×10^{-16} g. cm.s^{-1}
4) 6.625×10^{-23} g. cm.s^{-1}

92. The de Broglie wave length of a particle with mass 1g and velocity 100 m/s is (PMT)

1) 6.63×10^{-33} m
2) 6.63×10^{-34} m
3) 6.63×10^{-35} m
4) 6.63×10^{-36} m

93. The de Broglie wave length of a riffle bullet of mass 2 grams moving with a velocity of 2m/sec is

1) $\frac{6.6\times10^{-34}}{2\times2}$ m
2) $\frac{6.6\times10^{-27}}{2\times10^{-3}\times2}$ cm
3) $\frac{6.6\times10^{-34}}{2\times10^{-3}\times2}$ m
4) $\frac{6.6\times10^{-27}}{2\times2}$ m

94. A cricket ball of mass 0.5kg is moving with a velocity of 100 m.s^{-1}, the wavelength associated with its motion is

1) 13.25×10^{-26}m
2) 13.25×10^{-34}m
3) 13.25×10^{-36}m
4) 6.6×10^{-34}m

95. If the Planck's constant h = 6.6×10^{-34} Js, the de- Broglie's wave length of a particle having momentum of 3.3×10^{-24} kg.ms^{-1} will be

1) 2×10^{-10}m
2) 1×10^{-15} m
3) 10^{-5}m
4) 4×10^{-10} m

96. The de Broglie wave length associated with a particle of mass 1 mg moving with a velocity of 1 m/sec is

1) 6.63×10^{-29} m
2) 6.63×10^{-31} m
3) 6.63×10^{-28} m
4) 6.63×10^{-22} m

97. The de Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 metres per second is approximately

1) 10^{-33} metres
2) 10^{-31} metres
3) 10^{-16} metres
4) 10^{-25} metres

98. If the uncertainity in velocity of a moving object is 1.0×10^{-6} ms^{-1} and the uncertainty in its position is 58m, the mass of this object is approximately equal to that of ($h = 6.626 \times 10^{-34}$ Js) (M-2013)

1) Helium
2) Deuterium
3) Lithium
4) Electron

Heisenberg principle

99. If uncertainity in position is zero, the uncertainity in momentum of an electron will be

1) Zero
2) Infinity
3) Unity
4) Zero or infinity

100. Uncertainity in position of a minute particle of mass 25g in space is 10^{-5} m. What is the uncertainity in its velocity (in ms^{-1}) ? ($h = 6.6 \times 10^{-34}$ Js)

1) 2.1×10^{-34}
2) 0.5×19^{-34}
3) 2.1×10^{-28}
4) 0.5×10^{-23}

101. The uncertainity in momentum of an electron is 1×10^{-5} kg.m/s. The uncertainity in its position will be ($h = 6.62 \times 10^{-34}$ kg.m/s) (PMT)

1) 1.05×10^{-28} m
2) 1.05×10^{-26} m
3) 5.27×10^{-30} m
4) 5.27×10^{-28} m

102. Identify the correct set from the following for fundamental particles

LIST - A	LIST - B
I) Decreasing order of masses	a) $e^- > p > n$
II) Decreasingorder of e/m values	b) $p > e^- > n$
III)Decreasing order of de-Broglie's wavelength with same velocities	c) $n > p > e^-$
IV)Decreasingorder of uncertainity in velocity when Δx is same	d) $n > e^- > p$

1) I – c, II – a, III – d, IV – a
2) I – c, II – a, III – a, IV – a
3) I – c, II – d, III – b, IV – a
4) I – c, II – b, III – d, IV – a

103. The uncertainity in the momentum of a particle is 3.31×10^{-2} kgms^{-1}. The uncertainity in its position is (in metres)

1) 1.59×10^{-33} 2) 0.33×10^{-30}
3) 0.4×10^{-20} 4) 3.3×10^{-24}

Schrodinger equation and orbitals

104. According to Schrodinger model, nature of electron in an atom is as

1) Particles only
2) Wave only
3) Both simultaneously
4) Sometimes waves and sometimes particles

105. Which one of the following expressions represent the electron probability function (D)

1) $4\pi r\, dr\, \psi^2$ 2) $4\pi r^2\, dr\, \psi$
3) $4\pi r^2\, dr\, \psi^2$ 4) $4\pi r\, dr\, \psi$

106. Radial part of the wave function depends on quantum numbers

1) n and s 2) l and m
3) l and s 4) n and l

107. p-orbitals are --- degenerate

1) Two fold 2) Three fold
3) Four fold 4) Five fold

108. Number of nodal planes that a p-orbital has

1) 0 2) 1 3) 2 4) 3

109. Which of the following is correct with respect to 'p' orbitals?

1) Spherical
2) Strong directional character
3) Five fold degenerate
4) No directional character

110. The maximum number of electrons accommodated in 5f orbitals

1) 5 2) 10 3) 14 4) 18

111. The maximum probability of finding an electron of a particular energy in an orbital is about

1) 80% 2) 85% 3) 95% 4) 99%

112. The number of nodal planes for P_x orbital is

1) 1 2) 2 3) 3 4) 0

113. Number of radial nodes in 3p orbital is

1) 0 2) 1 3) 2 4) 3

114. The orbital without nodal planes is

1) 1s 2) 2p 3) 3d 4) 3p

115. The no.of spherical nodes in a 4s orbital is

1) Zero 2) 1 3) 2 4) 3

116. Which d-orbital has its four lobes along the axes

1) d_{xy} 2) $d_{x^2-y^2}$ 3) d_{z^2} 4) d_{xz}

117. The density of electron cloud of the orbital d_{xy} in yz plane is

1) Zero 2) Maximum
3) Not determined 4) None

118. The probability of finding an electron in p_y orbital along the x-axis is

1) Maximum 2) Zero
3) Not determined 4) Infinite

119. The number of radial nodes and nodal planes in 4p orbital are respectively

1) 2, 1 2) 1, 2 3) 2, 3 4) 3, 2

120. The number of nodes possible in radial probability distribution curve of 3d orbital is

1) 1 2) 2 3) 3 4) 0

121. The number of nodal planes 'd' orbital has (CEET Kuruksh)

1) Zero 2) one 3) two 4) three

122.

LIST - 1	LIST - 2
A) Bohr's atomic model	1) Fine spectrum of Hydrogen
B) de-Broglie's concept	2) Atomic orbital
C) Sommerfield atomic model	3) Dual nature of any particle in motion
D) Schrodinger wave equation	4) Quantisation of angular momentum

The correct match is

	A	B	C	D
1)	2	3	4	1
2)	4	3	2	1
3)	4	3	1	2
4)	3	4	2	1

Quantum numbers

123. For complete description of an electron in an atom, the number of quantum numbers required is

1) one 2) Two 3) Three 4) Four

124. The azimuthal quantum number indicates ..... of the orbital

1) Size 2) Shape
2) Orientation 4) Spin

125. Which of the following is indicated by the magnetic quantum number?

1) Size 2) Shape
3) Spatial orientation 4) Spin

126. Principal quantum number is related to

1) Size of the orbit
2) Spin angular momentum
3) Orbital angular momentum
4) Orientation of orbital in space

127. The spin quantum number has a value of

1) 1/2 2) +1/2 (PMT)
3) −1/2 4) either +1/2 or −1/2

128. When there are two electrons in the same orbital they have the spin values

1) $+\frac{1}{2}, +\frac{1}{2}$ 2) $-\frac{1}{2}, -\frac{1}{2}$
3) $+\frac{1}{2}, -\frac{1}{2}$ 4) 0, 0

129. The values of quantum numbers n, l and m for the fifth electron of boron is (pb.CET)

1) n = 2, l = 1, m = −1 2) n = 2, l = 0, m = −1
3) n = 2, l = 2, m = −1 4) n = 1, l = 2, m = −1

130. When n=3, l =1, the designation given to the orbital is

1) 4s 2) 4p 3) 3s 4) 3p

131. Which of the following designation is impossible?

1) 4f 2) 5g 3) 2d 4) 6p

132. l = 3, then the values of magnetic quantum numbers are

1) ±1, ±2, ±3 2) 0, ±1, ±2, ±3
3) -1, -2, -3 4) 0, +1, +2, +3

133. For a f-orbital, the values of m are

1) -1, 0, +1 2) 0, +1, +2, +3
3) -2, -1, 0, +1, +2 4) -3, -2, -1, 0, +1, +2, +3

134. The impossible set of quantum numbers is

1) n = 2, l = 0, m = 0 , s = +1/2
2) n = 2, l = 1, m = 0 , s = +1/2
3) n = 2, l = 0, m = 1 , s = −1/2
4) n = 3, l = 1, m = -1 , s = −1/2

135. Which of the following quantum numbers are not possible ? (CPMT)

1) n = 2, l = 1, m = −1, s = −1/2
2) n = 3, l = 2, m = −3, s = + 1/2
3) n = 2, l = 0, m = 0, s = +1/2
4) n = 3, l = 2, m = −2, s = +1/2

136. The correct set of quantum numbers for the unpaired electron of chlorine atom is

	n	l	m		n	l	m
1)	2	1	0	2)	2	1	1
3)	3	1	0	4)	3	0	0

137. The two electrons occupying an orbital are distinguished by

1) Principal quantum number
2) Azimuthal quantum number
3) Magnetic quantum number
4) Spin quantum number

138. Which of the following sets of quantum numbers is correct for an electron in 4 f orbital ?

1) n = 4, l = 3, m = + 4, s = +1/2
2) n = 3, l = 2, m = −2, s = +1/2
3) n = 4, l = 3, m = +1, s = +1/2
4) n = 4, l = 4, m = − 4, s = − 1/2

139. The set of quantum numbers not applicable to an electron is

1) 1, 1, 1, +1/2 2) 1, 0, 0, +1/2
3) 1, 0, 0, -1/2 4) 2, 0, 0, +1/2

140. For the p_z orbital, conventionally m is

1) −2 2) +2
3) 0 4) Any of these

141. For the d_{z^2} orbital, the value of m may be

1) –3 2) –2 3) 0 4) None

142. The qunatum number not obtained from the Schrodinger's wave equation is

1) n 2) l 3) m 4) s

143. A given orbital is labelled by the magnetic quantum number, m= –1. This can not be

1) s- orbital 2) p-orbital
3) d-orbital 4) f-orbital

144. The shape of orbital for which l = 1 is

1) Spherical 2) Dumb-bell
3) Double dumb-bell 4) Circular

145. The maximum number of electrons in a sub-shell is given by the expression.

1) $(l+2)$ 2) $(2l+2)$ 3) $(4l+2)$ 4) $(l+1)$

146. The magnetic quantum number, m for the outermost electron in the sodium atom is

1) 1 2) 0 3) 2 4) -1

147. For the configuration $1s^2 2s^1$, the quantum numbers for the outermost electron are

1) 2,1,0, –1/2 2) 2,0,0,+1/2
3) 2,1,0,+1/2 4) 2,0,1,+1/2

148. The maximum number of electrons that a p-orbital can accomodate is

1) 6 2) 2 3) 10 4) 14

149. The number of orbitals in the quantum level n = 4 is

1) 4 2) 9 3) 16 4) 18

150. The quantum number which is equal for all the d-electrons in an atom is

1) ℓ 2) m 3) s 4) n

151. Correct set of four quantum numbers for the valence electron of Rubidium (Z=37) is

1) 5, 0, 0, +1/2 2) 5, 1, 0, +1/2
3) 5, 1, 1, +1/2 4) 6, 0, 0, +1/2

152. n, l and m values of the $2p_z$ orbital are

1) 3,2,1 2) 2,1,0 3) 1,2,0 4) 2,0,1

153. The azimuthal quantum number for the last electron in sodium atom is

1) 1 2) 2 3) 0 4) 3

154. Which of the following is not a possible value of azimuthal quantum number (l) for an electron with n = 3?

1) zero 2) 1 3) 2 4) 3

155. Maximum number of electrons that can be present in M and N - shells respectively are

1) 18, 32 2) 8, 18
3) 32, 50 4) 32, 48

156. What is the maximum number of electrons that can be theoretically present in the seventh orbit?

1) 49 2) 32 3) 72 4) 98

157. The correct set of quantum numbers for a 4d electron is (Kerala Engineering)

1) 4, 3, 2, +1/2 2) 4, 2, 1, 0
3) 4, 3, –2, +1/2 4) 4, 2, 1, –1/2
5) 4, 2, –2, 0

158. Which of the following sets of quantum numbers is correct for an electron in 4f - orbitals? (AFMC)

1) n = 4, ℓ = 3, m = 4, s = +1/2
2) n = 4, ℓ = 4, m = –4, s = –1/2
3) n = 4, ℓ = 3, m = +1, s = +1/2
4) n = 3, ℓ = 2, m = –2, s = +1/2

Electronic configuration

159. No two electrons in an orbital can have parallel spin. This statement emerges from

1) Hund's rule
2) Aufbau principle
3) Pauli's exclusion principle
4) (n+l) rule

160. Electrons never pair, if there are empty orbitals in a given sub-shell. This is

1) Aufbau principle
2) Paulis exclusion principle
3) Hund's rule of maximum multiplicity
4) Heisenberg's uncertainity principle

161. Which of the following explains the sequence of filling electrons in different subshells? (AIIMS)

1) Hund's rule 2) Aufbau principle
3) Pauli's principle 4) All of these.

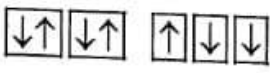
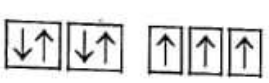
162. Nitrogen atom has 3 unpaired electrons in its ground state. It can be explained by

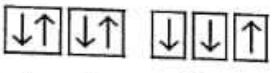
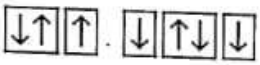
1) Auf - bau principle 2) Paulis principle
3) Hund's rule 4) None of these

163. The electronic configuration of sodium is

1) $[Ne]3s^2$ 2) $[Ne]3s^1$
3) $[Ar]4s^1$ 4) $[Ar]4s^2$

164. Which of the following may represent the ground state of nitrogen atom?

1)  2) 

3)  4) 

165. Electronic configuration of the element with atomic number 56 and mass number 138 is

1) $[Xe]6s^2$ 2) $[Kr]5s^2$
3) $[Xe]6s^2\ 6p^2$ 4) $[Xe]3d^2\ 5d^2$

166. The correct valence electronic configuration for Cu (z =29) is

1) $3d^9\ 4s^2$ 2) $3d^{10}\ 4s^1$
3) $3d^{10}\ 4s^2$ 4) $3d^8\ 4s^2$

167. Which one of the following pairs of ions have the same electronic configuration

1) Cr^{3+}, Fe^{3+} 2) Fe^{3+}, Mn^{2+}
3) Fe^{3+}, Co^{3+} 4) Sc^{3+}, Cr^{3+}

168. The $(n + l)$ value for 4f-sub shell is

1) 4 2) 5 3) 6 4) 7

169. The energy of the electron in the hydrogen atom depends on

1) The principal quantum number only
2) All the quantum numbers
3) The Azimuthal quantum number
4) The principal and azimuthal quantum numbers

170. After 3d-sub level is completely filled the differentiating electron enters into ..... sub level.

1) 4s 2) 4p 3) 4f 4) 5s

171. Number of unpaired electrons in the electronic configuration $1s^2 2s^2 2p^4$ are (CBSE)

1) 2 2) 3 3) 4 4) 6

172. The configuration $1s^2 2s^2 2p^6 3s^2 3p^3$ corresponds to

1) S 2) P 3) Na 4) Ar

173. The configuration $1s^2 2s^1 2p_x^{\ 1} 2p_y^{\ 1} 2p_z^{\ 1}$ represents

1) Nitrogen atom (ground state)
2) Carbon atom (ground state)
3) An excited carbon atom
4) An excited nitrogen atom

174. The total number of 'p' electrons present in phosphorous atom is

1) 9 2) 2 3) 8 4) 3

175. The valence electron configuration of an element with atomic number 23 is

1) $3d^5$ 2) $3d^3\ 4s^2$
3) $3d^2\ 4s^1\ 4p^1$ 4) $3d^2\ 4s^2\ 4p^1$

176. Mg^{2+} and Al^{3+} have same

1) Protons 2) Neutrons
3) Electronic configuration
4) Neutrons + protons

177. The number of unpaired electrons in the valence shell of silicon is

1) 2 2) 3 3) 1 4) 0

178. Which of the following electronic configuration corresponds to an inert gas?

1) $1s^2 2s^2 2p^5$ 2) $1s^2 2s^2 2p^6$
3) $1s^2 2s^2 2p^6 3s^1$ 4) None

179. The reason for chromium to have $[Ar]3d^5 4s^1$ configuration instead of $[Ar]3d^4 4s^2$ is

1) Pauli's exclusion principle
2) Aufbau principle
3) more exchange energy
4) Heisenberg's principle

180. Which of the following configuration is not possible?

1) $2p^2$ 2) $3f^7$ 3) $3d^5$ 4) $4p^6$

181. Which of the following ions is not isoelectronic with O^{2-}

1) N^{3-} 2) F^- 3) Ti^+ 4) Na^+

182. Number of valence electrons in carbon is
1) 3 2) 1 3) 4 4) 0

183. The number of unpaired electrons in Fe^{3+} ion are
1) 1 2) 0 3) 4 4) 5

184. The number of unpaired electrons in $1s^2\ 2s^2\ 2p^3$ is (AFMC)
1) 1 2) 2 3) 3 4) 5

185. In potassium the order of energy levels is
1) 4s > 3d 2) 4s < 3d
3) 4s < 3p 4) 4s = 3d

EXERCISE - 2

Fundamental particles

1. Ratio of masses of proton and electron is
1) 1.8 2) 1.8×10^3
3) Infinite 4) None of these

2. The charge of an electron is 1.6×10^{-19} coulombs. What will be the value of charge on Na^+ ion
1) 1.6×10^{-19} C 2) 3.2×10^{-19} C
3) 2.4×10^{-19} C 4) $11 \times 1.6 \times 10^{-19}$ C

3. The constancy of e/m ratio for electron shows that
1) Electron's mass is $1/1837^{th}$ of the mass of proton
2) Electrons are universal particles of all matter
3) Electrons are produced in discharge tubes only
4) None of the above

4. The increasing order of e/m values for electron, proton, neutron and alpha particle is
1) e, p, n, α 2) n, p, e, α
3) n, p, α, e 4) n, α, p, e

Atomic number and mass number

5. The ratio between the neutrons present in carbon atom and silicon atoms with mass numbers 12 and 28 is
1) 7 : 3 2) 3 : 7
3) 1 : 2 4) 2 : 1

6. The number of nucleons in the isotope of an atom ${}_ZX^m$ are
1) m 2) Z 3) m + Z 4) m – Z

7. An oxide of nitrogen has a molecular weight of 30. Total number of electrons in one molecule of the compound is
1) 15 2) 30 3) 45 4) 60

8. Maximum sum of the number of neutrons and protons in an isotope of hydrogen (IIT)
1) 6 2) 5 3) 4 4) 3

9. Consider the following pairs of ions
A) Sc^{+3} and Ti^{+4} B) Mn^{+2} and Fe^{+2}
C) Fe^{+2} and Co^{+3} D) Cu^+ and Zn^{+2}
Among these pairs of ions, isoelectronic pairs would include
1) B, C and D 2) A, C and D
3) A, B and D 4) A, B and C

Nature of light

10. According to Planck's Quantum theory, the correct statements are
a) The vibrating particle in the black body does not emit energy continuously
b) Radiation is emitted in the form of small packets called Quanta
c) Energy associated with emmitted radiations is inversely proportional to frequency.
d) The emitted radiant energy is propagated in the form of waves.
1) a, b, c 2) b, c
3) a, b, d 4) b, d, c

11. Energy equal to the mass of one electron is
1) 8.2×10^{-7}erg 2) 9.2×10^{-8}erg
3) 8.2×10^{-10}erg 4) 4.1×10^{-8}erg

12. Which of the following statements is incorrect?
1) Particle nature of radiations can be experimentally demonstrated by photoelectric effect
2) Wave nature of electrons can be experimentally demonstrated by diffraction experiment
3) The value of Planck's constant, h is 6.62×10^{-34} J.s
4) Intensity of light is directly proportional

13. The ratio of energies of two photons of wavelengths 2000 and 4000 A^0.
1) 1 : 4 2) 4 : 1 3) 1 : 2 4) 2 : 1

14. The energy of an electromagnetic radiation is 3×10^{-12}ergs. What is its wavelength in nanometers? ($h = 6.625 \times 10^{-27}$ erg. sec, $C = 3 \times 10^{10}$ cm. sec^{-1})
1) 400 2) 228.3
3) 3000 4) 662.5

Spectra

15. Which of the following statements regarding spectral series is correct? (CEE UP)
1) The lines in the Balmer series correspond to the electronic transition from higher energy level two n = 1 energy level.
2) Paschen series appears in the infra-red-region
3) The lines of Lyman series appear in the visible region
4) Transition from higher energy levels to 4th energy level produces Pfund series which fall in the infrared region.

16. In a series in the line spectrum of hydrogen, the wavelength of radiation is 6,563A^0. The name of the series and the orbits in which electron transition takes place are
1) Balmer series, 3rd to 2nd orbit
2) Lyman series, 2nd to 1st orbit
3) Pfund series, 6th to 5th orbit
4) Paschen series, 4th to 3rd orbit

17. The frequency of the spectral line obtained when the electron in n = 3 of Hydrogen atom drops to the ground state is
1) 2.925×10^{15} Hertz 2) 2.925×10^{13} Hertz
3) 2.925×10^{14} Hertz 4) 36559×10^{10} Hertz

18. The wavelength of the first member of the Balmer series in hydrogen spectrum is x A^0. Then the wave length (in A^0) of the first member of Lyman series in the same spectrum is
1) $\frac{5}{27}x$ 2) $\frac{4}{3}x$ 3) $\frac{27}{5}x$ 4) $\frac{5}{36}x$

19. Which of the following transitions will have minimum wavelength ? (AFMC)
1) $n_4 \rightarrow n_1$ 2) $n_2 \rightarrow n_1$
3) $n_4 \rightarrow n_2$ 4) $n_3 \rightarrow n_1$

20. The ratio of wavelength values of series limit lines ($n_2 = \infty$) of Balmer series and Paschen serie are
1) 4 : 9 2) 9 : 4 3) 2 : 3 4) 3 : 2

21. The minimum and maximum values of wavelength in the Lyman series of a H atom are, respectively
1) 364.3 nm and 653.4 nm
2) 91.2 nm and 121.5 nm
3) 41.2 nm and 102.6 nm
4) 9.12 nm and 121.5 nm

22. Which one of the following transitions of an electron in hydrogen atom emits radiation of the lowest wavelength ?
1) $n_2 = \infty$ to $n_1 = 2$ 2) $n_2 = 4$ to $n_1 = 3$
3) $n_2 = 2$ to $n_1 = 1$ 4) $n_2 = 5$ to $n_1 = 3$

23. In a hydrogen atom, the electron is at a distance of 4.76A^0 from the nucleus. The angular momentum of the electron is
1) $\frac{3h}{2\pi}$ 2) $\frac{h}{2\pi}$ 3) $\frac{h}{\pi}$ 4) $\frac{2h}{\pi}$

Bohr's theory

24. The total energy of electron in an atom is a combination of potential energy and kinetic energy. If total energy is –E for an electron in an atom, then its K.E. and P.E. respectively are
1) 2E, –E 2) 2E, E 3) E, –2E 4) E, –E

25. The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom?
1) He^+(n = 2) 2) Li^{2+} (n = 2)
3) Li^{2+} (n = 3) 4) Be^{3+} (n = 2)

26. The change in velocity when electron jumps from the first orbit to the second orbit is
1) Half its original velocity
2) Twice its original velocity
3) One fourth its original velocity
4) Equal to its original velocity

27. As an electron is brought from an infinite distance close to nucleus of atom, the energy of electron

1) Increases to a greater +ve value
2) Decreases to a smaller +ve value
3) Increases to a smaller –ve value
4) Decreases to a greater –ve value

28. Which one of the following statements is not correct?

1) Rydberg constant and wave number have same units
2) Lyman series of hydrogen spectrum occurs in the ultraviolet region
3) The angular momentum of the electron in the ground state of hydrogen atom is equal to $h/2\pi$
4) The radius of the first Bohr orbit of hydrogen atom is 2.116×10^{-8}cm

29. The ratio of the radii of the first three orbits in an atom of hydrogen is

1) 1:4:9 2) 9:4:1 3) 1:2:3 4) 3 : 2 : 1

30. The radius of hydrogen atom in the ground state is 0.53 A° ,the radius of Li^{2+}in the similar state is (PMT)

1) 1.06.06 A° 2) 0.265 A°
3) 0.175 A° 4) 0.53 A°

31. In hydrogen atom the kinetic energy of electron is 3.4 eV. The distance of that electron from the nucleus

1) 2.116A° 2) 0.529A°
3) 1.587A° 4) 21.16A°

32. The radius of first Bohr's orbit for hydrogen is 0.53 A^0. The radius of third Bohr's orbit would be (MPPMT)

1) 0.79 A^0 2) 1.59 A^0
3) 3.18 A^0 4) 4.77 A^0

33. The energy of second Bohr orbit of hydrogen atom is –328 kJ. mol^{-1}, hence energy of fourth Bohr orbit would be (BHU)

1) –41 kJ mol^{-1} 2) –82 kJ mol^{-1}
3) –164 kJ mol^{-1} 4) –1312 kJ mol^{-1}

34. Which of the following transistions in hydrogen atom will require the highest amount of energy

1) n = 1 to n = 2 2) n = 1 to n = 3
3) n = 2 to n = 1 4) n = 3 to n = 4

35. The energy of an electron in the first Bohr's orbit of a hydrogen atom is -2.18×10^{-18}J. Its energy in the second orbit would be

1) -1.09×10^{-18} J 2) -4.36×10^{-18} J
3) -5.45×10^{-19} J 4) -8.72×10^{-18} J

de-Broglie theory

36. The de Broglie wavelength associated with a moving particle of fixed mass is inversely proportional to

1) Its kinetic energy
2) Square root of its kinetic energy
3) Square of its kinetic energy
4) Cube of its kinetic energy

37. If the wavelength of the electron is numerically equal to the distance travelled by it in one second, then

1) $\lambda=\sqrt{\frac{h}{m}}$ 2) $\lambda=\frac{h}{p^2}$
3) $\lambda=\frac{h}{m}$ 4) $\lambda=\sqrt{\frac{h}{p}}$

38. For an electron to have the same de Broglie wave length as that of a Deuteron, its velocity should be --- times that of Deuteron

1) 1836 2) 1/1836
3) 3672 4) 1/3672

39. A hydrogen molecule and helium atom are moving with the same velocity. Then the ratio of their de Brogile wavelength is

1) 1:1 2) 1:27 3) 2:1 4) 2:3

40. Wavelength of an electron is 5A°.Velocity of the electron is

1) 1.45×10^8 cm/s 2) 1.6×10^{-8}cm/s

3) 3.2×10^{-27}cm/s 4) 3.2×10^{27}cm/s

41. The wavelength associated with a golf ball weighing 200g and moving at a speed of 5 m/h is of the order . (IIT)

1) 10^{-10} m 2) 10^{-20} m

3) 10^{-30} m 4) 10^{-40} m

Heisenberg principle

42. The size of a mircorscopic particle is 1 micron and its mass is 6×10^{-13}g. If its position may be measured to within 0.1%of its size, the uncertainity in velocity (in cm^{-1}) is approximately

1) $\frac{10^{-7}}{4\pi}$ 2) $\frac{10^{-5}}{4\pi}$ 3) 10^{-5} 4) 10^{-8}

43. The uncertainities in the velocities of two particles A and B are 0.05 and 0.02m.sec^{-1} respectively. The mass of B is five times to that of mass A. What is the ratio of uncertainities $\left(\frac{\Delta x_A}{\Delta x_B}\right)$ in their positions

1) 2 2) 0.25 3) 4 4) 1

44. The uncertainty in the position of an electron (mass 9.1×10^{-28}g) moving with a velocity of $3.0 \times 10^4 cm^{-1}$ accurate up to 0.011%, will be

1) 1.92cm 2) 7.68cm (PMT)

3) 0.175cm 4) 3.84 cm

Orbitals

45. There is no difference between a 2p and a 3p orbital regarding

1) Value of n 2) size

3) energy 4) shape

46. The probability of finding electron in XY plane for P_Z - orbital is

1) 100% 2) 50% 3) 99.9% 4) 0%

EXERCISE - 3

1. Mass numbers of Li, Be and B are 7, 9 and 10 respectively. Which of the following has two electrons, three protons and four neutrons?

1) B^+ 2) Be^{2+} 3) Li^+ 4) Be

2. The energy required to melt 1g. ice is 33J. The number of quanta of radiation of frequency 4.67×10^{13} sec^{-1} that must be absorbed to melt 10g ice is

1) 1.065×10^{22} 2) 3.205×10^{23}

3) 9.076×10^{20} 4) None

3. When a greater number of electrons from excited hydrogen atoms reach the ground state, then

1) The intensity of spectral lines in Lyman series increases

2) The number of lines in Lyman series increases

3) Both the intensity and number lines in Lyman series increase.

4) There is no observable change in spectrum

4. (A) : The mass ratio of proton and neutron is 1836 : 1837

(R) : Proton is negatively charged particle but neutron is neutral charged particle

1) Both A and R are true and R is the correct explanation of A

2) Both A and R are true and R is not the correct explanation of A

3) A is true and R is false

4) A is false and R is true

5. What electronic transition in Li^{+2} produces the radiation of the same wave length as the first line in the Lyman series of hydrogen?

1) n = 4 to n = 2 2) n = 9 to n= 6

3) n = 9 to n = 3 4) n = 6 to n = 3

6. The ratio of the wave lengths of the first line in the Lyman series of the spectrum of Hydorgen atom and the first line in the Balmer series of the spectrum of He^+ is

1) 20/27 2) 27/20 3) 27/5 4) 5/27

7. In a certain electronic transition from the quantum level, 'n' to the ground state in atomic hydrogen in one or more steps, no line belonging to the Brackett series is observed. What wave numbers may be observed in the Balmer series? (R=Rydberg Constant)

1) $\frac{8R}{9}, \frac{5R}{36}$ 2) $\frac{3R}{16}, \frac{8R}{9}$

3) $\frac{5R}{36}, \frac{3R}{16}$ 4) $\frac{3R}{4}, \frac{3R}{16}$

8. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter - orbit jumps of the electron for Bohr orbits in an atom of hydrogen ?

1) $3 \rightarrow 2$ 2) $5 \rightarrow 2$ 3) $4 \rightarrow 1$ 4) $2 \rightarrow 5$

9. Ionisation energy of He^+ is 19.6×10^{-18}J atom^{-1}. The energy of the first stationary state of Li^{2+} is

1) -4.41×10^{-18} J.atom^{-1}
2) -4.41×10^{-17} J.atom^{-1}
3) -44.1×10^{-16} J.atom^{-1}
4) -8.72×10^{-18} J.atom^{-1}

10. Kinetic energy of electron in a mono electronic species is +1312kJ/mole. Then which of the following statements are correct

I) The electron is present in the 2nd orbit of He^+ ion
II) The electron is present in the 2nd orbit of H atom
III) The electron is present in the 3rd orbit of Li^{+2} ion
IV) The electron is present in the 4th orbit of He^+ ion

1) I and II 2) II and III
3) I and III 4) III and IV

11. The kinetic energy of an electron in an orbit of hydrogen atom is 3.4ev/atom. Then identify the correctly matched set for that electron

LIST - 1	LIST - 2
A) Potential energy	1) 1.09×10^{8} cm/sec
B) Total energy	2) 2.116×10^{-8} cm
C) Velocity	3) –6.8 ev/atom
D) Its distance from nucleus	4) –3.4 ev/atom

The correct match is

	A	B	C	D		A	B	C	D
1)	4	3	2	1	2)	3	4	1	2
3)	2	1	4	3	4)	3	4	2	1

12. The Ionisation potential of Hydrogen is 2.17×10^{-11} erg/atom. The energy of the electron in the second orbit of the hydrogen atom in erg/atom is

1) $-\frac{2.17\times10^{-11}}{2}$ 2) $-\frac{2.17\times10^{-11}}{2^2}$

3) $-\frac{2.17\times10^{17}}{2^2}$ 4) $-\frac{2.17\times10^{11}}{2^2}$

13. The wavelength of radiation required to remove the electron of hydrogen atom (Ionisation energy 21.7×10^{-12} erg) from n = 2 orbit to $n = \infty$ is

1) 3.664×10^{-4} cm 2) 3.66×10^{-5} cm
3) 3.66×10^{-6} cm 4) 3.664×10^{-7} cm

14. The radii of two of the first four Bohr orbits of the hydrogen atom are in the ratio 1 : 4. The energy difference between them may be

1) 0.85 eV 2) 10.2 eV
3) 3.40 eV 4) 13.6eV

15. The velocity of electron in hydrogen atom is 7.29×10^7 cm/sec. The potential energy of that electron is

1) – 13.6 eV 2) – 3.4 eV
3) – 3.02 eV 4) – 1.70 eV

16. Choose the correct statement(s)

i) The energy of an electron in an atom is always negative, because it is negatively charged.

ii) The energy of an electron in an atom is positive

iii) When an electron is at an infinite distance from the nucleus so that there is no electrical interaction; then orbitarily the energy of electron is taken to be zero

iv) As the electron moves closer to the nucleus, energy is released and so its energy becomes less than zero i.e, negative.

1) all are correct

2) iii and iv are correct

3) only ii is correct

4) no statement is correct.

17. A particle of mass one microgram is confined to move along one direction (x-axis) within a region 1 mm in extension. What is the uncertanity in its velocity?

1) 3.313×10^{-20} cm^{-1}

2) 5.012×10^{-20} cm^{-1}

3) 8.325×10^{-20} cm^{-1}

4) 5.27×10^{-21} cm^{-1}

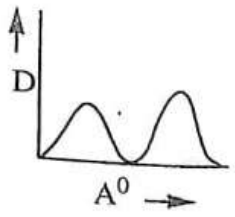
18. The set of quantum numbers 'n' and 'l' possible for the orbital shown in the radial probability curve are

1) n = 3; l = 2

2) n = 4; l = 1

3) n = 2; l = 0

4) n = 3; l = 3



19. In a H–atom, the transition takes place from L to K shell. If $R = 1.08 \times 10^{7} m^{-1}$, the wave length of the light emitted is nearly

1) 4400A° 2) 1250A°

3) 1650A° 4) 1850A°

20. An electron has magnetic quantum number as '–3'. Its principal quantum number is

1) 3 2) 2 3) 1 4) 4

21. Identify the incorrect match

LIST - 1	LIST - 2
A) n = 3 l = 3 m = 0 s = +1/2	I) when n = 3, l can not be 3
B) n = 5 l = 2 m = 3 s = +1/2	II) when l = 2, m can not be 3
C) n = 4 l = 2 m = 1 s = 0	III) when l = 2, s can not be 0
D) n = 0 l = 1 m = s = –1/2	IV) n can not be zero

1) A-I 2) B–II 3) C-III 4) D–I

22. Which one of the following statements is correct?

1) 2s orbital is spherical with two nodal planes

2) The de-Borglie wavelength of a particle of mass 'm' and velocity 'v' is equal to mv/h

3) The principal quantum number (n) indicates the shape of the orbital

4) The electronic configuration of phosphorus is given by [Ne] $3s^2 3p_x^1 3p_y^1 p_z^1$

23. If in Hydrogen atom, an electron jumps from n_2=2 to n_1= 1 in Bohr's orbit, then the value of wave number of the emitted photon will be (R=109700 cm^{-1})

1) 54850 cm^{-1} 2) 82275 cm^{-1}

3) 62875 cm^{-1} 4) 10970 cm^{-1}

24. When a certain metal was irradiated with light of frequency 3.2×10^{16} Hz, the photoelectrons emitted had twice the kinetic energy as did photoelectrons when the same metal was irradiated with light of frequency 2.0×10^{16} Hz. The threshold frequency for the metal is

1) 1.2×10^{16} Hz 2) 8×10^{15} Hz

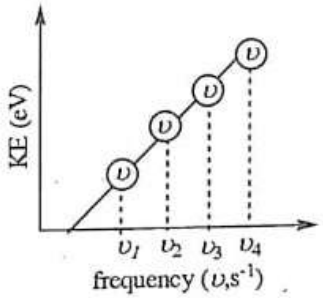
3) 8×10^{16} Hz 4) 1.2×10^{15} Hz

25. If a metal is irradiated with light of frequency 3×10^{19} sec^{-1}, electron is emitted with kinetic energy of 6.625×10^{-15}J. The threshold frequency of the metal is

1) 2×10^{19} sec^{-1} 2) 1.25×10^{19} sec^{-1}

3) 6.625×10^{35} sec^{-1} 4) 6.625×10^{19} sec^{-1}

26. In a photoelectric experiment, kinetic energy of photoelectrons was plotted aganist the frequency of incident radiation (ν), as the shown in figure. Which of the following statements is correct?



1) The threshold frequency is v_1
2) The slope of this line is equal to Plank's constant.
3) As the frequency of incident radiation increase frequency, kinetic energy of photoelectrons decreases
4) It is impossible to obtain such a graph.

27. True statements among the following are
A) As the temperature increases maximum intensity of radiation emitted by the black body shifts towards lower wavelength side
B) As the intensity of incident radiation increases kinetic energy of photo electrons increases
1) Both A and B 2) Only A
3) Only B 4) Neither A nor B

28. The wavelength of the electron in the first orbit of the Hydrogen atom is x. The wave length of the electron in the third orbit and the circumference of the third orbit of the Hydrogen atom are respectively
1) 3x, 9x 2) 9x, 27x 3) x, 3x 4) x/3, x

29. If the radius of first Bohr orbit of H atom is x, then de Broglie wavelength of electron in 3rd orbit is nearly
1) $2\pi x$ 2) $6\pi x$ 3) 9x 4) x/3

30. Uncertainity in the position of an electron (mass = 9.1×10^{-31} kg) moving with a velocity 300 $m.s^{-1}$, accurate upto 0.001 %, will be ($h = 6.63 \times 10^{-34}$ J.S) (MLNR)
1) 19.2×10^{-2} m 2) 5.76×10^{-2} m
3) 1.92×10^{-2} m 4) 3.84×10^{-2} m

31. If the Nitrogen atom had electronic configuration $1s^7$, it would have energy lower than that of the normal ground state configuration $1s^2\ 2s^2\ 2p^3$, because the electrons would be closer to the nucleus. Yet, $1s^7$ is not observed because it violates (IIT)
1) Heisenberg uncertainty principle
2) Hund's rule
3) Pauli exclusion principle
4) Bohr postulate of stationary orbits

32. Identify the incorrectly matched set from the following

LIST - 1	LIST - 2
1) Total no.of orbitals with (n+l)value Z = 24 = 5	A) 9
2) No.of vacant orbitals present in an atom with Z = 14	B) 6
3) No.of orbitals completely filled with electrons in an atom with Z = 24	C) 15
4) No.of degenerate orbitals present in d-subshell	D) 5

1) 1–A 2) 2–B 3) 3–C 4) 4–D

33. Calculate the mass of a photon with wavelength 3.6 A^0.
1) 6.135×10^{29} Kg 2) 6.135×10^{-33} Kg
3) 6.135×10^{19} Kg 4) 6.135×10^{16} Kg

34. A microscope using suitable photons is employed to locate an electron in an atom within a distance of $0.1A^0$. What is the uncertaintiy involved in the measurement of its velocity?
1) 0.79×10^6 ms^{-1} 2) 5.79×10^{16} ms^{-1}
3) 5.79×10^6 ms^{-1} 4) 5.79 ms^{-1}

35. In the radial probability curve of 2s orbital, the probability of finding electron density is least at a distance of

1) $0.53A^0$ from the nucleus

2) $1.10A^0$ from the nucleus

3) $2.2\ A^0$ from the nucleus

4) $2.6\ 3A^0$ from the nucleus

36. (A) : K and Cs are commonly used in photoelectric cells.

(R) : K and Cs can emit electrons when exposed to light of lesser frequency.

1) Both (A) and (R) are true and (R) is the correct explanation of (A)

2) Both (A) and (R) are true and (R) is not the correct explanation of (A)

3) (A) is true but (R) is false

4) (A) is false but (R) is true

37. The number of unpaired electrons present in palladium (Z = 46) atom is

1) 1 2) 2 3) Zero 4) 3

38. Which of the following isolated gaseous atoms has highest net electronic spin

1) scandium (value of Z is 21)

2) chromium (value of Z is 24)

3) iron (value of Z is 26)

4) nickel (value of Z is 28)

39. The energy of a photon is 3×10^{-12} ergs. What is its wavelength in nm ? ($h= 6.62 \times 10^{-27}$ erg. sec; $C = 3 \times 10^{10}\ Cm.s^{-1}$)

1) 662 2) 1324 3) 66.2 4) 6.62

40. If the wavelength of an electomagnetic radiation is 2000^0A. What is the energy in ergs?

1) 9.94×10^{-12} 2) 9.94×10^{-10}

3) 4.97×10^{-12} 4) 4.97×10^{-19}

41. A wave has a frequency of $3 \times 10^{15}\ sec^{-1}$. The energy of that photon is

1) 1.6×10^{-12} erg 2) 3.2×10^{-11} erg

3) 2.0×10^{-11} erg 4) 3×10^{15} erg

IV. MATCHINGS

1. List-I

A) J.J.Thomson
B) Moslcy
C) Chadwick
D) Rutherford

List-II

1) Discovery neutron
2) Nuclear model of atom
3) Cathode rays
4) X-ray spectra
5) Radioactivity

The correct match is

	A	B	C	D
1)	2	3	4	5
2)	3	4	1	2
3)	1	3	4	5
4)	2	3	5	4

2. List-I

A) Mass spectrum
B) X-ray spectrum
C) Paramagnetism
D) Orbitalş

List-II

1) Wave function
2) Unpaired Electrons
3) Atomic number
4) Isotopes
5) Inter molecular forces

The correct match is

	A	B	C	D
1)	2	4	3	1
2)	4	3	2	1
3)	3	2	4	1
4)	1	2	3	4

3. List-I

A) Energy

B) Velocity

C) Rydberg constant

D) Radius

List -II

1) $\frac{2\pi ze^2}{n\hbar}$

2) $\frac{-2\pi^2 mz^2e^4}{n^2h^2}$

3) $\frac{2\pi^2 mz^2e^4}{h^3}$

4) $\frac{n^2h^2}{4\pi^2 mz\, e^2}$

5) $\frac{-4\pi^2 mz^2e^4}{n^2h^2}$

The correct match is

	A	B	C	D
1)	A=2	B=4	C= 5	D=1
2)	A=2	B=1	C=3	D=4
3)	A=3	B=2	C=1	D=4
4)	A=4	B=3	C=1	D=5

4. List-I

A) Bohr's atomic model
B) deBroglie's concept
C) Somerfield atomic model
D) Schrodinger wave equation

List-II

1) Fine spectrum of hydrogen
2) Atomic orbital
3) Dual nature of any particle in motion
4) Quantisation of angular momentum
5) Spin of electron

The correct match is

	A	B	C	D
1)	4	3	1	2
2)	2	4	3	1
3)	3	2	4	5
4)	1	4	5	2

5. List-I

A) Heisenberg
B) Pauli
C) Hund
D) Wave function

List-II

1) Exclusion principle
2) Multiplicity rule
3) Uncertainty principle
4) nt method
5) Atomic orbital

The correct match is

	A	B	C	D
1)	2	3	4	5
2)	1	3	4	2
3)	3	1	2	5
4)	4	5	2	1

6. List-I

A)Sommerfield
B) Zeeman effect
C) 109O78 cm
D) Balmer series

List-II

1)Visible spectrum
2) Elliptical orbitals
3) Manegnetic quantum numbers
4)Rydberg constant
5) Nodal plane

The correct match is

	A	B	C	D
1)	3	2	1	4
2)	2	3	4	1
3)	3	1	5	2
4)	4	2	1	3

7. List – I

A)α-ray' scattering experiment
B) Quantum theory
C) Theory of photo electric effect
D) Atomic umber

List -II

1) Mosely
2)Plank
3)deBroglic
4)Eistein
5)Rutherford

The correct match is

	A	B	C	D
1)	2	3	1	4
2)	4	1	3	5
3)	5	2	4	1
4)	5	3	2	4

8. List-I

A) Electron
B) Proton
C) Neutron
D) Atomic number

List -II

1) Goldstein
2) Thomson
3) Mosely
4) Chadwick
5) Neils Bohr

The correct match is

	A	B	C	D
1)	1	3	4	5
2)	2	1	4	3
3)	1	4	5	2
4)	3	2	1	4

9. List-I

A) Nuclcus
B) Electromagnetic radiation
C) Wave length
D) Frequency

List-II

1) cm
2) Visible light
3) Rutherford
4) See
5) Einstein

The correct match is

	A	B	C	D
1)	3	2	1	4
2)	4	3	1	2
3)	2	5	3	1
4)	1	4	2	3

10. List-I List-II

A) Principal quantum number

B) Magnetic quantum number

C) Azimuthal quantum number

D) Spin quantum number

1) Shape of orbital

2) Orientation of orbital

3) Spinning of Electron

4) Size of orbital

5) Wave nature of electron

The correct match is

	A	B	C	D
1)	4	1	2	3
2)	4	2	1	3
3)	1	2	4	5
4)	3	1	5	2

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SOLUTIONS

Important Formulae

1. Molarity $= \frac{W}{GMW} \times \frac{1000}{V}$

2. Molarity $= \frac{10(\%w/v)}{GMW}$

3. Molarity $= \frac{10\,d\,(\%w/w)}{GMW}$

4. Normality $= \frac{W}{GEW} \times \frac{1000}{V}$

5. Normality $= \frac{10(\%w/v)}{GEW}$

6. Normality $= \frac{10\,d\,(\%w/w)}{GEW}$

7. Normality $= \frac{N_1V_1 + N_2V_2}{V_1+V_2}$

8. Molarity $= \frac{W}{GMW} \times \frac{1000}{W}$

9. Relation between Molality and Molarity $m = \frac{1000 \times M}{1000 \times d - M \times MW}$

10. Mole fraction of Solute $= X_{solute} = \frac{n_1}{n_1 + n_2}$

11. Mole fraction of Solvent $= X_{solvent} = \frac{n_2}{n_1 + n_2}$

12. Raoult's Law $= \frac{P_0 - P_s}{P_0} = \frac{n}{N+n}$ Raoult's Law $= \frac{P_0 - P_s}{P_0} = \frac{w\,M}{mW}$

13. $\Delta T_b = K_b \times m$

14. $\Delta T_f = K_f \times m$

15. Osmotic pressure $\prod = CRT$

16. (Degree of dissociation or ionisation) $\alpha_{ionization} = \frac{i-1}{n-1}$

17. Total no of particles after dissociation $= [1 + (n-1)\alpha]$

18. Total no of particles after association $= [1 + (1/n - 1)\alpha]$

19. (Degree of association) $\alpha_{association} = \frac{i-1}{1/n - 1}$

20. In terms of Van't Hoff;s factor (i)

    (a) Elevation of boiling point $\Delta T_b = i \times K_b \times m$

    (b) Depression of freezing point $\Delta T_f = i \times K_f \times m$

    (c) Osmotic pressure $\prod = iCRT$

I. Short Answer Questions

1. Define the term Solution
2. Define molarity.
3. Define molality.
4. Give the example of a solid solution in which the solute is solid
5. Define mole fraction
6. Define mass percentage of solution
7. What is ppm of a solution
8. What role do the molecular interactions play in a solution of alcohol and water?
9. State Raoult's law.
10. State Henry's law.
11. What is Ebullioscopic constant?
12. What is Cryoscopic Costant?
13. Define osmotic pressure.
14. What are isotonic solutions ?
15. What are Hypotonic solutions?
16. What are Hypertonic solutions?
17. What is reverse osmosis?
18. What are ideal solutions ? Give example.
19. What are Non ideal solutions ? Give example.

II.Multiple Choice Questions

20. Molarity of the liquid HCl if density of the solution is 1.17g/cc is
    a)36.5 b) 18.25 c) 32.05 d) 42.10
21. The following is not a fixed quantity
    a)Atomic weight of an element b) equivalent weight of an element or compound
    c) Molecular weight of a compound d) formula weight of a substance
22. The equivalent weight of CH4 in the reaction $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ is (M=mol.weight)
    a)M/4 b) M/8 c) M/12 d) M/16
23. At 25^0C for a given solution M=m ,then at 500C the correct relationship is
    a)M=m b) M>m c) M< m d) M=2m
24. 6 g of urea dissolved in 90 g of water. The mole fraction of solute is
    a)1/5 b) 1/50 c) 1/51 d) 1/501
25. Incorrect statement is (K_H = Henry's constant)
    a) K_H Is characteristic constant for a given gas solvent system
    b) Higher is the value of K_H lower is solubility of a gas for a given partial pressure of gas
    c) K_H has temperature dependence
    d) K_H decreases with temperature
26. Which of the following liquid pairs shows a positive deviation from Raoults law
    a)Water- Hydrochloric acid b) Benzene – methanol
    c) Water – Nitricacid d) Acetone – Chloroform
27. 9.6g of urea dissolved in 90 g of boiling water . The vapour pressure of the solution is
    a) 744.8mm b) 758mm c) 761mm d) 760mm
28. The vant Hoff's factor (i) accounts for
    a) extent of solubility of solute b) extent of mobility of solute
    c) extent of dissolution of solute d) extent of dissociation of solute

29. 11.1 gm of $CaCl_2$ is present in 100 ml of the aqueous solution .The chloride ion concentration is

a) 1 M b) 2 M c) 0 .05 M d) 0.2 M

30. what is the volume (in ml) of 0.1M potasuim permanganate solution required to completely Oxdise 100 ml of 0.5 M ferrous sulphate solution in acedic medium

a) 20 b) 200 c) 50 d) 100

31. The vapour pressure of pure water at 25^0C is 30mm .The vapour pressure of 10% (W/W) glucose solution at 25^0C is

a) 31.5mm b) 30.6mm c) 29.67mm d) 26.56mm

32. The molal elevation constant of water is 0.51. The boiling point of 0.1 molal aqueous NaCl solution is nearly

a) 100.05^0C b)$100.1\ ^0$C c)100.2^0C d)101.0^0C

33. Molal depression constant is given by the expression

a) ΔT_f x m b) ΔT_f x M c) ΔT_f /M d) ΔT_f /m

34. which of the following aqueous solution has highest freezing point ?

a) 0.1 molal $Al_2(SO_4)_3$ b) 0.1 molal $BaCl_2$ c) 0.1 molal $AlCl_3$ d) 0.1 molal NH_4Cl

35. The osmotic pressure 5% aqueous solution of sugar (mol mass 342) at 15^0C

a) 4atm b) 3.45atm c) 3.75atm d) 2.45atm

36. what is the mole fraction of the solute in a 1.00m aqueous solution .

a) 0.0354 b) 0.0177 c) 0.171 d) 1.770

37. Isotonic solutions are solutions having the same

a) surface tension b) vapour pressure c) osmotic pressure d) viscosity

38. If x_1 and x_2 represent the mole fraction of a component A in the vapour phase and liquid mixture respectively and P_A^0 and P_B^0 represent vapour pressures of pure A and b then total vapour pressure of the liquid mixture is

a) $P_A^0\ x_1 / x_2$ b) $P_A^0\ x_2 / x_1$ c) $P_B^0\ x_1 / x_2$ d) $P_B^0\ x_2 / x_1$

39. Statement -1 : Acetone + Carbon disulphide solution shows positive deviation from Raoult's law

statement -2 : Acetone + Aniline solution shows positive deviation from Raoult's law

a) Both statement -1 and statement -2 are correct
b) Both statement -1 and statement -2 are wrong
c) statement -1 is correct and statement -2 is wrong
d) statement -1 is wrong and statement -2 is correct

40. The weight of $KMnO_4$ that can oxidise 100ml of 0.2M oxalic acid in acidic medium is (Mol.Wt of $KMnO_4$ = 158)

a)1.58g b) 1.264g c) 12.64g d) 15.8g

41.Which of the following aqueous solutions has highest boiling point

a)0.1M KNO_3 b) 0.1 M Na_3PO_4 c) 0.1 M $BaCl_2$ d) 0.1 M K_2SO_4

42.If α is the degree of dissociation of Na_2SO_4 the vant Hoff's factor (i) used for calculating the molecular mass is

a)1+α b) 1- α c) 1+ 2α d) 1- 2α

43. 6.02 x 10^{20} molecules of urea present in 100ml of its solution the concentration of solution

a)0.1M b) 0.001M c) 0.01M d) 0.02M

44. 5 liters of a solution contains 25mg of $CaCO_3$ its concentration in parts per million (ppm)

a)1 b) 5 c) 25 d) 250

45.When the volume of the solution is doubled the following becomes exactly half

a)Molarity b) Mole fraction c) Molality d) Weight percentage

46.What volume of 0.8M solution contains 0.1 mole of the solute

a)100ml b) 125ml c) 500ml d) 62.5ml

47. The equivalent weight of H_3PO_4 in the following reaction is

$H_3PO_4 + Ca(OH)_2 \rightarrow CaHPO_4 + 2H_2O$

a)98 b) 49 c) 32.66 d) 40

48.Three statements are given about mole fraction

i)Mole fraction of solute + Mole fraction of solvent = 1

ii) Equal weights of Helium and methane are present in a gaseous mixture ,the mole fractionof He is 4/5

iii)The mole fraction of water in the aqueous solution of NaOH is 0.8 the molality of the solution is nearly 14 moles Kg^{-1}

a) i and ii are correct b) ii and iii are correct c) I and iii are correct d) all are correct

49.The boiling point of C_2H6 , CH_3OH ,$C_6H_5NH_2$ and $C_6H_5NO_2$ are 80 ^{OC} , 63oC ,184^{OC} and 212^{Oc} respectively ,which will show highest vapour pressure at room temperature

a) C_2H6 b) CH_3OH c) $C_6H_5NH_2$ d) $C_6H_5NO_2$

50.Which of the following solutions will have maximum lowering of vapour pressure

a)1M BaCl2 b) 1M NaCl c) 1M phenol d) 1M sucrose

51.Which of the following solutions will have boiling point

a)0.1M $FeCl_3$ b) 0.1M $BaCl_2$ c) 0.1MNaCl d) 0.1M Urea

52.138gm of ethyl alcohol is mixed with 72gm of water .The ratio of mole fraction of alcohol to water

a)3:4 b) 1:2 c) 1:4 d) 1:1

53.When 45 gm of a solute is added to 900 gm of water ,its vapour pressure decreased from 30mm to 24mm .The mole fraction of the solvent in the solution is

a)0.2 b) 0.8 c) 0.1 d) 0.9

54.Which of the following contains more number of ions per unit volume

a) 1M K_2S + 1M HNO_3
b) 2M HCl + 0.5 M NH_4Cl
c) 2M K_2S + 2M K_2SO_4
d) 2M K_2SO_4 + 2M NH_4Cl

55.Two solutions of glucose have osmotic pressure 1.5 and 2.5atm.1 litre of 1st solution is mixed with 2 litres of 2nd solution .The osmotic pressure of resultant solution will be

a)21.6atm b) 0.126atm c) 2.16atm d) 0.216atm

56.The osmotic pressure of a decimolar solution of urea at 27^{OC}

a)2.49 bar b) 5 bar c) 3.4 bar d) 1.25 bar

57.The van't Hoff factor for 0.1M Barium nitrate is 2.74 . The percentage of dissociation of Barium nitrate is

a)91.3% b) 87% c) 100% d) 74%

58. A solution of a substance containing 1.05 g per 100ml was found to be isotonic with 3% glucose solution. The molecular weight of the substance is

(a) 63 (b) 630 (c) 6.3 (d) 31.5

59. When HgI_2 is mixed with aqueous solution of KI, then

(a) freezing point decrease
(b) freezing point does not change
(c) freezing point increase
(d) boiling point remains un changes

60. The freezing point of 0.05 molal solution of a non-electrolyte in water is(K_f = 1.86 Kkg mol^{-1})
(a) -1.86°C (b) -0.93°C (c) -0.093°C (d) 0.93°C

61. Which of the following 0.1 M aqueous solutions will have lowest freezing point

(a) potassium sulphate (b) sodium chloride (c) urea (d) glucose

62. If 0.50 mole of $BaCl_2$ is mixed with 0.20 mole of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ that can be formed is

(a) 0.1 (b) 0.2 (c) 0.5 (d) 0.7

63. 30 mL of solution is neutralized by 15 mL of 0.2 N base. The strength of the acid solution is
(a) 0.1 N (b) 0.15 N (c) 0.3 N (d) 0.4 N

64. A 500 g tooth paste sample has 0.2 g fluoride concen- tration. What is the concentration of F in terms of ppm level ?

(a) 250 (b) 200 (c) 400 (d) 1000

65. Increasing the temperature of an aqueous solution will cause

(a) decrease in molality (b) decrease in molarity
(c) decrease in mole fraction (d*) decrease in % W/W*

66*. Which of the following solutions has* the highest normality

(a) 1.8 g of KOH/1 lit
(b) N-Phosphoric acid
(c) 6 g of NaOH/100 mL
(d) 0.5 m H_2SO_4

67. Hydrochloric acid solutions A and B have concentration of 0.5 N and 0.1 N respectively The volumes of solutions A and B required to make 2 litres of 0.2N HCl are
(a) 0.5 lit of A + l.5 lit of B
(b) 1.5 lit of A + 0.5 lit of B
(c) 1.0 lit of A + l.0 lit of B
(d) 0.75 lit of A + l.25 lit of B

68. The molarity of pure water is
(a) 55.6 (b) 50 (c) 100 (d) 18

69. The mole fraction of water in 20% aqueous solution of H_2O_2 is

(a) 77/68 (b) 68/77 (c)20/80 (d) 80/20

70. Volume of 0.1 M $K_2Cr_2O_7$ required to oxidize 35 mL of 0.5 M $FeSO_4$ solution is
(a) 29 ml (b) 87 ml (c) 175 ml (d) 145 ml

71. Which one is a colligative property ?
(a) Boiling point (b) Vapour pressure (c) Osmotic pressure (d) Freezing point

72. Which of the following is not a colligative property?
(a) Osmotic pressure
(b) Elevation of b.p
(c) Vapour pressure
(d) Depression of f.p

73. 100 mL of a liquid A was mixed with 25 mL of a liquid B to give a non-ideal solution of A-B mixture having positive - deviations. The volume of this mixture would be
(a) 75 mL
(b) 125 mL
(c) just more than 125 mL
(d) close to 125 mL but not exceeding 125 mL

74. Which of the following pairs shows a positive deviation from Raoult's law?
(a) Water-Hydrochloric acid
(b) Water-Nitric acid
(c) Acetone-Chloroform
(d) Benzene-methanol

75. Which one of the following solution would produce maximum elevation in B.P
(a) 0.1 M Glucose (b) 0.2 M Sucrose (c) 0.1 M $BaCl_2$ (d) 0.1 M $MgSO_4$

76. Elevation in boiling point was 0.52°C When 6 gm of a compound X was dissolved in 100 gm of water. Molecular weight of X is (K_b of water is 5.2 K per 100 g of water)
(a) 120 (b) 60 (c) 600 (d) 180

77. The latent heat of vapourisation of water is 9700 cal/ mole and if the b.p. is 100°C. The ebullioscopic constant of water is
(a) 0.513 K (b) 1.026 K (c) 10.26 K (d) 1.832 K

78. The molal freezing point constant for water is 1.86 K Kg/mole. If 342 gm of cane sugar ($C_{12}H_{22}O_{11}$) is dissolved in1000g of water, the solution will freeze at
(a) -1.86°C (b) 1.86°C (c) -3.92°C (d) 2.42°C

79. Which has the minimum freezing point
(a) one molal NaCl solution
(b) one molal KCl solution
(c) one molal $CaCl_2$ solution
(d) one molal urea solution

80. The freezing point of 1 molal NaCl solution assuming NaCl to be 100% dissociated in water is K_f = 1.86 K kg mol^{-1}
(a) -1.86°C (b) -3.72°C (d) +1.86°C (d) +3.72°C

81. If 0.01 M solution each of urea, common salt and Na_2SO_4 are taken, the ratio of depression of freezing Point is
(a) 1:1:1 (b) 1:2:1 (c)1:2:3 (d) 2:2:3

82. What is the molality of a solution of a certain solute in a solvent if there is a freezing point depression of 0.184°C and the freezing point constant is 18.4.
(a) 0.01 (b) 1 c) 0.001 d) 100

83. The vapour pressure of a liquid in a closed container depends upon

(a) amount of liquid
(b) surface area of the container
(c) temperature
(d) None of the above

84. The temperature at which the vapour pressure is equal to the external pressure is called the
(a) critical temperature
(b) boiling point
(c) normal point
(d) saturation point

85. What would happen if a thin slice of sugar beet is placed in a concentrated solution of NaCl?

(a) Sugar beet will lose water from its cells.
(b) Sugar beet will absorb water from solution.
(c) Sugar beet will neither absorb nor lose water.
(d) Sugar beet will dissolve in solution.

86. The freezing point of the water is depressed by 0.037°C in a 0.01 moles NaCl solution. The freezing point of a 0.02 mol solution of sucrose in °C is

(a) -0.0370 (b) -0.0185 (c) -0.0740 (d) -0.1850

87. The osmotic pressure of solution increases if
(a) temperature is decreased.
(b) solution constant is increased.
(c) number of solute molecules is increased.
(d) volume is increased.

88. Osmotic pressure of sugar solution at 24°C is 2.5 atm. The concentration of the solution in gm mole per litre is

(a) 10.25 (b) 1.025 (c) 102.5 (d) 0.1025

89. Solutions with same osmotic pressure are called
(a) Hypertonic (b) Hypotonic (c) Isotonic (d) Normal

90. Which of the following correctly expresses the Van't Hoff factor?

(a)Calculated osmotic pressure / Observed osmotic pressure
(b)Observed molecular weight/ calculated molecular weight
(c) Calculated boiling point/Observed boiling p
(d) Observed colligative property/Calculated colligative property

91. Van't Hoff factor for an electrolyte is

(a) >1 (b) <1 (c) =1 (d) none of the above

92. The ratio of the value of any colligative property of KCl solution to that of sugar solution is nearly
(a) 1 (b) 0.5 (c) 2 (d) 2.5

93. The Van't Hoff factor for 0.1 M $Ba(NO_3)_2$ solution is 2.74. The degree of dissociation is

(a) 91.3% (b) 87% (c) 100% (d) 74%

94. The molecular weight of benzoic acid in benzene as determined by depression in freezing point method corresponds to
(a) Ionization of benzoic acid
(b) Dimerisation of benzoic acid
(c) Trimerization of benzoic acid
(d) Solvation of benzoic acid

95. Benzoic acid undergoes dimerisation in benzene solution the Van't Hoff factor 'i' is related to thedegree of association 'x'of the acid is

(a) $i = (1-x)$ (b) $i = (1+x)$ (c) $i = (1-x/2)$ (d) $i = (1+x/2)$

96. The aqueous solution with the lowest freezing point of the following group is

(a) 0.01 M $MgSO_4$
(b) 0.01 M NaCl
(c) 0.01 M C_2H_5OH
(d) 0.008 M $MgCl_2$

97. When two solutions are separated by a semipermeable membrane and there is no flow of the solvent across the membrane, the solutions are said to be

(a) hypertonic (b) hypotonic (c) isotonic (d) None of these

98. If P_A is the vapour pressure of a pure liquid A and the mole fraction of A in the mixture of two liquids A and Bis x the particles vapour pressure of A is

(a) $(1-x)P_A$ (b) xP_A (c) $x/(1-x)P_A$ (d) $(1-x/x)P_A$

99. The freezing point depression constant K_f depends on
(a) properties of pure solvent
(b) properties of pure solute
(c) properties of solute and solvent
(d) always constant for all solutes and solvents

100. The most likely of the following mixtures to be an ideal solution is

(a) NaCl-H_2O
(b) C_2H_5OH-C_6H_6
(c) C_7H_{16}(l)–H_2O
(d) C_7H_{16} (l) – C_8H_{18}(l)

101. "Relative lowering in vapour pressure" of a solution containing one mol. K_2SO_4 in 54 gm H_2O is (K_2SO_4 is100% ionized)

(a) 1/55 (b) 3/58 (c) 3/4 (d) 1/2

102. Van't Hoff factor for $K_3[Fe(CN)_6]$ (ionization 50%) will be

(a) 1 (b) 5.5 (c) 2.5 (d) None of these

103. Osmosis of A into solution B will take place if
(a) A is hyper tonic (b) A is hypotonic (c) Both 1 and 2 (d) None of these

104. Molal elevation constant has unit _____
(a) mol kg^{-1} K (b) kg mol^{-1} K (c) K (d) None of these

105. 1 M Glucose solution at TK will have osmotic pressure (S = solution constant)

(a) 10ST/4 (b) 3 ST (c) 4 ST (d) ST

106. An aqueous solution contains 5% by mass of urea and 10% by mass of sucrose . If mol of depression constant of water is 1.86 K kg mol^{-1}. The frezing point of solution as

(a) -1.43°C (b) -2.43°C (c) -3.43°C (d) -4.43°C

107.

List -I	List – II
A) $AlCl_3$ if $\alpha = 0.8$	1) i = 3.4
B) $BaCl_2$ if $\alpha = 0.9$	2) i = 2.8
C) Na_3PO_4 if $\alpha = 0.9$	3) i = 3.8
D) $K_4[Fe(CN)_6]$ if $\alpha = 0.7$	4) i = 3.7
	5) i = 7.3

A B C D	A B C D	A B C D	A B C D
a)1 2 4 3	b) 1 2 4 5	c)2 1 5 4	d) 3 1 2 4

108. List I List II

A) Lowering of vapour pressure 1. $p^o - P/P^o$
B) Relative lowering of vapour pressure 2. $p^o - P/P^o = w/m \times M/W$
C) Raoult's law 3. $p^o - P$
D) Ideal solution 4. Obeying Raoult's law
5. Boiling point

A B C D A B C D A B C D A B C D
a) 3 2 1 5 b) 4 1 2 3 c) 3 1 2 4 d) 1 3 4 2

109. List I List II

A) 0.5 M H_2SO_4 Solution 1) 0.1N Solution
B) 0.1 M NaCl Solution 2) 1N Solution
C) 0.2 M $AlCl_3$ Solution 3) 1.5N Solution
D) 0.5 M H_3PO_4 Solution 4) 2.0N Solution
5) 0.6 N Solution

A B C D A B C D A B C D A B C D
a)2 5 1 3 b) 4 2 1 5 c) 2 1 5 3 d) 5 4 2 1

110. List -I List – II

A) Mole fraction 1) No of equivalents in 1000ml of solution
B)Molarity 2) Always less than one
C) Normality 3) Greater than or equal to molarity
D) Molality 4) No of gram moles present in 1000ml of solution
5) No of gram moles of solute 1kg of solvent

A B C D A B C D A B C D A B C D
a) 1 2 3 4 b) 2 3 1 5 c)1 4 2 3 d)2 4 3 5

111. List –I List –II

A) Solid in gas 1) Brass
B) Solid in solid 2) Amalgam
C) Liquid in solid 3) Comphor in air
D) Liquid in liquid 4) Alcohol in water

A B C D A B C D A B C D A B C D
a) 3 1 2 4 b) 2 3 1 4 c)1 4 2 3 d)2 4 3 1

112. List –I List – II

A) Hypophorous acid 1) M.W / 2
B) Phosphorous acid 2) M.W/ 3
C) Orthophosphorous acid 3) M.W / 4
D) Pyrophosphoric acid 4) M.W / 5
5) M.W / 1

A B C D A B C D A B C D A B C D
b) 3 2 1 5 b) 4 1 2 3 c)1 4 2 3 d)2 4 3 5

113. Van't Hoff's factor (i) of K_2SO_4 for complete dissociation of solution is _____

114. The number of phases present in true solution is _____

115. Van't Hoff's factor for a dilute solution of glucose is _____

116. Milli molar solution M = _____

117. When an oxide M_2O_3 is oxidised to M_2O_5 its equivalent is _____

118. Number of milli equivalents of solute in 0.5 litres of 0.2N solution is _____

119. For a Non –electrolytic solution , van't Hoff's factor (i) is equal to _____

120. The van't Hoff's factor (i) for a very dilute aqueous solution of $K[Ag(CN)_6]$ is _____

121. Density of a 2.05 M solution of acetic acid in water is 1.02g/ml . The molality of the solution is _____

122. An ideal solution is one which obey Raoult's law at all _____

123. The molality of 2% (W/W) NaCl solution nearly _____

124. When 10 ml of 10M solution of H2SO$ and 100ml of 1M NaOH are mixed,the resultant solution will be _____

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CHEMICAL KINETICS

Short answer type questions.

1. Define the speed or rate of a reaction
2. Write the units of rate of reaction.
3. What is rate equation or rate law or rate expression ?
4. Define order of a reaction.
5. Define molecularity of the reaction
6. Write the differences between the order and molecularity of a reaction.
7. Write the units of rate constant of a nth order reaction.
8. Give two examples for a gaseous zero order reactions.
9. Give two examples for a gaseous first order reactions.
10. Define half life time or half-life period of a reaction.
11. What are pseudo first order reactions.
12. Give two examples of pseudo first order reactions.
13. Explain the term Activation energy
14. Explain the term collision frequency
15. Explain the term probability factor.
16. What are bimolecular reactions? Give examples
17. What are termolecular reactions? Give examples.
18. Write the Arrhenius equation and explain the terms in it.
19. Write the factors affecting the rate of a reaction.
20. Write the effect of catalyst on rate of reaction.
21. Define rate constant or Specific reaction rate?
22. What is the effect of temperature on the rate constant?
23. Draw the graphs between potential energy-reaction coordinates for uncatalysed and catalyzed reactions.
24. What are elementary reactions?
25. what are complex reactions? Give examples

True / False:

1 Rate constant depends on the concentration of reactants

2 Units of rate constant depends on the order of the reaction

3 Order of reaction can be predicted by seeing the molecular reaction

4 Half life of a first order reaction directly proportional to the concentration of reactants.

5 Half life period of a second order reaction is inversely proportional to the concentration of reactants.

6 The slope of the plot of ln K vs 1/T gives the activation energy.

7 If concentration of reactants increases, the rate of reaction increases

8 Radioactive decay follows first order kinetics

9 Acid catalyzed ester hydrolysis is a psueo first order reaction.

10 For a first order reaction, ln[R] vs time plot gives a straight line with negative slope.

11 Higher the activation energy, slower the rate of reaction.

12 Molecularity of a reaction can be zero

13 Catalyst shows an alternative path which has less activation energy.

14 Genrally ionic reactions have faster rates than covalent reactions.

15 For zero order reactions, rate and rate constant have same uinits.

16 For a first order reaction, the plot of Rate vs concentration of reactants is parallel to X-axis.

17 The number of collosions per second per unit volume of the reaction mixture is known as collosion frequency

18 For base catalyzed ester hydrolysis, order is 1 and molecularity is 2

19 Decomposition of Hydrogen perioxide follows first order kinetics

20 Decomposition of ammonia on the surface of Platinum follows first oder kinetics.

Fill in the blanks:

1) The sum of the powers of the concentration terms in the rate equation is called _____ of a reaction.

2) The ratio between rate constant of a reaction at (t+10)°C and t°C is called _____

3) Temperature coefficient varies from ___

4) Half life time of a first order reaction is _____ of the concentration of reactants

5) Units of rate constant of a reaction whose order is 5.5 are _____

6) For _____ order reactions, the rate and rate constant have same units.

7) The slope of the plot lnK Vs 1/T gives _____

8) The number of molecules participating in the rate determining step of the reaction is called _____

9) Temperature coefficient of a reaction is 2. If temperature is increased from 10°C to 40°C, rate constant increases by ___ times.

10. If concentration of reactants increases, the rate of reaction____

11. Decomposition of gold on the surface of gold is an example of _____order reaction.

12. The expression for zero order rate constant is _____

13. For a reaction, rate constant is 0.237 Ms^{-1} . order of the reaction is ___

14. Half life period of a first order reaction is given by _____

15. _____ of a reaction cannot be determined experimentally.

16. The time taken for the completion of 90% of a first order reaction is‘t’ min. The time (in sec) taken for the completion of 99% of the reaction is____

17. If both rate (dc/dt) & specific rate (k) have same units, then rate law is _____

18. A reaction A → B follows second order kinetics. If concentration of A is increased by four times, rate of reaction increases by ___times

19. Radio active disintegration is an example of _____order reaction.

20. A first order reaction takes 40 minutes for 30% decomposition. Half life will be _____

Multiple choice questions:

1. _____ a reaction cannot be determined experimentally.

a) Order b) Rate c) Rate constant d) Molecularity

2. If both rate & specific rate (k) have same units, then rate law is

a) $R=K[A]^2$ b) $R=K[A]^{½}$ c) $R=K[A]^{-2}$ d) R=K

3. For A+B→C+D, when [A] alone is doubled, rate gets doubled. But, when [B] alone is increased by 9 times, rate gets tripled. Then, order of reaction is

a) 3/4 b) 3/2 c) 4/9 d) 2

4. Rate law for 2A+BC+D from following data

S.No	[A] (M)	[B] (M)	Rate (M/s)
1	0.01	0.01	2.5
2	0.01	0.02	5
3	0.03	0.02	45

a) $r=K[A]^{1/3}[B]$ b) $r=K[A]^2[B$ c) $r=K[A][B]^{1/3}$ d) $r=K[A]^{2/3}[B]^{1/3}$

5. Which of the following is correct for a first order reaction?
(K= rate constant, $t_{1/2}$ = half-life)

a) $t_{1/2} = 0.693K$ b) $K * t_{1/2} = 0.693$ c) $K * t_{1/2} = 0.301$ d) None

6) Order of a reaction is decided by

a) Molecularity b) Law of Mass Action c) Performing experiment

d) Le chatelier principle

7) $2A \rightarrow B+C$ would be a zero order reaction when rate of reaction

a) Is directly proportional [A] b) Is directly proportional $[A]^2$

c) Is independent of [A] d) Is independent of [B] & [C]

8) The time taken for the completion of 90% of a first order reaction is 't' min. What is the time (in sec) taken for the completion of 99% of the reaction?

a) 2t b) t / 30 c) 120t d) 60t

9) $A_{(g)} \rightarrow B_{(g)}$ is a first order reaction. The initial concentration of A is 0.2 M after 10 minutes, the concentration of B is found to be 0.18 M. The rate constant (in min^{-1}) for the reaction is

a) 0.2303 b) 2.303 c) 0.693 d) 0.01

10) Consider the following statements.

(i) Increase in concentration of reactant increases the rate of zero order reaction.

(ii) Rate constant 'k' is equal to collision frequency, A if $E_a = 0$.

(iii) Rate constant 'k' is equal to collision frequency, A if $E_a = \infty$.

(iv) log k vs 1/T is a straight line.

Correct statements are

a) i & iv b) ii & iv c) iii & iv d) ii & iii.

11) Which of the following statements for the order of a reaction is incorrect?

a) Order of a reaction is always a whole number.

b) Order can be determined only experimentally.

c) Order is not influenced by stoichiometric coefficient of the reactants.

d) Order of a reaction is sum of power to the concentration terms in rate equation.

12. A first order reaction has a rate constant 0.00115 S^{-1}. How long will 5 g of this reactant take to reduce to 3 g?

a) 444 s b) 400 s c) 528 s d) 669 s

13. Half-life period of a first order reaction is 10 min. what percentage of the reaction will be completed in 100 min?

a) 25 % b) 50 % c) 99.9 % d) 75 %

ELECTROCHEMISTRY

Short answer type questions.

1) State Faraday's first law of electrolysis

2) State Faraday's second law of electrolysis.

3) What is electrolysis?

4) What is Galvanic cell?

5) What is an electrochemical series?

6) What is standard hydrogen electrode?

7) What is cell constant of a conductivity cell ?

8) What is a primary battery? Give one example.

9) Give one example for a secondary battery. Write the cell reactions.

10) Define conductivity of a material.

11) What is metallic corrosion? Give one example.

12) What is a fuel-cell?

13) How fuel cell is different from a conventional Galvanic cell?

14) How Specific conductance varies with dilution?

15) How molar conductance varies with dilution?

16) What is Nernst equation?

17) What is cell constant of a conductivity cell ?

18) Write the reactions take place at anode and cathode of a Galvanic cell?

19) What is the role of salt bridge in Galvanic cell?

20) Write the relationship between standard cell potential and Standard Gibbs free energy?

21) How standard cell potential is related to the Equilibrium constant of a reaction?

22) Write the reactions occur during rusting of iron.

23) Write the reactions occur at cathode and anode of lead storage battery during charging process?

24) What are the products formed at anode and cathode during electrolysis of aqueous NaCl using platinum electrodes.

25) What are the products formed at anode and cathode during electrolysis of aqueous K_2SO_4 using platinum electrodes.

26) What are the products formed at anode and cathode during electrolysis of molten NaCl using platinum electrodes.

27) What are the products formed at anode and cathode during electrolysis of aqueous copper sulphate using platinum electrodes.

28) State Kohlrausch law of independent migration of ions.

29) What are the factors affecting the conductivity of electrolytic solutions.

30) What are the factors affecting the electronic conductance?

True or False:

1) In Galvanic cell, cathode is the negative charged electrode.

2) In electrolytic cell, oxidation occurs at anode.

3) Salt bridge is the cathode in Galvanic cell.

4) Specific conductance increases with increase in dilution.

5) Molar conductance increases with increase in dilution.

6) Cell constant value depends on the nature of electrolyte.

7) In Galvanic cell, electrons flow from cathode to anode.

8) Dry cell is an example of primary battery.

9) Electronic conductance increases with increase in temperature.

10) Electrolytic cell is a device which converts chemical energy to electrical energy.

11. Cell constant has no units.

12. Lead storage battery is an electrolytic cell.

13. NaCl, $MgCl_2$ are examples for electrolytic conductors

14. If E^o is positive, the cell reaction is spontaneous.

15. In Daniel cell cell, cathode is the Zinc electrode

Fill in the blanks:

1. Specific conductance _____with increase in dilution.
2. In electrolytic cell, cathode is a _____ charged electrode and anode is a _____charged electrode.
3. In galvanic cell, oxidation occurs at _____ and reduction occurs at _____
4. In galvanic cell electrons flow from _____electrode to ____electrode through external circuit.
5. The charge of one mole of electrons is called _____
6. The amount of substance deposited when 1 amp of current is passed for 1 second is called _____
7. When fused NaOH is electrolyzed, the products formed at cathode and anode are _____ & _____ respectively.
8. Standard hydrogen electrode has a potential of ____ V
9. Specific conducatance has a units of _____
10. The charge required for reducing 1 mole of MnO_4^- to Mn^{2+} is ____
11. _____ Faradays of electricity is required to produce 100 g of Ca from moleten $CaCl_2$.
12. In electrolysis of dilute Sulphuric acid, the product liberated at anode is ____
13. The anode in dry cell is ____
14. The overall reaction of a hydrogen-oxygen fuel cell is _____
15. If a current of 0.5 amperes flows through a metallic wire for 2 hours, then the number of electrons flow through the wire is _____

Multiple choice questions:

1. What is the electrochemical equivalent (in g coulomb^{-1}) of silver?

a) 108F b)108/F c) 108/96500 d) 96500/108

2. when a lead storage battery is discharged

a) Lead sulphate is consumed b) Oxygen gas is evolved.

c) Lead sulphate is formed d) Lead sulphide is formed.

3. During the charging of a lead-acid storage battery, the cathode reaction is

a) Formation of $PbSO_4$ b) Reduction of Pb^{+2} to Pb

c) Formation of PbO_2 d) Oxidation of Pb to Pb^{2+}

4. When 3.86 amperes current are passed through an electrolyte for 50 minutes, 2.4 grams of a divalent metal is deposited. The gram atomic weight of the metal (in grams) is

a) 24 b) 12 c) 64 d) 40

5. Which reaction is not feasible?

a) $2KI + Br_2 \rightarrow 2KBr + I_2$ b) $2KBr + I_2 \rightarrow 2KI + Br_2$

c) $2KBr + Cl_2 \rightarrow 2KCl + Br_2$

d) $2H_2O + 2F_2 \rightarrow 4HF + O_2$

6. In the cell, Zn/Zn^{2+} // Cu^{2+}/Cu, the negative terminal is

a) Zn b) Cu c) Zn^{2+} d) Cu^{2+}

7. Flourine is the best oxidising agent because it has

a) Highest electron affinity b) Highest reduction potential

c) Highest oxidation potential d) lowest electron affinity

8. The hydrogen electrode potential depends on

a) Nature of metal used as anode b) The of the solution

c) Both nature of the metal used as anode and the of the solution

d) Nature of the metal used as cathode and the of the solution

9. The single electrode potential of 0.1M solution of M+/M ions is (E0 = 2.36V)

a) 2.42V b) 2.30V c) 0.236V d) 0.230v

10. Which one is the most powerful oxidizing agent?

a) $Cl_2 + 2e^- \; 2Cl^-$; E=1.36V b) $Na^+ + e^-$ Na;E=–2.71V

c) $MnO_4^- + 2H_2O + 2e^- MnO_2 + 4\ OH^-$, E=0.6v

d) $H_2O_2 + 2H^+ + 2e^- \; 2H_2O$; E=1.78V

11. At 25^0 C, the standard oxidation potential of Zn and Ag in water are

$Zn(s) Zn^{+2}(aq) + 2e^-$, $E^0 = 0.76V$

$Ag(s) Ag^+ (aq) + e^-$, $E^0 = -0.80V$

Which of the following reaction actually takes place.

a) . $Zn^{2+}(aq) + 2\ Ag(s)\ 2Ag^+(aq) + Zn(s)$

b) $Zn(s) + 2\ Ag^+\ (aq)\ Zn^{2+}(aq) + 2Ag(s)$

c) $Zn^{2+}(aq) + 2\ Ag^+aq)\ Zn(s) + 2Ag(s)$

d) $Zn(s) + Ag(s)\ Zn^{2+}(aq) + Ag^+(aq)$

12. $H_2 – O_2$ fuel cell is

a) primary cell b) secondary cell

c) both d) can't be predicted

13. A solution of Na_2SO_4 in water is electrolysed using inert electrodes. The product at cathode and anode are respectively.

a) H_2, O_2 b) O_2, H_2 c) O_2,Na d) O_2,SO_2

14. The amount of ions discharged during electrolysis is directly proportional to

a) resistance b) strength of electrolyte

c) area of electrodes d) chemical equivalent of ion

15.I n a salt bridge KCl is used because

a) agar–agar forms a good jelly with it b) K^+ and Cl^- are isoelectronic

c) K^+ and Cl^- have equal mobilities or equal transference numbers

d) KCl solution is a good conductor

CHEMISTRY CHAPTER - 5

GENERAL PRINCIPLES OF METALLURGY

SYNOPSIS

The process of extraction and isolation of the metal from its naturally occurring compounds is called metallurgy. For this, we first look for its mineral in which the metal is found. These are obtainable by mining. The minerals which are used as sources for the extraction of the metal are known as ores. Ore is usually contaminated with earthy materials and undesired chemical compounds. These are collectively known as gangue or matrix. the extraction and isolation of metals from ores involve the following major steps :

1.Concentration of ore

2. Isolation of the metal from concentrated ore by chemical or electrochemical methods

3. Purification of isolated metal

Concentration of ore : Removal of gangue from the ore is known as concentration. It involves several steps and selection of the steps depends upon the differences in the physical properties of the compound of the metal present and those of the gangue. Hydraulic washing or levigation is based on the differences in the gravities of the ore and gangue particles. magnetic separation is based on the differences in the magnetic properties of the ore and gangue. Froth flotation method is used to remove gangue from sulphide ores. The process of leaching is used in case of metals like Al,Au and Ag.

Isolation of metal from concentrated ore involves two major steps :

a.)Conversion of ore into oxide by calcination and roasting/smelting.

b.)Reduction of metal oxide usually involves heating it with reducing agents. In these reduction processes the thermodynamic and electrochemical concepts are given due consideration. The metal oxide reacts with a reducing agent; the oxide is reduced to the metal and the reducing agent is oxidised .In the two reactions, net gibbs energy change is negative, which becomes more negative on raising temperature. Conversion of the physical states from solid to liquid or to gas and formation of gaseous states favours decrease in gibbs energy for the entire system. This concept is graphically displayed in plots of ΔG vs T (Ellingham diagram) for such oxidation/reduction reactions at different temperatures . The concept of electrode potential is useful in isolation of metals (eg. Al,Au,Ag) where the sum of the two redox couples is +ve so that the gibbs energy change is negative. Extraction of 'Al' is usually carried out from its bauxite ore by leaching it with NaOH. Extraction of Iron is done by reduction of its oxide ore in blast furnaces. Copper is extracted by smelting and heating in a reverberatory furnace. Extraction of Zn from zinc oxides is done using coke. For obtaining metals of high purity 'refining' is required.

Distillation is useful for low boiling metals like zinc and mercury. Liquefaction is useful for low low melting metals like Tin. In poling the impurities are removed either as gases or they get oxidised and form slag over the surface of the molten metal. Zone refining is useful for producing semiconductor grade metals of very high purity. Ni and Zn are purified by vapour phase refining methods. Metals in general are very widely used and have contributed significantly in the development of a variety of industries.

MULTIPLE CHOICE QUESTIONS

1. Calamine is the ore of

(A.) Al (B.) Fe (C.) Cu (D.) Zn

2. Cuprite is a / an

(A.) Oxide ore (B.) Sulphide Ore (C.) Halide ore (D.) Carbonate ore

3. Find the odd one out

(A.) Bauxite (B.) Siderite (C.) Cuprite (D.) Zincite

4. The first step involved in the extraction of metal from the mineral

(A.) Conversion of the ore into oxide

(B.) Concentration of Ore

(C.) Reduction of oxide to metal

(D.) Refining

5. An ore of tin containing $FeCrO_4$ is concentrated by

(A.) Magnetic Separation (B.) Froth flotation

(C.) Electrode method (D.) Gravity separation

6. The common impurities present in Bauxite ore are

(A.) Fe_2O_3 and CuO (B.) Fe_2O_3 and PbO (C.) Fe_2O_3 and SiO_2 (D.) SiO_2 and CuO

7. The froth flotation process is based on

(A.) preferential wetting of ore particles by oil

(B.) magnetic properties of gangue

(C.) specific gravity of ore particles

(D.) preferential wetting of gangue particles by oil

8. Which of the following act as depressant in froth flotation of galena which contains ZnS ?

(A.) Sodium ethyl Xanthate (B.) Pine Oil (C.) $CuSO_4$ Solution (D.) NaCN or KCN

9. The process of removing lighter gangue particles by washing in a current of water is called

(A.) Cupellation (B.) leaching (C.) liquation (D.) levigation

10. The removal of impurities from an ore by forming molten mass is called

(A.) Calcination (B.) Levigation (C.) Refining (D.) Slagging

11. Find the odd one out

(A.) Pine oil (B.) Fatty acid (C.) Xanthate (D.) Aniline

12. Which of the following beneficiation process is used for bauxite $Al_2O_3.2H_2O$

(A.) Froth flotation (B.) Leaching (C.) Liquation (D.) Magnetic Separation

13. In roasting

(A.) moisture is removed

(B.) non-metal impurities are removed

(C.) Ore becomes porous

(D.) All the above

14. Metal which do not form amalgam is

(A.) Fe (B.) Co (C.) Ag (D.) Zn

15. The common method of extraction of metal form oxide ore is

(A.) reduction with Carbon

(B.) reduction with hydrogen

(C.) electrolytic method

(D.) reduction with aluminium

16. Wrought iron is manufactured from cast iron by heating it with

(A.) C (B.) $CaCO_3$ (C.) Fe_2O_3 (D.) SiO_2

17. Select correct matching

(A.) pyrometallurgy : Extraction of Fe

(B.) Electrometallurgy : Extraction of Al

(C.) Hydrometallurgy : Extraction of Cu

(D.) All are correct

18.Hydrometallurgicak process of extraction of metal is based on

(A.) dehydrogenation (B.) Complex formation (C.) Dehydration (D.) Hydrolysis

19. In metallurgy flux is a substance used to convert

(A.) Infusible impurities to fusible mass

(B.) mineral to silicate

(C.) Soluble particles to insoluble impurities

(D.) Fusible impurities to infusible material

20. Aluminium is extracted from alumina (Al_2O_3) by electrolysis of a molten mixture of

(A.) $Al_2O_3 + KF + Na_3AlF_6$

(B.) $Al_2O_3 + CaF_2 + NaAlF_4$

(C.) $Al_2O_3 + HF + NaAlF_4$

(D.) $Al_2O_3 + CaF_2 + Na_3AlF_6$

21. Which of the following type of iron can be welded easily ?

(A.) Steel (B.) Cast Iron (C.) Wrought iron (D.) All of these

22. Which is known as Blister copper?

(A.) Ore of copper (B.) Alloy of copper (C.) 98% copper (D.) pure copper

23. The chemical composition of slag formed during smelting process in the extraction of copper is

(A.) $Cu_2O + FeS$ (B.) $FeSiO_3$ (C.) $CuFeS_2$ (D.) $Cu_2S + FeO$

24. Bell metal is an alloy of

(A.) Cu and Sn (B.) Cu and Zn (C.) Cu ,Zn and Sn (D.) Cu, Zn and Ni

25. The process of zone refining used for getting ultra pure

(A.) Silicon (B.) germanium (C.) gallium (D.) All of the above

26. Van Arkel method of purification of metals involves converting the metal to a

(A.) Non volatile stable compound

(B.) Volatile stable compound

(C.) Volatile unstable compound

(D.) None of these

27. Identify the reaction which does not take place in a blast furnace

(A.) $2Fe_2O_3 + 3C$ ----------> $4Fe + 3CO_2$ (B.) $CO_2 + C$ ----------> $2CO$

(C.) $CaCO_3$ ----------> $CaO + CO_2$ (D.) $FeO + SiO_2$ ----------> $FeSiO_3$

28. Which of the following are correct

(1.) Iron is extracted from haematite

(2.) Wrought iron is the impure form of iron

(3.) The reducing agent in iron extracted is CO

(4.) The slag obtained in iron extraction is ferrous silicate

(A.) 1&4 (B.) 1 &2 (C.) 2&3 (D.) 1&4

28. Stainless steel does not rust because

(A.) Chromium and Nickel combine with Iron

(B.) Nickel present in it, does not rust

(C.) Chromium forms an Oxide layer and protects iron from rusting

(D.) Iron forms a hard chemical compound with chromium present in it.

29. Carbon cannot be used in the reduction if Al_2O_3 because

(A.) pure carbon is not easily available

(B.) it is an expensive proportion

(C.) The enthalpy of formation of CO_2 is more than that of Al_2O_3

(D.) The enthalpy of formation of Al_2O_3

30. Addition of high proportions of Mn makes steel useful in making rails because it

(A.) gives hardness to steel

(B.) Can remove oxygen and sulphur

(C.) helps the formation of oxides

(D.) Both (A) and (B)

31. Extraction of Zinc from zinc blende is achieved by

(A.) Roasting followed by self reduction

(B.) Electrolytic Reduction

(C.) Roasting followed by reduction with another metal

(D.) Roasting followed by reduction with carbon

32. The most electropositive metals are isolated from their ores by

(A.) High Temperature reduction with carbon

(B.) Electrolysis of fused ionic salts

(C.) Thermal decomposition

(D.) Self reduction

33.Refractory metals are used in construction of furnace because

(A.) They can withstand high temperature

(B.) They are chemically inert

(C.) Their melting point is high

(D.) Their melting point is low

34. Ellingham diagram is useful

(A.) To know the temperature where metal oxide decompose on its own.

(B.) To select suitable reducing agent for reduction of metal oxide

(C.) To know the temperature where phase transformation occurs

(D.) All of these

35. Extraction of zinc from zinc blende is achieved by

(A.) Roasting followed by self- reduction

(B.) Electrolytic reduction

(C.) roasting followed by reduction with another metal

(D.) roasting followed by reduction with carbon.

MATCH THE FOLLOWING

1.)

1. Kaolinite	(A.) Fe
2. Calamine	(B.) Cu

3. Malachite (C.) Al

4. Magnetite (D.) Zn

2.)

1. Silver (A.) Fused Salt analysis

2. Lead (B.) Cyanide process

3. Iron (C.) Carbon monoxide reduction

4. Magnesium (D.) Self Reduction

3.)

1. Aluminium (A.) Blast Furnace

2. Iron (B.) Mond process

3. Nickel (C.) Bayer process

4. Copper (D.) Van Arkel method

5. Zirconium (E.) Froth flotation

4.)

1. Fools gold (A.) Sulphate

2. Magnetite (B.) Carbonate

3. Calamine (C.) Oxide

4. Anglesite (D.) Sulphide

5.)

1. $PbS + 2PbO \text{ ----> } 3Pb + SO_2$ (A.) Carbon Reduction

2. $2PbS + 3O_2 \text{ -------> } 2PbO + 2SO_2$ (B.) Self- Reduction

3. $ZnCO_3$ ------> $ZnS + O_2$ (C.) Calcination

4. $PbO + C$ -------> $Pb + CO$ (D.) Roasting

6.)

1. Froth collector (A.) NaCN

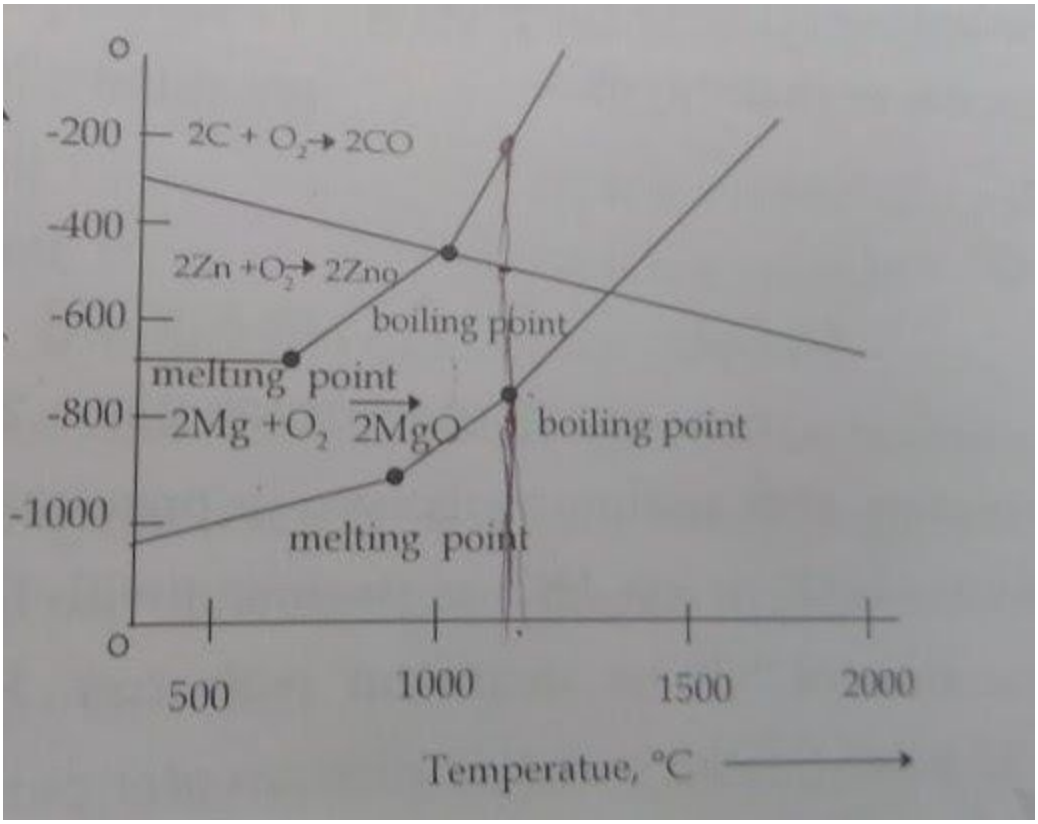
2. depressant (B.) aniline

3. stabilizer (C.) $FeSiO_3$

4. Slag (D.) Pine Oil

DIAGRAM BASED QUESTIONS

The Ellingham diagram for zinc, magnesium and carbon converting into corresponding oxides is shown below



1. At what temperature, zinc and carbon have equal affinity for oxygen ?

(A.) 1000°C (B.) 1500°C (C.) 500°C (D.) 1200°C

2. To make the following reduction process spontaneous ZnO + C -------> Zn + CO temperature should be

(A.) 1000°C (B.) 1100°C (C.) < 500°C (D) < 1000°C

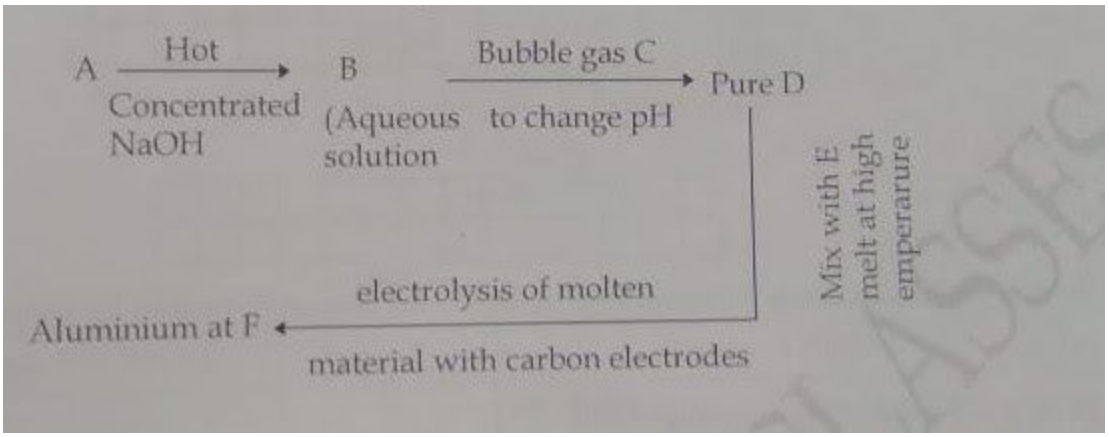
3. At 1100°C which reaction is spontaneous to a maximum extent ?

(A.) MgO + C --------> Mg + CO (B.) ZnO + C ----------> Zn + CO

(C.) MgO + Zn --------> Mg + ZnO (D.) ZnO + Mg ----------> Zn + MgO

4. This method is also known as

(A.) Pyrometallurgy (B.) Pyrometallurgy (C.) Hydrometallurgy (D.) Semi Metallurgy



1. 'A' is

(A.) $CuFeS_2$ (B.) $MgCl_2.6H_2O$ (C.)$Al_2O_3.2H_2O$ (D.) CuS

2. 'B' is

(A.) $Na[Al(OH)_4]$ (B.) NaOH (C.) H_2SO_4 (D.) Al_2O_3

3. 'C' is

(A.) CO_2 (B.) SO_2 (C.) SO_3 (D.) NO_2

4. 'E' is

(A.) Na_3GeF_6 (B.) Na_3AlF_6 (C.) Al_2O_3 (D.) None of these

TRUE /FALSE QUESTIONS

1. Every mineral is an Ore but every Ore is not a mineral

2. Liquation is applied when the metal has low melting point than that of impurities

3. Galvanized steel is the steel coated with zinc to improve its corrosion resistance

4. Tempering of Steel decreases mechanical strength

5. Haematite, Cassiterite and Argentite are oxide Ores

6. Lead is extracted from its chief ore galena by both carbon reduction as well as self- reduction

7. Blister copper is purified by distillation

8. Any metal will reduce the oxide of other metals which lie above it in the Ellingham diagram

9. In hydrometallurgy, Zn is used as oxidising agent in the displacement of Ag from $[Ag(CN)_2]^-$

10. Substance that reacts with gangue to form fusible mass is called slag

11. In froth flotation process $CuSO_4$ converts $Na_2[Zn(CN)_4]$ into ZnS

12. Wrought iron is the impure form if commercial Iron

13. Cast Iron can be permanently magnetized

14. Almico is used for making utensils and automobile parts

15. Heating of Steel to a higher temperature following by a quick quenching in water is called annealing

16. Aluminium is a good reducing agent

17. Carbon , Sulphur and gold metals occur in free state in nature

18. The flux used in extraction of Iron in Silica

19. High electropositive metals cannot be commercially extracted by carbon reduction process

20. Magnesium oxide acts as flux to remove the impurities of Si, P and S through slag formation

FILL IN THE BLANKS

1. The matte obtained in the extraction of copper contains _____.

2. German silver is an alloy of _____.

3. The method used for refining iron is _____.

4. Chemically rust of iron is _____.

5. Heating of pyrites in presence of air to remove sulphur is called_____.

6. Cinnabar is an ore of _____.

7. The non- metal present in cryolite is _____.

8 .Smelting is done in _____ furnace.

9. The metallurgical process in which a metal is obtained in a fused state is called_____.

10. Heating a mixture of Cu_2O and Cu_2S will give _____.

11. Monel metal is an alloy of _____.

12. In metallurgy of silver and gold, the respective metals are leached with _____.

13. The depressant NaCN selectively prevents ZnS forming a layer of _____ on the surface of ZnS.

14. In the Hall-Heroult process of electrolysis the overall reaction can be written as _____.

15. Copper from low grade and Scraps is extracted by _____.

16. In _____ process the molten metal is stirred with logs of green wood.

17. In Van - Arkel method of refining the crude metal is heated with _____.

18. The change in Gibbs energy (ΔG) for any process at any specified temperature, is described by the equation _____.

19. The volatile complex formed when Nickel is heated with carbon monoxide _____.

20. Wolframite is separated from tinstone ore by the process of _____.

VERY SHORT ANSWER QUESTIONS

1.Why sulphide ores are usually dressed by froth flotation method?

2. Give balanced equation for the extraction of silver from sulphide ore

3. What is the role of a collector, stabilizer and depressant in the froth flotation process? give one example of each.

4. Between C and CO which is a better reducing agent at 673K ?

5. What is the role of silica in the metallurgy of copper?

6. How is Ag or Au obtained by leaching from the respective ores?

7.The value of ΔG for the formation of Cr_2O_3 is -540 KJ/mol and that of Al_2O_3 is -827 KJ/mol . Is the reduction of Cr_2O_3 possible with aluminium?

8. Give the principle of zone refining.

9. Write two basic requirements for refining of a metal by mond process and van arkel method.

10. Why is gold found free in nature?

11. Why graphite is used as anode but not diamond

12. Why is CaF_2 used in the extraction of aluminium

13. Why does carbon reduce copper oxide but not calcium oxide?

14. Why is aluminium a good reducing agent?

15. Excess of carbon is added in the zinc metallurgy why?

16. Elements of 1A group are strong reducing agents and are used in the extraction of metals why?

17. Metal usually does not occur in nature as nitrates. Why?

18. Copper and Silver lie below hydrogen in electro-chemical series and yet they are found in the combined state as sulphide in nature. comment.

19. A metal is in a combined state as sulphide. Identify the steps A, B,C

Sulphide -------> A ---------> Oxide--------> B --------> Impure Metal -------> C -------> pure metal

20. What is the function of basic furnace linings in steel manufacture?

21. At a temperature above 1073K coke can be used to reduce FeO to Fe. How can you justify this with Ellingham diagram

22. Although carbon and hydrogen are better reducing agents but they are not used to reduce metallic oxides at high temperatures why?

23. How is copper extracted from low grade copper ores?

24. How is aluminium useful in the extraction of Cr and Mn from their oxides?

25. What is the role of graphite rod in the electrometallurgy of Al

CHAPTER 6

GROUP 15 ELEMENTS:

VERY SHORT ANSWER QUESTIONS:

1. Why ionization potential of group 15 elements greater than adjacent group elements?
2. Why metallic nature increases down the group from Nitrogen to bismuth?
3. The maximum covalency of nitrogen is 4, while that of other elements in the group is 6. Why?
4. Why nitrogen does not form penta halides?
5. Why PH_3 has low boiling point than NH_3?
6. Why BiH_3 is the strongest reducing agent amongst all the hydrides of group 15 elements?
7. Why penta halides are more covalent than tri halides?
8. Why dinitrogen is inert at room temperature?
9. How can you prepare purest nitrogen?
10. Write two uses of liquid nitrogen.
11. Mention the conditions required to get maximum yield of NH_3?
12. Why does NH_3 acts as Lewis base?
13. Why the compounds of bismuth are more stable in +3 oxidation state?
14. Write two uses of NH_3?
15. What is brown ring test? Write the composition of brown ring.
16. What happens when white phosphorous is heated with concentrated NaOH solution in a inert atmosphere of CO_2?
17. Why white phosphorous is more reactive under normal condition?
18. Why is the mixture if CaC_2 and CaC_3 used as Holmes's signals?
19. How does PCl_5 exist in solid state?
20. What happens when H_3PO_3 is heated?

FILL IN THE BLANKS:

1. The valence shell electronic configuration of group 15 elements is _____
2. The most abundant element in earth's atmosphere is _____
3. The most abundant group 15 element in earth's crust is _____
4. The maximum covalency and oxidation state of nitrogen of nitrogen are _____ and _____ respectively
5. The atomicity of nitrogen and phosphorous are _____ and _____
6. The shape of ammonia molecule is _____
7. The stable oxidation state of Bi is _____

8. The oxidation state of P in NaH_2PO_2 is _____
9. The most reactive allotropic form if phosphorous is _____
10. The bond angle is P_4 molecule is _____
11. The formula of diphosphine is _____
12. The shape of PCl_5 molecule is _____
13. The basicities of H_3PO_2, H_3PO_3, H_3PO_4 are ____, ____ and ____ respectively
14. Chemical formula of laughing gas is _____
15. The formula of sesqui oxide of nitrogen is _____
16. Fractional distillation of nitric acid give _____ % HNO_3
17. The starting material used for the manufacturing of HNO_3 by Ostwald process is _____
18. The anhydride of pyrophosphoric acid is _____
19. The P-P bond energy is x KJ/mole. Then the energy needed for the dissociation of 124g of white phosphorous is _____
20. The formula of metaphosphoric acid is _____

TRUE/FALSE:

1. The maximum covalency of nitrogen is five. (True/ False)
2. Nitrogen doesn't form pentahalides. (True/ False)
3. Arsenic and antimony oxides are atmospheric. (True/ False)
4. Commonly NF_3 is known to be the stable trihalides of nitrogen. (True/ False)
5. In N2 molecule, the nitrogen atoms are joined by 1∏ and 2σ bonds. (True/ False)
6. Barium azide on thermal dissociation gives dinitrogen. (True/ False)
7. Moist NH_3 can be dried by using either anhydrous $CaCl_2$ or P_4O_{10}. (True/ False)
8. NH_3 is less basic than PH_3. (True/ False)
9. Among the hydrides of group 15 elements, BiH_3 is the strongest reducing agent. (True/ False)
10. Conc. HNO_3 does not react with Cr, Al. (True/ False)
11. Nitric acid is used in the manufacturing of explosives and pyro techniques. (True/ False)
12. Nitric acid is used as rocket fuel. (True/ False)
13. All the 5 P-Cl bonds are identical in PCl_5 molecule. (True/ False)
14. All the oxoacids of phosphorous are used as reducing agents. (True/ False)
15. On heating PCl_5 undergoes sublimation. (True/ False)
16. NO_2 is brown gas and paramagnetic. (True/ False)
17. Red phosphorous is least reactive form allotropic forms. (True/ False)
18. The bond angle is PH_4^+ is higher than PH_3. (True/ False)
19. Pure form of phosphine is non inflammable. (True/ False)
20. The oxidation state of Fe in brown ring $[Fe(H_2O)_5NO]SO_4$ is +2. (True/ False)

MATCH THE FOLLOWING:

LIST 1	LIST 2
A. Phosphorite	1) KNO_3
B. Indian salt petre	2) $NaNO_3$
C. Chili salt petre	3) $3Ca_3(PO_4)_2.CaF_2$
D. Fluropatite	4) $Ca_3(PO_4)_2$

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. HNO_3	1. +5
B. NH_4NO_3	2. -1/3
C. N_3H	3. -3,5
D. H_3PO_3	4. +3

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. NO	1. Reddish brown and paramagnetic
B. NO_2	2. Colourless and paramagnetic
C. N_2O_3	3. Blue solid and acidic
D. N_20_5	4. Colourless solid and acidic

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. $4NH_3 + 5O_2 \rightarrow$	1. $PbO + 2NO_2 + O_2$
B. $P_4 + 3NaOH + 3H_20 \rightarrow$	2. $N_20 + H_2O$
C. $NH_4NO_3 \rightarrow$	3. $4NO + 6H_20$
D. $Pb(NO_3)_2 \rightarrow$	4. $3NaH_2PO_2 + PH_3$

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. NH_4^+	1. sp^3 pyramidal
B. N_2O_3	2. sp^3 tetrahedral
C. PCl_5	3. sp^3d- trigonal bipyramid
D. PCl_3	4. sp^2 pyramidal

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. $PCl_3 + H_20 \rightarrow$	1. $CH_3COCl + POCl_3 + HCl$
B. $PCl_5 + H_20 \rightarrow$	2. $H_3PO_3 + 3HCl$
C. $PCl_5+CH_3COOH \rightarrow$	3. $H_3PO_4 + 5HCl$
D. $PCl_5+C_2H_50H \rightarrow$	4. $C_2H_5Cl + POCl_3 + HCl$

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. H_3PO_2	1. Tribasic
B. H_3PO_3	2. Monobasic
C. H_3PO_4	3. Tetrabasic
D. $H_4P_20_6$	4. Dibasic

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. N_20	1. Colourless solid
B. NO_2	2. Blue colour solid
C. N_2O_3	3. Neutral oxide
D. N_20_5	4. Paramagnetic

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2 (O-N-O Bond angle)
A. NO_2^+	1. 108^0
B. NO_2	2. 132^0
C. N_2O_3	3. 120^0
D. N_2O_5	4. 115^0

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2 (Anhydride)
A. HOCl	1. N_2O_5
B. HNO_3	2. Cl_2O_7
C. H_3PO_4	3. Cl_2O
D. $HClO_4$	4. P_4O_{10}

A. (__) B. (__) C. (__) D. (__)

MULTIPLE CHOICE QUESTIONS:

1. In group 15 elements, which element exhibits wide range of oxidation states
    a) P
    b) As
    c) N
    d) Bi
2. Thermally more stable hydride is
    a) NH_3
    b) PH_3
    c) AsH_3
    d) BiH_3

3. The correct order of reducing abilities of group 15 elements is
    a) $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$
    b) $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$
    c) $NH_3 < PH_3 > AsH_3 > SbH_3 > BiH_3$
    d) $SbH_3 > BiH_3 > NH_3 > PH_3 > AsH_3$
4. Which is the decreasing order of boiling points of hydrides
    a) $NH_3 > PH_3 > AsH_3 > SbH_3$
    b) $SbH_3 > NH_3 > PH_3 > AsH_3$
    c) $PH_3 > NH_3 > AsH_3 > SbH_3$
    d) $SbH_3 > NH_3 > AsH_3 > PH_3$
5. Ammonium nitrate on heating gives
    a) NO
    b) N_2
    c) N_2O
    d) N_2O_4
6. The basic oxide among the following is
    a) N_20_3
    b) As_2O_3
    c) P_2O_3
    d) Bi_2O_3
7. The neutral oxide of nitrogen is
    a) NO
    b) N_20_5
    c) NO_2
    d) Both 1 and 2
8. The number of oxygen atoms present around nitrogen is N_2O_5 is
    a) 2
    b) 1
    c) 3
    d) 4
9. PCl_3 on hydrolysis gives
    a) H_3PO_2
    b) H_3PO_3
    c) HCl
    d) Both 2 and 3

10. The oxidation state of nitrogen in HNO_4 is
    a) +7
    b) +5
    c) +3
    d) +1
11. Oxidation state of phosphorous is least in
    a) Hypo phosphoric acid
    b) Hypo phosphorous acid
    c) Meta phosphoric acid
    d) Pyro phosphoric acid
12. NH_4Cl on heating with NaOH liberates
    a) NaCl
    b) NH3
    c) HCl
    d) NaOCl
13. Ammonia is dried over
    a) Quick lime
    b) Conc. H_2SO_4
    c) P_2O_5
    d) $CaCl_2$
14. Conc. HNO_3 is treated with iron metal. The metal is passive because
    a) It is a transition metal
    b) It is reduced
    c) It forms protective oxide film
    d) It liberates laughing gas
15. Conc. HNO_3 oxidizes I_2 and P_4 respectively to
    a) HI, H_3PO_3
    b) $HI0_3$, H_3PO_4
    c) $HI0_4$, H_3PO_3
    d) $HI0_4$, H_3PO_4
16. Which of the following is not an acidic salt?
    a) NaH_2PO_2
    b) NaH_2PO_3
    c) NaH_2PO_4
    d) $NaHPO_4$

17. Which pair of oxo acids of phosphorous contains P-H bonds?
    a) H_3PO_3, H_3PO_4
    b) H_3PO_5, $H_4P_20_7$
    c) H_3PO_3, H_3PO_2
    d) H_3PO_2, HPO_3
18. The statements regarding oxo acids of phosphorous are
    1. HPO_3 molecule is basic
    2. $H_4P_2O_6$ molecule has P-P bonds
    3. $H_4P_2O_7$ molecule has P-O-P bond
        a) All are correct
        b) Only 2 is correct
        c) 2 and 3 are correct
        d) 1 and 2 are correct
19. A and B are two gases. 'A' is identified with a glass rod dipped in NH_3 and the gas B is identified with glass rod dipped in HCl. A and B are respectively
    a) HCl, NO_2
    b) HCl, NH_3
    c) NH_3, HCl
    d) NH_3, $S0_2$
20. Aqueous solution of PCl_3 conducts electricity due to the presence of
    a) HOCl
    b) H_3PO_4
    c) HCl
    d) H_2O

GROUP 16 ELEMENTS

VERY SHORT ANSWER QUESTIONS:

1. Why group 16 elements are called chalcogens?
2. Why ionization enthalpy values of group 16 elements are low when compared to those of group 15 elements?
3. Why is H_20 a liquid and H_2S a gas?
4. How is dioxygen prepared in the laboratory?
5. How is dioxygen prepared industrially on a large scale?
6. Give one example each for:
    1. Acidic oxide
    2. Basic oxide
    3. Neutral oxide
    4. Amphoteric oxide
7. How can you justify the fact that Al_2O_3 is an amphoteric oxide?
8. How is ozone prepared?
9. Why does O_3 act as a powerful oxidizing agent?
10. How is ozone estimated qualitatively?
11. Why O_2 is always divalent while sulphur can form 2, 4 and 6 bonds?
12. Write two uses of ozone?
13. What happens when SO_2 is passed through aqueous solution Fe(III) salt?
14. How is SO_2 detected?
15. Give the hybridization of sulphur in the following:
    a. SO_2
    b. SO_3
    c. SF_4
    d. SF_6
16. Write two uses of SO_2?
17. Why $Ka_1 >> ka_2$ for H_2SO_4 in water?
18. Which form of sulphur shows paramagnetism and why?
19. Concentrated sulphuric acid is a strong dehydrating agent. Justify with one example.
20. Write two uses of sulphuric acid.

FILL IN THE BLANKS:

1. The valence shell electronic configuration of group 16 elements is _____
2. The radioactive element among group 16 elements is _____
3. The most abundant element of all the elements in the earth's crust is _____

4. The oxidation state of oxygen in OF_2 and O_2F_2 is _____ and _____ respectively
5. The most stable allotropic form of sulphur is _____
6. Complete the following reactions:
    1. $C_2H_4 + O_2 \rightarrow$ _____
    2. $4Al + 3O_2 \rightarrow$ _____
7. The O-O bond length in ozone is _____
8. The oxidation numbers of sulphur in S_8 and S_2F_2 and H_2S are _____, _____ and _____ respectively
9. The total number of bond pairs and lone pairs in Se_2Cl_2 are _____, _____
10. The strongest reducing agent among the hydrides of group 16 elements is _____
11. The shape of SF_6 molecule is _____
12. The number of σ and ∏ bonds in peroxodisulphuric acid are _____, _____ respectively
13. The total number of lone pairs of electrons present in OF_2 molecule is _____
14. The shape of SO_2 molecule is _____
15. The sulphuric acid obtained by contact process is _____ % pure

TRUE or FALSE:

1. The rhombic and monoclinic sulphuric acid has puckered and crown shaped structures. (True/ False)
2. O_2 and O_3 molecules are paramagnetic. (True/ False)
3. O_2 and S_2 molecules are paramagnetic. (True/ False)
4. The two O-O bond lengths in O_3 molecule are identical. (True/ False)
5. The favorable conditions for the formation of ozone according to Lechatlier's principle are high temperature and high pressure. (True/ False)
6. Among tetra fluorides of group 16 elements the TeF_4 is a solid. (True/ False)
7. The dimeric dihalide Se_2Cl_2 undergoes disproportionation. (True/ False)
8. All the elements of group 16 form dichlorides and dibromides. (True/ False)
9. Dioxygen does not react with metals Au, Pt and noble gases. (True/ False)
10. The bleaching action of SO_2 is due to reduction. (True/ False)
11. O_3 acts as both oxidant and reductant. (True/ False)
12. The basicity of all the oxoacids of sulphur is 2. (True/ False)
13. Oxygen does not show positive oxidation state. (True/ False)
14. The oxidation state of oxygen in super oxides is -1/2. (True/ False)
15. Sulphuric acid can act as reducing agent. (True/ False)

MATCH THE FOLLOWING:

1.

LIST 1	LIST 2
A. Pyrolusite	1. FeS_2
B. Heamatite	2. ZnS
C. Iron pyrites	3. Fe_2O_3
D. Zinc blend	4. MnO_2

B. (__) B. (__) C. (__) D. (__)

2.

LIST 1	LIST 2
A. SF_6	1. Angular
B. SF_4	2. Open book
C. SF_2	3. Octahedral
D. S_2F_2	4. See saw

A. (__) B. (__) C. (__) D. (__)

3.

LIST 1	LIST 2
A. Crown shape	1. S_2Cl_2
B. Angular shape	2. S_8 molecule
C. Planar trigonal	3. O_3 molecule
D. H_2O_2 like structure	4. SO_3 molecule

A. (__) B. (__) C. (__) D. (__)

4.

LIST 1	LIST 2
A. O-S-O angle in SO_2	1. 120^0
B. O-S-O angle in SO_3	2. 103^0
C. Cl-S-Cl angle in SCl_2	3. 104^0
D. S-S-Cl angle in S_2Cl_2	4. $119^0 30'$

A. (__) B. (__) C. (__) D. (__)

5.

LIST 1	LIST 2
A. Oleum	1. $Na_2S_2O_3$
B. Marshall's acid	2. $H_2S_2O_7$
C. Caro's acid	3. H_2SO_5
D. Hypo	4. $H_2S_2O_8$

A. (__) B. (__) C. (__) D. (__)

6.

LIST 1	LIST 2
A. Sulphuric dioxide	1. Detection of double bond in organic compound
B. Oxygen	2. Antichlor
C. Ozone	3. Paramagnetic
D. Hydrogen sulphide	4. Laboratory regent used during salt analysis

A. (__) B. (__) C. (__) D. (__)

7.

LIST 1	LIST 2
A. Oxidation state of S in S_8	1. +1
B. Oxidation state of S in H_2SO_4	2. 0
C. Oxidation state of S in S_2Cl_2	3. +6
D. Oxidation state of S in $Na_2S_2O_3$	4. +2

A. (__) B. (__) C. (__) D. (__)

8.

LIST 1	LIST 2
A. Number of $p_{\prod}$- $d_{\prod}$ bonds in SO_2	1. 2
B. Number of $p_{\prod}$- $d_{\prod}$ bonds in SO_3	2. 1
C. Number of $p_{\prod}$- $d_{\prod}$ bonds in $H_2S_2O_5$	3. 4
D. Number of $p_{\prod}$- $d_{\prod}$ bonds in $H_2S_2O_7$	4. 3

A. (__) B. (__) C. (__) D. (__)

9.

LIST 1	LIST 2
A. Sulphur	1. Oleum
B. Sulphuric acid	2. Vulcanizing agent
C. Fuming sulphuric acid	3. Marshall's acid
D. Peroxo di sulphuric acid	4. Petroleum refining

A. (__) B. (__) C. (__) D. (__)

10.

LIST 1	LIST 2
A. H_2SO_3	1. +2
B. $H_2S_2O_6$	2. +3
C. $H_2S_2O_3$	3. +4
D. $H_2S_2O_4$	4. +5

A. (__) B. (__) C. (__) D. (__)

MULTIPLE CHOICE QUESTIONS:

1. Element with lowest atomicity
   a. Te
   b. S
   c. Se
   d. O
2. α, β and γ forms of sulphur differ in
   a. Overall packing of rings
   b. Molecular weight
   c. Atomicities
   d. Their ring structure
3. The oxidation state of oxygen is zero in
   a. CO
   b. O_3
   c. SO_2
   d. H_2O_2
4. In sulphate ion the oxidation state of sulphur is +6 and the hybridization of sulphur is
   a. sp
   b. sp^2
   c. sp^3
   d. sp^2 or sp^3d^2
5. Element with higher catenation capacity is
   a. S
   b. Se
   c. Te
   d. Po

6. The pair of exothermic hydrides of VI A group are
   a. H_2O, H_2S
   b. H_2O, H_2Se
   c. H_2Se, H_2Te
   d. H_2S, H_2Te
7. Which is non poisonous hydride
   a. H_2O
   b. H_2S
   c. H_2Se
   d. H_2Te
8. Correct decreasing order of volatility is
   a. $H_2O > H_2S > H_2Se$
   b. $H_2S > H_2O > H_2Se$
   c. $H_2Se > H_2O > H_2S$
   d. $H_2S > > H_2Se > H_2O$
9. The most acidic and thermally stable hydride of chalcogens are respectively
   a. H_2O, H_2Te
   b. H_2Te, H_2S
   c. H_2S, H_2Te
   d. H_2Te, H_2O
10. The element of VI A group which cannot form hexahalides is
   a. O
   b. S
   c. Se
   d. Te
11. Which of the following has open- book structure
   a. SCl_2
   b. S_2Cl_2
   c. SF_4
   d. SF_2
12. In SO_2 two oxygen atoms are linked to sulphur atom through double bonds. The bonds are:
   a. Both p_π -p_π
   b. Both p_π -d_π
   c. Both d_π -d_π
   d. One d_π -p_π and p_π -d_π

13. SO_2 forms an addition compound sulphuryl chloride with Cl_2 in presence of
    a. Camphor
    b. CCl_4
    c. $H^+/K_2Cr_2O_7$
    d. $H^+/KMnO_4$
14. Acid that contains S-O-S linkage is
    a. $H_2S_2O_7$
    b. $H_2S_2O_5$
    c. $H_2S_2O_6$
    d. $H_2S_2O_4$
15. Peroxy linkage is present in
    a. $H_2S_2O_2$
    b. $H_2S_2O_3$
    c. $H_2S_2O_6$
    d. $H_2S_2O_8$
16. Hybridization of central sulphur in all oxo anions of sulphur is
    a. sp^3d
    b. sp^3
    c. sp^3d^2
    d. sp^2d
17. The catalyst used in the manufacture of H_2SO_4 by contact process is
    a. Al_2O_3
    b. Cr_2O_3
    c. V_2O_5
    d. MnO_2
18. The formation of O_3 from O_2 is
    a. Exothermic and reversible
    b. Endothermic and irreversible
    c. Endothermic and reversible
    d. Exothermic and spontaneous
19. The compound formed in the tailing of mercury by O_3 is
    a. HgO
    b. Hg_2O
    c. Hg_2O_2
    d. $HgO + Hg_2O$

20. A black compound ‘X’ when treated with O3 turned white. The compound ‘X’ is
    a. ZnS
    b. PbS
    c. CuS
    d. Ag_2S

GROUP 17 ELEMENTS

VERY SHORT ANSWER QUESTIONS:

1. Why group 17 elements have very high ionization enthalpy?
2. Halogens have maximum negative electron gain enthalpy in the respective periods of periodic table. Why?
3. Why the negative electron gain enthalpy of fluorine is less than that of chlorine?
4. Although electron gain enthalpy of fluorine is less than that of chlorine, fluorine is a stronger oxidizing agent than chlorine. Why?
5. Why most of the reactions of fluorine are exothermic?
6. Why are halogens colored?
7. Write the uses of O_2F_2?
8. Write the uses of I_2O_5?
9. What are inter halogen compounds? Give two examples.
10. What happens when chlorine reacts with dry slaked lime?
11. How does chlorine react with concentrated NaOH solution?
12. What is aqua regia? Write its uses.
13. Write two uses of HCl.
14. Calculate the oxidation state of chlorine in the following:
    a. Cl_2O
    b. $NaClO_4$
    c. ClO_3^-
    d. NaOCl
15. Why inter halogen compounds are more reactive than halogens except fluorine?
16. Write the hydrolysis products of ClF and ClF_3.
17. Why fluorine can form only one oxoacid HOF?
18. Name two poisonous gases which can be prepared from chlorine.
19. Write the reactions of F_2 and Cl_2 with water.
20. Write the shapes of IF_5 and IF_7.

FILL IN THE BLANKS:

1. The valence shell electronic configuration of group 17 elements is _____
2. The most electro negative element is _____
3. The element with highest negative electron gain enthalpy is _____
4. The halogen that undergoes sublimation is _____
5. The liquid and solid halogens are _____ and _____

6. The maximum oxidation state that can be exhibited by a halogen in its second exicited state is _____
7. The strongest oxidizing agent is _____
8. When brine solution is subjected to electrolysis _____ is liberated at anode and _____ at cathode.
9. The number of peroxy bonds in per chloric acid is _____
10. The geometry of ClO_3^- according to VSEPR theory is _____
11. The maximum number of atoms present in an inter halogen compound is _____
12. The most abundant halogen in sea water is _____
13. Chlorine is prepared by oxidation of hydrogen chloride gas in the present of _____ catalyst.
14. The only halogen which shows -1 oxidation state is _____
15. The halogen which is more soluble in water is _____

TRUE OR FALSE:

1. All the halogens are colored. (True/ False)
2. The bond dissociation enthalpy of F_2 is greater than that of Cl_2. (True/ False)
3. Highest oxidation state of fluorine is -1. (True/ False)
4. All the halogens are diatomic and form univalent ions. (True/ False)
5. Lighter halogens displace larger halogens from its metal halides. (True/ False)
6. The composition of bleaching powder is $Ca(OCl_2).CaCl_2.Ca(OH)_2.2H_2O$. (True/ False)
7. The bleaching action of chlorine is due to reduction. (True/ False)
8. One part of conc. HCl and three parts of conc. HNO_3 is called aqua regia. (True/ False)
9. ClF are BrF are colorless gases. (True/ False)
10. ClF_5 is a colorless liquid and is having square pyramidal shape. (True/ False)
11. All the inter halogen compounds are diamagnetic in nature. (True/ False)
12. ClF is more reactive than fluorine. (True/ False)
13. ClO2 is used as a bleaching agent for paper pulp and textiles. (True/ False)
14. The decreasing order of stability of oxides formed by halogens is I> Cl> Br. (True/ False)
15. The shape of HOCl is linear. (True/ False)

MATCH THE FOLLOWING:

LIST 1	LIST 2
A. Most electro negative	1. Br_2
B. Most electron affinity	2. F_2
C. Liquid halogen	3. Cl_2
D. Radioactive halogen	4. At

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. Maximum solubility in water	1. F_2
B. Maximum enthalpy of dissociation	2. Cl_2
C. Maximum inter molecular distance	3. Br_2
D. Corrosive liquid	4. I_2

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. Tear gas	1. $(C_2H_4Cl)_2S$
B. Mustard gas	2. $COCl_2$
C. Phosgene	3. CCl_3NO_2
D. Teflon	4. $(C_2F_4)_n$

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. HClO	1. Chlorate
B. $HClO_2$	2. Chlorite
C. $HClO_3$	3. Hypo chlorite
D. $HClO_4$	4. Per chlorate

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. HClO	1. 0
B. $HClO_2$	2. 1
C. $HClO_3$	3. 2
D. $HClO_4$	4. 3

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2(Physical state and color)
A. ClF	1. Black solid
B. BrF	2. Pale brown gas
C. ICl	3. Colorless gas
D. IBr	4. Ruby red solid

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2(Shape)
A. ClO^-	1. Trigonal pyramid
B. $HClO_2$	2. Tetrahedral
C. $HClO_3$	3. Angular
D. $HClO_4$	4. Linear

A. (__) B. (__) C. (__) D. (__)

LIST 1 (Property)	LIST 2 (Order)
A. Melting point	1. $I_2 < Br_2 < F_2 < Cl_2$
B. Boiling point	2. Cl> F> Br> I
C. Electron affinity	3. $Cl_2 > Br_2 > F_2 > I_2$
D. Bond dissociation energy	4. $F_2 < Cl_2 < Br_2 < I_2$

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. Fluorospar	1. Na_3AlF_6
B. Fluoropatite	2. $KCl.\ MgCl_2.\ 6H_2O$
C. Cryolite	3. $3Ca_3(PO4)_2.CaF_2$
D. Carnalite	4. CaF_2

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2 (Shape)
A. BrF_3	1. Angular
B. ClF_5	2. T- shape
C. IF_7	3. Square pyramidal
D. OF_2	4. Pentagonal bipyramidal

A. (__) B. (__) C. (__) D. (__)

MULTIPLE CHOICE QUESTIONS:

1. The element which never acts as a reducing agent in a chemical reaction is:
   a. O
   b. Li
   c. F
   d. C
2. The type of forces present among halogen molecules
   a. H-bonds
   b. Covalent bonds
   c. Vander wall's forces
   d. Ionic bond
3. Liquid and solid halogens are
   a. Br_2 and Cl_2
   b. I_2 and Br_2
   c. Br_2 and I_2
   d. Cl_2 and I_2

4. The elements with the highest electron affinity and electro negativity respectively are:
   a. Cl and Cl
   b. F and F
   c. F and Cl
   d. Cl and F
5. The maximum oxidation state that can be exhibited by a halogen in its second excited state
   a. +1
   b. +3
   c. +5
   d. +7
6. Enthalpy of dissociation is low for
   a. F_2
   b. Cl_2
   c. Br_2
   d. I_2
7. The order of reactivity of halogens with hydrogen is
   a. $F_2 < Cl_2 < Br_2 < I_2$
   b. $F_2 > Cl_2 > Br_2 > I_2$
   c. $F_2 < Br_2 < Cl_2 < I_2$
   d. $F_2 > I_2 > Br_2 > Cl_2$
8. The electron affinity values (in KJ/mole) of three halogens x, y, z are respectively -349, -333, -325. Then x, y, z respectively are
   a. F, Cl and Br
   b. Cl, F and Br
   c. Cl, Br and F
   d. Br, Cl and F
9. Correct order of boiling point of hydrogen halides is
   a. HF> HCl> HBr> HI
   b. HF< HCl< HBr< HI
   c. HCl< HBr< HI< HF
   d. HF< HBr< HI< HCl

10. One gas bleaches the color of flowers by reduction and another gas by oxidation. The gases respectively are
    a. SO_2 & Cl_2
    b. CO & Cl_2
    c. NH_3 & SO_2
    d. H_2S & Br_2
11. Which of the following has greatest reducing power?
    a. HI
    b. HBr
    c. HCl
    d. HF
12. Ozonized oxygen can be obtained from H_2O by action of
    a. Conc. H_2SO_4
    b. $KMnO_4$
    c. MnO_4^{-2}
    d. F_2
13. Which one of the following halogens does not exhibit positive oxidation state in its compound
    a. I
    b. Br
    c. Cl
    d. F
14. Chlorine acts as a bleaching agent only in the presence of
    a. Dry air
    b. Moisture
    c. Sun light
    d. None of these
15. Cl_2 or Br_2 or I_2 reacts with conc. Alkali solution to form
    a. Halide + hypohalite
    b. Halide + hypohalite + H_2O
    c. Halide + halite
    d. Halide + halate + H_2O
16. Chlorine oxidizes H_2S to
    a. S
    b. SO_2
    c. H_2SO_4
    d. H_2SO_3

17. When chlorine is made to react with Na_2SO_3, the products formed are
    a. Na_2SO_3+ S + HCl
    b. Na_2SO_4+ S + HCl
    c. Na_2S+ S + HCl
    d. Na_2SO_4 + HCl
18. What are the products obtained when ammonia is reacted with excess chlorine
    a. N_2 & NCl_3
    b. N_2 & HCl
    c. N_2 & NH_3Cl
    d. NCl_3 & HCl
19. Which of the is used in the extraction of gold
    a. F_2
    b. Cl_2
    c. Br_2
    d. I_2
20. The number of ∏ bonds present in ClO_4^- ion is
    a. 2
    b. 3
    c. 4
    d. 1

GROUP 18 ELEMENTS

VERY SHORT ANSWER QUESTIONS:

1. Why are group 18 elements known as noble gases?
2. Noble gases have very low boiling points. Why?
3. Write the name and formula of first noble gas compound prepared by Bartlett.
4. How is XeF_6 prepared from XeF_4 and O_2F_2?
5. Why do noble gases have comparatively large atomic sizes?
6. How is $XeOF_4$ prepared?
7. How is XeO_2F_2 prepared?
8. How is XeO_3 prepared?
9. Why do noble gases form compounds with fluorine and oxygen?
10. Why is helium gas used in modern diving apparatus?
11. Though helium is heavier than hydrogen it is used in filling balloons for metrological observations. Why?
12. Write two uses of Argon?
13. Write two uses of Neon?
14. Does hydrolysis of XeF_6 lead to a redox reaction?
15. Why has it been difficult to study the chemistry of radon?

FILL IN THE BLANKS:

1. The valence shell electronic configuration of group 18 elements is _____
2. The percentage by volume of noble gases occupied in dry atmosphere is nearly _____ %
3. The radioactive element among the noble gases is _____
4. The main commercial source of helium is _____
5. The noble gas obtained from the decay of $^{226}_{88}Ra$ is _____
6. The formula of red compound which is inspiration for the preparation of first noble gas compound is _____
7. The first ionization enthalpy of helium is almost same as that of _____
8. The shape of XeF_2 is _____
9. The shape of XeF_4 is _____
10. The shape of XeF_6 is _____
11. The shape of XeO_3 is _____
12. The number of lone pairs present at the central atom of XeO_3 and XeO_4 are respectively _____, _____
13. The shape of XeO_2F_2 is _____

14. The gas used in filling electric bulbs is _____
15. The inert gas used as a substituent for nitrogen in oxygen cylinders used by deep sea drivers for breathing is _____

TRUE OR FALSE:

1. All the noble gases are colorless, odorless and tasteless. (True/ False)
2. Noble gases are highly soluble in water. (True/ False)
3. All the noble gases are mono atomic molecules. (True/ False)
4. Helium has the lowest boiling point than any known substance. (True/ False)
5. Noble gases have large positive values of electron gain enthalpy. (True/ False)
6. No compounds if Ar, Ne or He is known till now. (True/ False)
7. The maximum oxidation state exhibited by xenon in its compounds is +6. (True/ False)
8. Helium is found in radioactive minerals like pitch blend, monazite or cleveite. (True/ False)
9. XeF_4 has tetrahedral geometry. (True/ False)
10. Liquid helium is used as cryogenic liquid for the production of very low temperature. (True/ False)

MATCH THE FOLLOWING:

LIST 1	LIST 2
A. XeF_6	1. Tetrahedral
B. XeF_4	2. Square planar
C. XeO_3	3. Distorted octahedral
D. XeO_4	4. Pyramidal

B. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2 (Lone pairs)
A. XeF_2	1. 0
B. XeF_4	2. 2
C. XeO_3	3. 3
D. XeO_4	4. 1

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. $XeF_4 + O_2F_2 \rightarrow$	1. $XeF_4 + 2HF$
B. $2\ XeF_2 + 2H_20 \rightarrow$	2. $XeF_6 + O_2$
C. $XeF_6 + H_20 \rightarrow$	3. $XeO_2F_2 + 4HF$
D. $XeF_6 + 2H_20 \rightarrow$	4. $2Xe + 4HF + O_2$

A. (__) B. (__) C. (__) D. (__)

LIST 1	LIST 2
A. XeO_3	1. Colorless and volatile liquid
A. $XeOF_4$	2. colorless and explosive solid
B. Liquid helium	3. red color solid
C. $XePtF_6$	4. cryogenic liquid

A. (__) B. (__) C. (__) D. (__)

MULTIPLE CHOICE QUESTIONS:

1. Welding of magnesium can be done in an atmosphere of
   a. O_2
   b. He
   c. N_2
   d. All
2. The gas used for inflating the tires of aero planes is
   a. H_2
   b. He
   c. N_2
   d. Ar
3. Which inert gas is used in the colored electric discharge tubes used for advertisements and decoration
   a. Helium
   b. Neon
   c. Argon
   d. Xenon
4. Radon is a noble gas. Its radioactivity is used in the
   a. Typhoid
   b. Cancer
   c. Cough and cold
   d. None of these
5. Helium is added to oxygen supply by deep sea divers because
   a. It is less soluble in blood than nitrogen at high pressures
   b. It is lighter than nitrogen
   c. It is readily miscible with oxygen
   d. It is less poisonous than nitrogen

6. The inert gas forms during nuclear disintegration is
    a. Xe
    b. He
    c. Rn
    d. Both He and Rn
7. Which of the following element have same number of electrons in its ultimate and penultimate shells?
    a. Ne
    b. Ar
    c. Kr
    d. Xe
8. The elements with atomic numbers 10, 18, 36, 54 are
    a. Halogens
    b. Rare gases
    c. Rare earth
    d. Alkali metals
9. The reason for the formation of compounds by xenon with fluorine and oxygen is
    a. Ionization potential of Xe is low among inert gases
    b. F_2 and O_2 are most electro negative elements
    c. Xe has vacant d- orbital's into which its p- electron can be excited
    d. All of these
10. The boiling points of zero group element increase down the group because
    a. Vanderwaal's attractive forces increases with increase in atomic size
    b. Polarisability of inert gases increases with increase of atomic size
    c. Extent of association to diatomic molecules increases
    d. Atomic weight increases
11. The chemistry of inert gas elements is not very much known because of their
    a. Rare occurrence
    b. Electronic configuration
    c. Low ionization potentials
    d. High electron affinities
12. The structure of xenon difluoride
    a. Linear with two lone pars
    b. Linear with three lone pairs and two bond pairs
    c. angular with two lone pairs and two bond pairs
    d. Linear with two lone pairs and two bond pairs

13. The hybridization of xenon in XeO_3 and XeO_4 respectively is
    a. sp^3d, sp^3
    b. sp^3, sp^3d
    c. sp^3d, sp^3d
    d. sp^3, sp^3
14. In XeF_4 molecule the lone pairs of electrons on Xe atom occupy which of the following positions in the octahedral structure?
    a. Two corners of the planar square adjacent to each other.
    b. Two corners of the planar square opposite to each other.
    c. One of the planar square and one trans position
    d. Two opposite corners(transpositions) of the octahedron
15. Tetrahedral geometry is of
    a. XeO_4
    b. XeF_4
    c. XeO_3
    d. XeF_6

COORDINATION COMPOUNDS

I.VERY SHORT ANSWER TYPE QUESTIONS:

1.What are coordination compounds ? Give two examples.

2.What is a coordination polyhedron?

3.What is a double salt ? Give example.

4.What is the difference between a double salt and a complex compound?

5.What is a ligand ?

6.Give one example each for ionic and neutral ligands.

7.What is a chelate ligand ? Give example.

8.What is an ambidentate ligand ? Give example.

9.$CuSO_4.5H_2O$ is blue in colourwhere as anhydrous $CuSO_4$ is colourless.Why?

10.$[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral.Why?

II.FILL UP THE BLANKS:

1.Formula of carnallite is……

2.Complexes in which a metal is bound by onlyone kind of ligands are known as ……

3.The coordination number of Fe in $[Fe(C_2O_4)_3]^{3-}$ is ……..

4.Geometry of $[PtCl_4]^{2-}$ is……..

5.The energy required for electron pairing in a single orbital is called ……

6.In a ligand ,the atom which gives the lone pair of electrons is called a ……atom.

7.$[CoF_6]^{3-}$ uses outer orbital (4d)inhybridisation(sp^3d^2).It is thus called …… complex.

8.Δ_t = ……Δo

9. ---------- of coordination compounds is defined as the reciprocal of the formation constant.

10.CFT attributes the colour of the coordination compounds to …….of the electron.

III. TRUE OR FALSE:

1.Alfred Werner proposed the concept of a primary valence and secondary valence for a metal ion. (T/F)

2.$[Co(NH_3)_6Cl_3]$ is a heteroleptic complex. (T/F)

3.Every metal ion has a fixed number of secondary valencies called coordination number. (T/F)

4.Bridging ligands between two metal ions in a coordination entity are denoted by prefix Ø.(T/F)

5.VBT explains the colour exhibited by coordination compounds.(T/F)

6.$Mn_2(CO)_{10}$ has three Mn-Mn bonds.(T/F)

7.Oxidation state of the metal ion is indicated by Roman numeral in parenthesis.(T/F)

8.$CoCl_3.4NH_3$ has two geometrical isomers.(T/F)

9.Strong field ligands form high spin complexes.(T/F)

10.The spin only magnetic moment of $[MnBr_4]^{2-}$ is 1.73 BM.(T/F)

IV.MATCH THE FOLLOWING:

1.LIST-I LIST-II

A) $CoCl_3.6NH_3$ i) Violet

B) $CoCl_3.5NH_3$ ii) Yellow

C) $CoCl_3.4NH_3$ (cis) iii) Purple

D) $CoCl_3.4NH_3$ (trans) iv) Green

2. LIST-I (FORMULA) LIST-II (MOLES OF AgCl precipitated)

A) $PdCl_2.4NH_3$ i) 0

B) $PtCl_2.2NH_3$ ii) 1

C) $CoCl_3.4NH_3$ iii) 2

D) $NiCl_2.6H_2O$ iv) 2

v) 0

3. LIST-I (COMPLEX) LIST-II (GEOMETRY)

A) $Ni(CO)_4$ i) Octahedral

B) $Fe(CO)_5$ ii) Square planar

C)$[NiCl_4]^{2-}$ iii) Tetrahedral

D) $Cr(CO)_6$ iv) TBP

4. LIST-I (COMPLEX) LIST-II (Charge on the coordination sphere)

A) $CoCl_3.6NH_3$ i) 0

B) $CoCl_3.5NH_3$ ii) +3

C) $CoCl_3.4NH_3$ iii) +2

D) $CoCl_3.3NH_3$ iv) +1

v) +4

5. LIST-I LIST-II

(colour of the absorbed light) (colour of the transmitted light)

A) Violet i) Green blue

B) Blue ii) Yellow green

C) Blue green iii) Yellow

D) Orange iv) Red

V.MULTIPLE CHOICE QUESTIONS:

1.In complex compounds ,the metal atom acts as a……..

1) Lewis acid 2) Lewis base 3) Bronsted acid 4) Bronsted base

2.The formula of nitrosyl group

1) NO 2) NO^+ 3) NO^- 4) ONO

3. Which of the following is an example of ambidentate ligand

1) CO 2) CN^- 3) H_2O 4)SO_4^{2-}

4.The secondary valency of chromium in $[Cr(en)_3]Cl_3$ is…….

1) 6 2) 4 3) 2 4) 1

5.Cationic complex among the following is :

1) Potassium ferrocyanide

2) Cryolite

3) Cupraammonium (II) sulphate

4) Sodium argentothiosulphate

6.The hybridisation of metal ion in square planar complexes is……..

1) dsp^2 2) sp^3d 3) d^2sp^3 4) sp^3

7.Number of dative bonds in the complex $CoCl_3.5NH_3$ is :

1) 6 2)5 3) 4 4) 3

8.CN of Cr is 6. A complex entity with $C_2O_4^{2-}$,en, superoxide as ligands is

$[Cr(C_2O_4)_x\ (en)_y(O_2)_z]^{2+}$.The ratio of x:y:z is :

1) 1:1:2 2) 1:1:1 3) 1:2:2 4) 2:1:1

9.Name of oxalate in IUPAC version changes to

1) oxalite 2) oxalato 3) oxalito 4) oxalide

10.Geometrical isomerism in square planar complexes is given by:

1) Ma_4 type complex 2) Mabcd type complex

3) Ma_2b_2 type complex 4) both 2 &3

VI.PROBLEMS: Using IUPAC norms write the formulas for the following

1) Tetrahydroxozincate(II)
2) Hexaamminecobalt(III) sulphate
3) Potassium tetrachloropalladate(II)
4) Potassium tri(oxalato)chromate(III)
5) Tetraamminediaquacobalt(III) chloride
6) Diamminesilver(I)dicyanoargentate(I)
7) Diamminechloronitrito-N-platinum(II)

8) Mercury tetrathiocyanocobaltate(III)

9) Dichlorobis(ethane -1,2-diamine) cobalt(III) chloride

10) Sodium tetrathiocyanatocobaltate(II)

8. POLYMERS

Life began with and still being maintained by polymers. Without polymers there is no life on earth.

Polymers are referred to **macromolecules**, which are formed by the joining of repeating units on a large scale. The repeating structural units are known as **monomers**. The process of formation of polymer from monomer is called **polymerisation.**

CLASSIFICATION OF POLYMERS:-

Classification based on source:-These are three categories.

1. **Natural polymers**:- These polymers are obtained from natural source such as plants and animals. Ex :- Proteins, starch, etc.
2. **Semi-synthetic polymers**:- These polymers are the synthetic derivatives of the natural polymers. Ex:- Cellulose acetate (rayon), cellulose nitrate, etc.
3. **Synthetic polymers**:- These polymers are man-made polymers. These are extensively used in daily life as well as in industry. Ex:- polythene, nylon-6, etc.

Classification based on structure:- These are also divided in to three groups.

1. **Linear polymers:** Polymer consists of long and straight chains. Examples – High density polythene, polyvinyl chloride, etc.
2. **Branched chain polymers**: Polymers contains linear chains having some branches. Examples – Low density polythene
3. **Cross linked or network polymers**: Polymers in which monomer units are cross linked together to form a 3 dimensional network polymers. Examples – Bakelite, melamine, etc.

Classification based on the mode of polymerisation:- These are divided in two groups.

1. **Addition polymers**: Polymers are formed by the repeated addition of monomers with double and triple bonds. It is further classified into,

Homopolymers:Polymers formed by the polymerisation of a single monomeric species.
Examples – Polythene, Polystyrene.
Copolymers:Polymers formed by addition polymerisation of two different monomers.
Examples – Buna-S, Buna –N.

2. **Condensation polymers**: Polymers formed by repeated condensation reaction between
two different bi-functional or tri-functional monomeric units with elimination of simple molecules. Examples – Nylon 6, Terylene.

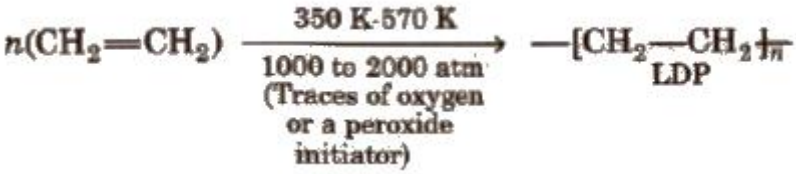
Classification based on molecular forces:- These are divided in four groups.

1. **Elastomers**: Polymer chains are held together by weakest intermolecular forces. Polymers are rubber – like solids with elastic properties. Examples – Buna – S, Buna – N, Neoprene.
2. **Fibre:** Polymers have strong intermolecular force like hydrogen bonding. Fibres are the thread forming solids which possess high tensile strength and high modulus. Examples – Nylon 6, 6, Polyesters.
3. **Thermoplastic polymers**: Polymers are held by intermolecular forces which are in between those of elastomers and fibres. These polymers are capable of repeated softening on heating and hardening on cooling. Examples – Polythene, Polystyrene.

4. **Thermosetting polymers**: Polymers are cross linked or heavily branched molecules, which on heating undergo extensive cross linking in moulds and eventually undergo a permanent change. Examples – Bakelite, Urea-formaldelyde resins

Polymers – preparation – uses:-

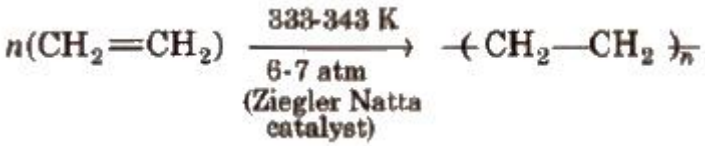
(i) **Low density polythene** (LDP)



It is tough, flexible, transparent, chemically inert as well as poor conductor pf electricity. It has moderate tensile strength but good tearing strength.

It is used in the insulation of electricity carrying wires and manufacture of squeeze bottles, toys and flexible pipes.

(ii) **High density polyethylene** (HOP)

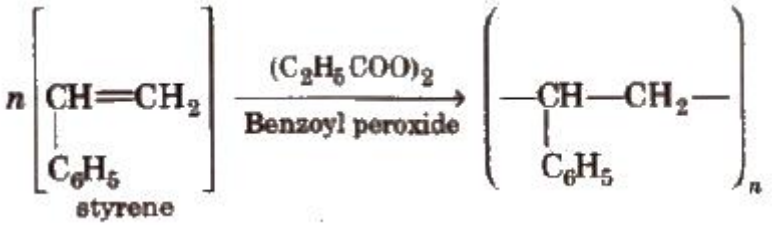


It has high density due to close packing. It is also chemically inert and more tougher and harder.

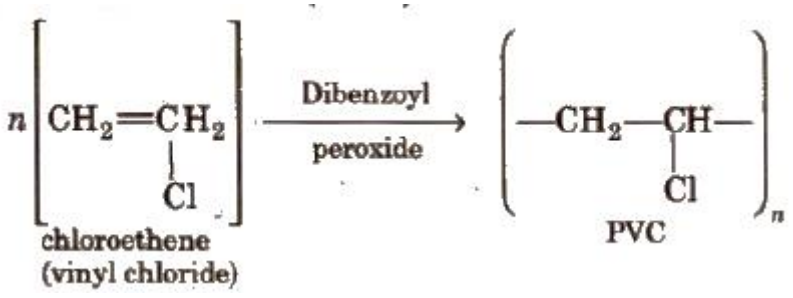
It is used for making containers, house wares, bottles, toys, electric insulation etc.

2. **Polystyrene**

The monomers are styrene molecules. It is thermoplastic. It is used for making toys, radio and TV cabinets

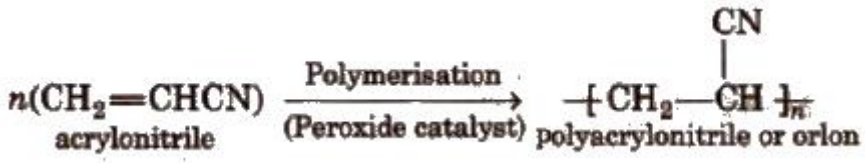


3. Polyvinylchloride (PVC)



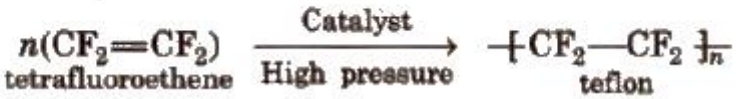
It is used for making rain coats, toys, electrical insulation. It is hard and resistant to heat and chemicals.

4. **Polyacrylonitrile**



It is used as a substitute for wool in making commercial fibres as orlon or acrilan.

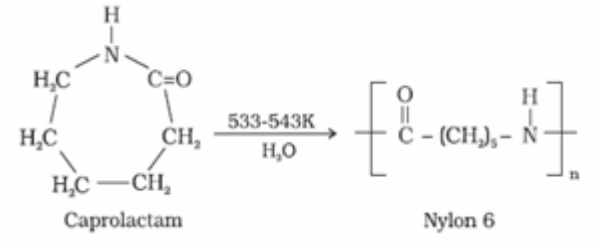
5. **Polytetrafluoroethene** (Teflon)



It is chemically inert and resistant to attack by corrosive reagent. It is used in making oil seals, gaskets and also for non-stick surface coated utensils.

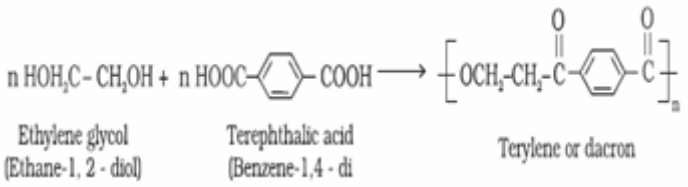
1. Polyamides: Polymers possess amide linkage (-CONH-) in chain. Thesepolymers are popularly known as nylons. Examples:
(a) **Nylon 6, 6**: It is prepared by the condensation polymerisation of hexamethylenediamine with adipic acid under high pressure and at high temperature. It is used in making sheets, bristles for brushes and in textile industry.

(b) **Nylon 6**: It is obtained by heating caprolactum with water at a high temperature



It is used for the manufacture of tyre cords, fabrics and ropes.

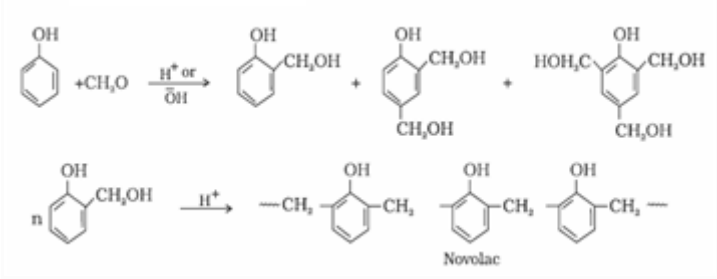
2. Polyesters: These are the polycondensation products of dicarboxylic acids and diols Example: Terylene or Dacron



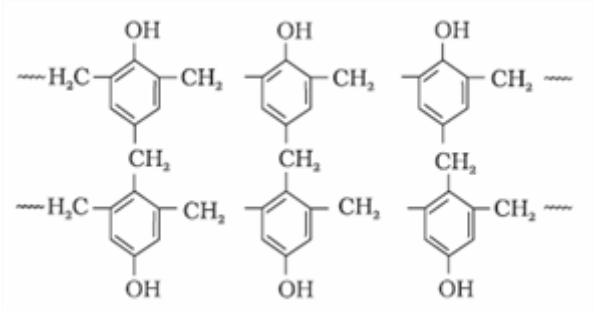
It is used to create resistance in polymerised product and is used in blending with cotton and wool fibres and also as glass reinforcing materials in safety helmets, etc.

3. **Phenol – formaldehyde polymer** (Bakelite and related polymers)

a**). Bakelite**: These are obtained by the condensation reaction of phenol with formaldehyde in the presence of either an acid or a base catalyst. The initial product could be a linear product – Novolac used in paints.

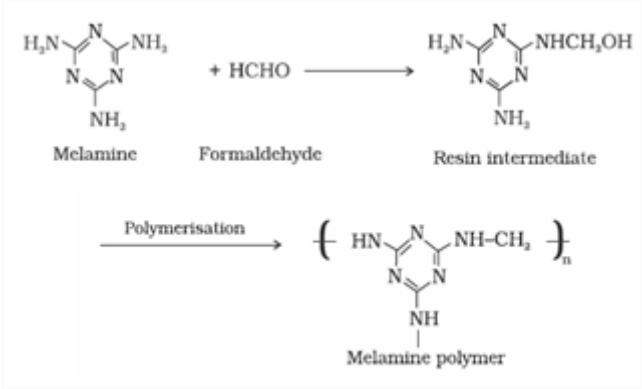


b). **Novolac** on heating with formaldehyde forms Bakelite



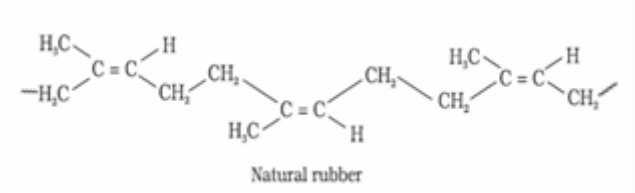
It is used for making combs, phonograph records, electrical switches and handles of various utensils

4. **Melamine – formaldehyde polymer**: Melamine formaldehyde polymer isformed by the condensation polymerisation of melamine and formaldehyde



It is used in the manufacture of unbreakable crockery.

a). **Natural rubber**: Natural rubber is a linear polymer of isoprene (2-methyl-1, 3-butadiene) and is also called as *cis* – 1, 4 – polyisoprene.



Vulcanisation of Rubber

The properties of natural rubber can be modified by introducing -S-S- polysulphide crosslinks in its structure. This process of introducing -S-S- crosslinks in the structure of natural rubber by heating with sulphur at 110°C is called vulcanisation of rubber.

Vulcanisation is carried out by adding sulphur (3-5%) and zinc oxide to the rubber, and then heating the object at about 110°Cfor about 20-30 minutes. Zinc oxide accelerates the rate of vulcanisation. Vulcanisation introduces polysulphide (-S-S-) bonds between the adjacent chains. These crosslinks tend to limit the motion of chains relative to each other.

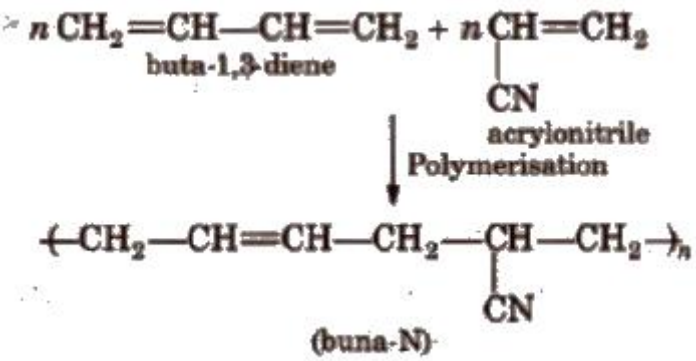
b). **Synthetic rubber**: Synthetic rubbers are either homopolymers of 1, 3 – butadiene derivatives or copolymers of 1, 3 – butadiene or its derivatives with another unsaturated monomer.

Neoprene :

Polymer formed by polymerisation of chloroprene is neoprene or synthetic rubber.

It is used for the manufacturing conveyers belts, gasket and hoses.

Buna-N :
It is a copolymer of buta-l, 3-diene and acrylonitrile. It is formed as follows



Properties and Uses
It is insulator in nature and is used for making conveyor belts and printing rollers.

Molecular Mass of Polymers
The growth of the polymer chain depends upon the availability of the monomers in the reaction. Thus, the polymer sample contains chain of varying lengths and hence, its molecular mass is always expressed as an average molecular mass.

Number-Average Molecular Mass M_n
If N_1 molecules have molecular mass M_1 each, N_2 molecules have molecular mass M_2 each, N_3 molecules have molecular mass M_3 each and so on,
then, $M_n = \Sigma N_i M_i / \Sigma N_i$
It is determined by osmotic pressure method.

Mass-Average Molecular Mass M_w :-

If N_1 molecules have molecular mass M_1 each, N_2 molecules have molecular mass M_2 each, N_3 molecules have molecular mass M_3 each and so on,
Then, $M_w = \sum N_i M_i^2 / \sum N_i M_i$

It is determined by light scattering and ultracentrifugation method.

Polydispersity Index
It is the ratio of the mass average molecular mass to the number average molecular mass

PDI = M_w / M_n
For natural polymers, PDI is usually equal to one which means that they are monodisperse. In other words, such polymers are more homogeneous. On the contrary, synthetic polymers generally have PDI > 1 which means that they are less homogeneous.

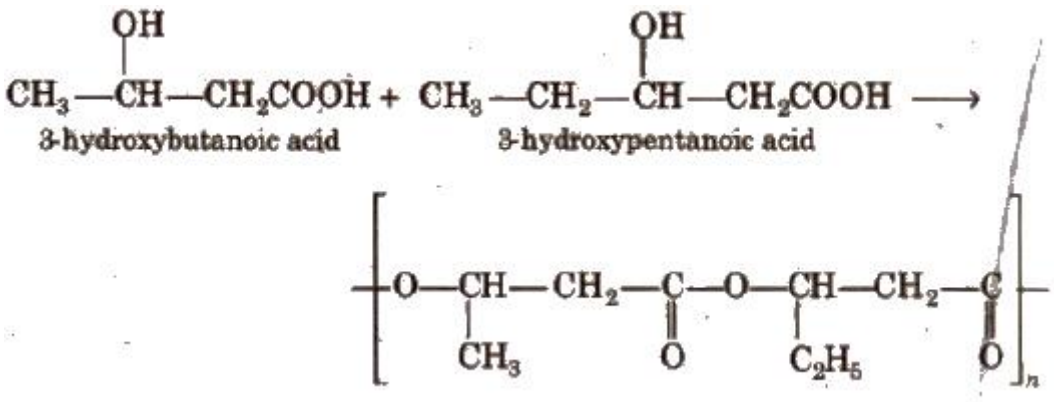
Biopolymers and Biodegradable Polymers :
Synthetic polymers are mostly non-biodegradable i.e., it is very difficult to dispose off the polymeric waste, e.g., polythene bags.

Nature has provided us a variety of polymers which can be produced by the biological systems in plants and animals. These are called biopolymers, e.g., polysaccharides, proteins, nucleic acids, etc. In the biological system, these polymers decompose or hydrolyse in the Presence of different enzymes. This means that they are biodegradable.

Aliphatic polyesters are the common examples of biodegradable Polymers.

1. **PHBV:-**

It is a copolymer of 3-hydroxybutanoic acid and 3-hydroxypentanoic acid.



2. Nylon-2-Nylon-6 :
It is an alternating polyamide copolymer of glycine (H_2N-CH_2-COOH) and amino caproic acid [$H_2N(CH_2)_5COOH$] and is biodegradable.

01. which of the following is a polyamide?
(A) TEFLON (B) NYLON-6,6 (C) TERYLENE (D) BAKELITE
Answer: Option B

02. _____ resins are produced by the condensation polymerisation of formaldehyde with urea or melamine.
(A) Epoxy (B) Amino (C) Alkyd (D) Phenolic
Answer: Option B

03. Nylon-6, 10 which is used for bristles making is superior to nylon 6, 6 due to its lower water absorption capacity, is a/an
(A) Polyester (B) Polyamide (C) Polyisoprene (D) Polystyrene
Answer: Option B

04. Which of the following natural bio polymers are formed as a result of polymerisation of amino-acids?
(A) Starch (B) Cellulose (C) Proteins (D) Nucleic acids
Answer: Option C

05. Natural rubber is which type of polymer?
(A) addition polymer (B) condensation polymer (C) coordination polymer (D) None of these
Answer: A

06. Trans form of polyisoprene is
(A)BUNA-S (B) GUTTA PERCHA (C) SYNTHETIC RUBBER (D) HYDROCHLORIDE RUBBER
Answer: B

07. Which of the following is an inorganic polymer?
(A) Teflon (B) Perspex (C) Silicones (D) Bakelite
Answer: Option C

08. Buna-S is a _____ material.
(A) Fibrous (B) Plastic (C) Resinous (D) Rubbery
Answer: Option D

09. which of the following is not a polyamide?
(A) PROTEIN (B) GLYPTAL (C) NYLON-6,6 (D) NYLON_6
Answer: B

10. Which of the following has the weakest intermolecular forces?
(A) Polyisoprene (B) Nylon-66 (C) Polystyrene (D) Bakelite
Answer: Option A

11. Which of the following statements is not true.
(A)Natural rubber is trans isoprene (B) vulcanisation makes rubber hard due to cross linking
(C)Buna-S is addition copolymer (D) Natural rubber is cis-1,4 poly isoprene
Answer: A

12. Natural rubber is which type of polymer
(A) Condensation polymer (B) addition polymer (C) coordination polymer (D) None of these
Answer:B

13. Transistor parts and refrigerator components are normally made of
(A) Polystyrene (B) Polyester (C) High density polythene (D) Polyurethane
Answer: Option A

14. Condensation polymerisation of _____ produces Bakelite.
(A) Propylene (B) Phenol & formaldehyde (C) Phenol & acetaldehyde (D) Urea & formaldehyde
Answer: Option B

15. Caprolactum is used for the preperation of
(A) NYLON-6,6 (B) NYLON-6,10 (C) NYLON-6 (D) NYLON-2,NYLON-6
Answer: C

16. The polymer used in orthopedic devices and controlled drug release is
(A) ORION (B) PHBV (C) PTFE (D) SBR
Answer: B

17. Which of the following is not correct regarding terelene

(A) Step growth polymer (B) synthetic fibre
(C) it is thermosetting plastic (D) also called decron
Answer: C

18. The commercial name of poly acrylonitrile is_____ .
(A) DECRAN (B) ORION(acrilon) (C) BEKALITE (D) PVC
Answer: B

19. The polymer containing strong inter molecular H-bonding and crystalline nature is
(A) Natural rubber (B) Nylon-6,6 (C) Teflon (D) polystyrene
Answer: B

20. Thermoplastic resins usually
(A) Remain hard as long as they are hot (B) Cannot be reclaimed from waste
(C) Permanent setting resins (D) Less brittle than thermosetting resins
Answer: Option D

21. Main constituent of cotton fibre is
(A) Lignin (B) Cellulose (C) Starch (D) Gelatine
Answer: Option B

22. Glyptal used in the manufacture of paints & lacquers is a _____ polymer.
(A) Polyamide (B) Polystyrene (C) Polyester (D) Polyacrylonitrile
Answer: Option C

23. Which polymers occures naturally
(A) Starch & Nylon (B) Starch & Cullulose (C) Proteins & Nylon (D) Proteins & PVC
Answer: B

24. The main use of butadiene is
(A) As a plasticiser for unsaturated polyester (B) In the manufacture of synthetic rubber
(C) As an anti-skimming agent in paint (D) None of these
Answer: Option B

25. Teflon is
(A) Phenol formaldehyde (B) An inorganic polymer
(C) Polytetrafluroethylene (D) a monomer
Answer: C

26. Which of the following is a polymer containing nitrogen
(A) BAKELITE (B) TERYLENE (C) Nylon (D) Polyvenyl chloride
Answer: C

27. Neoprene which is used for making shoe heels & belts is superior to natural rubber in its stability to aerial oxidation and resistance to oils & other solvents. The monomer used for making neoprene is
(A) Chloroethane (B) Isoprene (C)Chloroprene (D) None of these
Answer: Option C

28. Zeigler process
(A) Produces high density polythene (B) Uses no catalyst
(C) Produces low density polythene (D) Employs very high pressure
Answer: Option A

29. which of the following is a bio degradable polymer

(A) PVC (B) Polythene (C) Nylon-6 (D) Cellulose
Answer: D

30. Which of the following polymers belong to the class of formaldehyde resin?
(A) Melamine resins (B) Teflon (C) Dacron (D) None of these
Answer: Option A

31. Nylon-6 is manufactured from
(A) Adipic acid and Hexamethylenediamine (B) Maleic anhydride and Hexamethylenediamine
(C) Sebacic acid and Hexamethylenediamine (D) Caprolactum
Answer: Option D

32. Identify the odd one
(A) Neoprene (B) terylene (C) Polythene (D) PVC
Answer:B

33. Which of the following is not a thermoplastic material?
(A) Epoxy polymer (B) PVC (C) Polystyrene (D) Polythene
Answer: Option A

34. Which of the following types of polymers has the strongest inter particle forces?
(A) Elastomers (B) Fibres (C) Thermoplastics (D) Thermosetting polymers
Answer: Option D

35. BAKELITE is a product of the reaction between
(A) Formaldehyde and NaOH (B) Urea and Aniline (C) Phenol and Methanal (D)Phenol and Chloroform
Answer:C

36. Addition polymerisation is not involved in the manufacture of
(A) Low density polythene (B) Poly vinyl chloride
(C) Polystyrene (D) Polyhexamethylene adipamide
Answer: Option D

37. _____ polymer is used for making unbreakable crockery.
(A) Thermoplastic (B) Melamine (C) Addition (D) None of these
Answer: Option B

38. The synthetic fibres produced from _____ are known as rayon.
(A) Lignin (B) Cellulose (C) Polyamides (D) Ethylene glycol
Answer: Option B

39. Pick out the wrong statement regarding the solubility characteristics of high polymers.
(A) Greater the degree of cross-linking in the polymer, lesser is its solubility
(B) Polymers having more aliphatic character are more soluble in aliphatic solvents, while those polymers having more aromatic character are more soluble in aromatic solvents
(C) Swelling tendency or solubility of polymers in a particular solvent decreases with increase in molecular weight of the solvent
(D) High molecular weight polymers on dissolving gives solution of very low viscosity
Answer: Option D

40.Polymer used in bullet proof material or plexi glass is
(A) Poly styrene (B) Poly ethyl acrylate (C) Poly methyl methacrylate (D) Poly acrylonitrile
Answer: C

41. The organic acid monomer in nylon-66 is
(A) Sebacic acid (B) Terephthalic acid (C) Adipic acid (D) Benzoic acid
Answer: Option C

42. Which of the following polymers is used for making a non stick coating on frying pans?
(A) Bakelite (B) Teflon (C) Perspex (D) PVC
Answer: Option B

43. Buna-S is also known as
(A) Teflon (B) PTFE (C) SBR (D) Polycrylates
Answer: Option C

44. Flexible plastic pipes are made of
(A) High density polyethylene (HDPE) (B) Low density polyethylene (LDPE)
(C) Polypropylene (D) Unsaturated polyester
Answer: Option B

45. Buna-N is also called
(A) Butyl rubber (B) Nitrile rubber (C) Neoprene (D) Thiokol
Answer: Option B

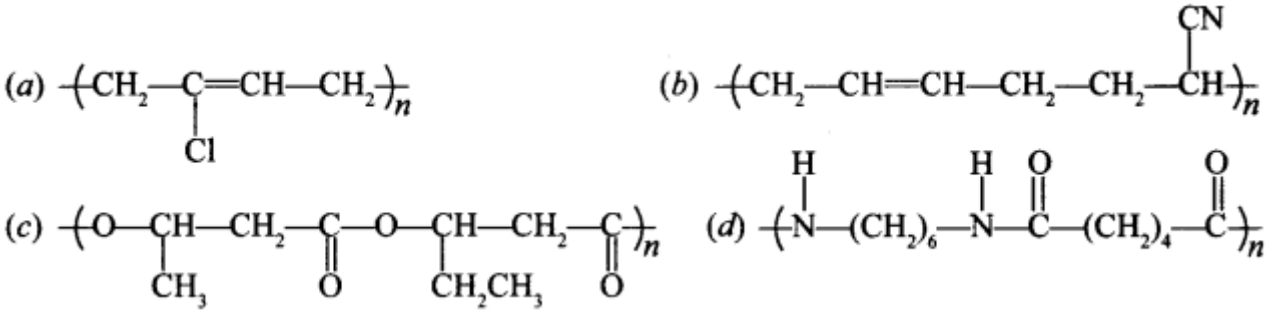
46. Whichof the following statements is correct regarding the drawbacks of raw rubber.
(A)it is plastic in nature (B)it has little durability
(C) it has large water absorption capacity (D)all the above
Answer: D

47. Ebonite is
(A) highly vulcanised rubber (B) Natural rubber (C) Synthetic rubber (D) Polropene
Answer: A

48. The monomer of polystyrene is
(a)C2H â€"CH=CH2 (b)CH2=CHCl (c)C6H5CH=CH2 (d)CH2=CHâ€"CHO
Answer: c

49. PHBV has _____ type of linkages
(a) Amide
(b) Ester
(c) Diene
(d) Nitrile
Answer: b

50.Which of the following polymer is biodegradable? [NCERT Exemplar]



Answer: c

51. Match the polymer of column I with correct monomer of column II.

Column I	Column II
(a) High density polythene	(i) Isoprene
(b) Neoprene	(ii) Tetrafluoro- ethene
(c) Natural rubber	(iii) Chloroprene
(d) Teflon	(iv) Acrylonitrile
(e) Acrilan	(v) Ethene

Answer:
(a) (v)
(b) (in)
(c) (i)
(d) (ii)
(e) (iv)

52. Match the polymers given in Column I with their chemical names given in Column II.

Column I	Column II
(a) Nylon 6	(i) Polyvinyl chloride
(b) PVC	(ii) Polyacrylonitrile
(c) Acrilan	(iii) Polycaprolactum
(d) Natural rubber	(iv) Low density polythene
(e) LDP	(v) cis-polyisoprene

Answer:
(a) (iii)
(b) (i)
(c) (ii)
(d) (v)
(e) (iv)

53. Match the polymers given in Column I with their commercial names given in Column II.

Column I	Column II
(a) Polyester of glycol and phthalic acid	(i) Novolac
(b) Copolymer of 1, 3-butadiene and styrene	(ii) Glyptal
(c) Phenol and formaldehyde resin	(iii) Buna-S
(d) Polyester of glycol and terephthalic acid	(iv) Buna-N
(e) Copolymer of 1, 3-butadiene and acrylonitrile	(v) Dacron

Answer:
(a) (ii)
(b) (iii)
(c) (i)
(d) (v)
(e) (iv)

54. Match the polymers given in Column I with their main applications given in Column II.

Column I	Column II
(a) Bakelite	(i) Unbreakable crockery
(b) Low density polythene	(ii) Non-stick cook-wares
(c) Melamine- formaldehyde resin	(iii) Packaging material for shock absorbance
(d) Nylon 6	(iv) Electrical switches
(e) Polytetrafluo- roethane	(v) Squeeze bottles
(f) Polystyrene	(v) Tyre, cords

Answer:
(a) (iv)
(b) (v)
(c) (i)

(d)(vi)
(e) (ii)
(f) (iii)

55. Match the polymers given in Column I with the preferred mode of polymerisation followed by their monomers.

Column I	Column II
(a) Nylon-6,6	(i) Free radical Polymeriaation
(b) PVC	(ii) Ziegler-Natta polymerisation or coordination polymerisation
(c) HDP	(iii) Anionic polymerisation
	(iv) Condensation polymerisation

Answer:
Explaination:
(a) (iv)
(b) (i)
(c) (ii)

56. Match List-I and List-II and select the correct answer using the codes below the lists:

List-I		List-II
(i)	PMMA	1.Polyester
(ii)	Terylene	2.PTEF
(iii)	Teflon	3.Synthetic rubber
(iv)	Neoprene	4.Polyacrylate

	(i)	(ii)	(iii)	(iv)
(a)	2	3	1	4
(b)	2	3	4	1
(c)	4	1	3	2
(d)	4	1	2	3

Answer: d

57. Match the polymers in List 1 with its use in List 2

List-I (Polymer)	List-(II) (use)
1)Urea formaldehyde resin	a) Unbreakable cups
2)Nylon-6	b) TV cabinets
3)Polystyrene	c) Oil Seals
4)GRN	d) Tyre cords

1	2	3	4
A)	a	d	b	c
B)	a	b	d	c
C)	a	b	c	d
D)	d	c	b	a

Answer: A

58.

List-I	List-II
1) PHBV	a) Synthetic fibres
2) Teflon	b) Orthopaedic devices
3) Nylon-66	c) For making laminates
4) Bakelite	d) non-sticking utensils
e) Automobile tyres	

1	2	3	4
A)	b	d	a	c
B)	a	c	b	d

C) c b a d
D) d a c b
Answer: A

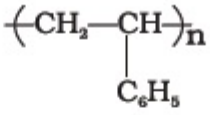
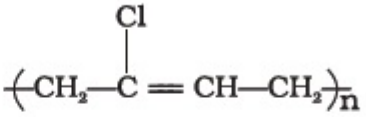
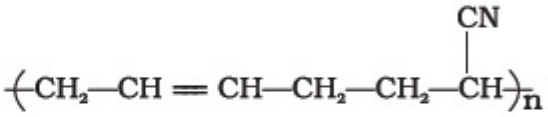
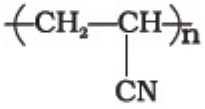
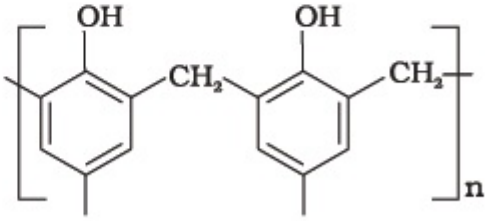
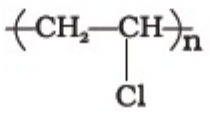
59.

List-I	List-II
1. Natural Polymer	a. PVC
2. Synthetic Polymer	b. Nylon-66
3. Condensation Polymer	c. Silk
4. Addition Polymer	d. Polyethylene

	1	2	3	4
A)	b	c	d	a
B)	c	b	a	d
C)	c	d	b	a
D)	c	b	d	a

Answer: C

60. Match the polymers given in column I with their repeating units given in Column II

Column I	Column II
(i) Acrilan	(a) 
(ii) Polystyrene	(b) 
(iii) Neoprene	(c) 
(iv) Novolac	(d) 
(v) Buna—N	(e) 
	(f) 

Answer :
(i) (d)
(ii) (a)
(iii) (b)
(iv) (e)
(v) (c)

Note: In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices. (Q.61 to Q.70)
(A) Assertion and reason both are correct and reason is correct explanation of assertion.

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Reason: The carbo cation resulting from styrene is more stable than that resulting from propylene.
Answer: A

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Reason: Mechanical and aesthetic properties of cellulose can be improved by acetylation.
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Answer: true

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* * *

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Chapter -
POLYMERS

01. which of the following is a polyamide?
(A) TEFLON (B) NYLON-6,6 (C) TERYLENE (D) BAKELITE
Answer: Option B

02. _____ resins are produced by the condensation polymerisation of formaldehyde with
urea or melamine.
(A) Epoxy (B) Amino (C) Alkyd (D) Phenolic
Answer: Option B

03. Nylon-6, 10 which is used for bristles making is superior to nylon 6, 6 due to its lower water
absorption capacity, is a/an
(A) Polyester (B) Polyamide (C) Polyisoprene (D) Polystyrene
Answer: Option B

04. Which of the following natural bio polymers are formed as a result of polymerisation of amino-acids?
(A) Starch (B) Cellulose (C) Proteins (D) Nucleic acids
Answer: Option C

05. Natural rubber is which type of polymer?
(A) addition polymer (B) condensation polymer (C) coordination polymer (D) None of these
Answer: A

06. Trans form of polyisoprene is
(A)BUNA-S (B) GUTTA PERCHA (C) SYNTHETIC RUBBER (D) HYDROCHLORIDE RUBBER
Answer: B

07. Which of the following is an inorganic polymer?
(A) Teflon (B) Perspex (C) Silicones (D) Bakelite
Answer: Option C

08. Buna-S is a _____ material.
(A) Fibrous (B) Plastic (C) Resinous (D) Rubbery
Answer: Option D

09. which of the following is not a polyamide?
(A) PROTEIN (B) GLYPTAL (C) NYLON-6,6 (D) NYLON_6
Answer: B

10. Which of the following has the weakest intermolecular forces?
(A) Polyisoprene (B) Nylon-66 (C) Polystyrene (D) Bakelite
Answer: Option A

11. Which of the following statements is not true.
(A)Natural rubber is trans isoprene (B) vulcanisation makes rubber hard due to cross linking
(C)Buna-S is addition copolymer (D) Natural rubber is cis-1,4 poly isoprene
Answer: A

12. Natural rubber is which type of polymer
(A) Condensation polymer (B) addition polymer (C) coordination polymer (D) None of these
Answer:B

13. Transistor parts and refrigerator components are normally made of
(A) Polystyrene (B) Polyester (C) High density polythene (D) Polyurethane
Answer: Option A

14. Condensation polymerisation of _____ produces Bakelite.
(A) Propylene (B) Phenol & formaldehyde (C) Phenol & acetaldehyde (D) Urea & formaldehyde
Answer: Option B

15. Caprolactum is used for the preperation of
(A) NYLON-6,6 (B) NYLON-6,10 (C) NYLON-6 (D) NYLON-2,NYLON-6
Answer: C

16. The polymer used in orthopedic devices and controlled drug release is
(A) ORION (B) PHBV (C) PTFE (D) SBR
Answer: B

17. Which of the following is not correct regarding terelene
(A) Step growth polymer (B) synthetic fibre
(C) it is thermosetting plastic (D) also called decron
Answer: C

18. The commercial name of poly acrylonitrile is_____ .
(A) DECRAN (B) ORION(acrilon) (C) BEKALITE (D) PVC
Answer: B

19. The polymer containing strong inter molecular H-bonding and crystalline nature is
(A) Natural rubber (B) Nylon-6,6 (C) Teflon (D) polystyrene
Answer: B

20. Thermoplastic resins usually

(A) Remain hard as long as they are hot (B) Cannot be reclaimed from waste
(C) Permanent setting resins (D) Less brittle than thermosetting resins
Answer: Option D

21. Main constituent of cotton fibre is
(A) Lignin (B) Cellulose (C) Starch (D) Gelatine
Answer: Option B

22. Glyptal used in the manufacture of paints & lacquers is a _____ polymer.
(A) Polyamide (B) Polystyrene (C) Polyester (D) Polyacrylonitrile
Answer: Option C

23. Which polymers occures naturally
(A) Starch & Nylon (B) Starch & Cullulose (C) Proteins & Nylon (D) Proteins & PVC
Answer: B

24. The main use of butadiene is
(A) As a plasticiser for unsaturated polyester (B) In the manufacture of synthetic rubber
(C) As an anti-skimming agent in paint (D) None of these
Answer: Option B

25. Teflon is
(A) Phenol formaldehyde (B) An inorganic polymer
(C) Polytetrafluroethylene (D) a monomer
Answer: C

26. Which of the following is a polymer containing nitrogen
(A) BAKELITE (B) TERYLENE (C) Nylon (D) Polyvenyl chloride
Answer: C

27. Neoprene which is used for making shoe heels & belts is superior to natural rubber in its stability to aerial oxidation and resistance to oils & other solvents. The monomer used for making neoprene is
(A) Chloroethane (B) Isoprene (C)Chloroprene (D) None of these
Answer: Option C

28. Zeigler process
(A) Produces high density polythene (B) Uses no catalyst
(C) Produces low density polythene (D) Employs very high pressure
Answer: Option A

29. which of the following is a bio degradable polymer
(A) PVC (B) Polythene (C) Nylon-6 (D) Cellulose
Answer: D

30. Which of the following polymers belong to the class of formaldehyde resin?

(A) Melamine resins (B) Teflon (C) Dacron (D) None of these
Answer: Option A

31. Nylon-6 is manufactured from
(A) Adipic acid and Hexamethylenediamine (B) Maleic anhydride and Hexamethylenediamine
(C) Sebacic acid and Hexamethylenediamine (D) Caprolactum
Answer: Option D

32. Identify the odd one
(A) Neoprene (B) terylene (C) Polythene (D) PVC
Answer:B

33. Which of the following is not a thermoplastic material?
(A) Epoxy polymer (B) PVC (C) Polystyrene (D) Polythene
Answer: Option A

34. Which of the following types of polymers has the strongest inter particle forces?
(A) Elastomers (B) Fibres (C) Thermoplastics (D) Thermosetting polymers
Answer: Option D

35. BAKELITE is a product of the reaction between
(A) Formaldehyde and NaOH (B) Urea and Aniline (C) Phenol and Methanal (D)Phenol and Chloroform
Answer:C

36. Addition polymerisation is not involved in the manufacture of
(A) Low density polythene (B) Poly vinyl chloride
(C) Polystyrene (D) Polyhexamethylene adipamide
Answer: Option D

37. _____ polymer is used for making unbreakable crockery.
(A) Thermoplastic (B) Melamine (C) Addition (D) None of these
Answer: Option B

38. The synthetic fibres produced from _____ are known as rayon.
(A) Lignin (B) Cellulose (C) Polyamides (D) Ethylene glycol
Answer: Option B

39. Pick out the wrong statement regarding the solubility characteristics of high polymers.
(A) Greater the degree of cross-linking in the polymer, lesser is its solubility
(B) Polymers having more aliphatic character are more soluble in aliphatic solvents, while those
polymers having more aromatic character are more soluble in aromatic solvents
(C) Swelling tendency or solubility of polymers in a particular solvent decreases with increase in

molecular weight of the solvent
(D) High molecular weight polymers on dissolving gives solution of very low viscosity
Answer: Option D

40.Polymer used in bullet proof material or plexi glass is
(A) Poly styrene (B) Poly ethyl acrylate (C) Poly methyl methacrylate (D) Poly acrylonitrile
Answer: C

41. The organic acid monomer in nylon-66 is
(A) Sebacic acid (B) Terephthalic acid (C) Adipic acid (D) Benzoic acid
Answer: Option C

42. Which of the following polymers is used for making a non stick coating on frying pans?
(A) Bakelite (B) Teflon (C) Perspex (D) PVC
Answer: Option B

43. Buna-S is also known as
(A) Teflon (B) PTFE (C) SBR (D) Polycrylates
Answer: Option C

44. Flexible plastic pipes are made of
(A) High density polyethylene (HDPE) (B) Low density polyethylene (LDPE)
(C) Polypropylene (D) Unsaturated polyester
Answer: Option B

45. Buna-N is also called
(A) Butyl rubber (B) Nitrile rubber (C) Neoprene (D) Thiokol
Answer: Option B

46. Whichof the following statements is correct regarding the drawbacks of raw rubber.
(A)it is plastic in nature (B)it has little durability
(C) it has large water absorption capacity (D)all the above
Answer: D

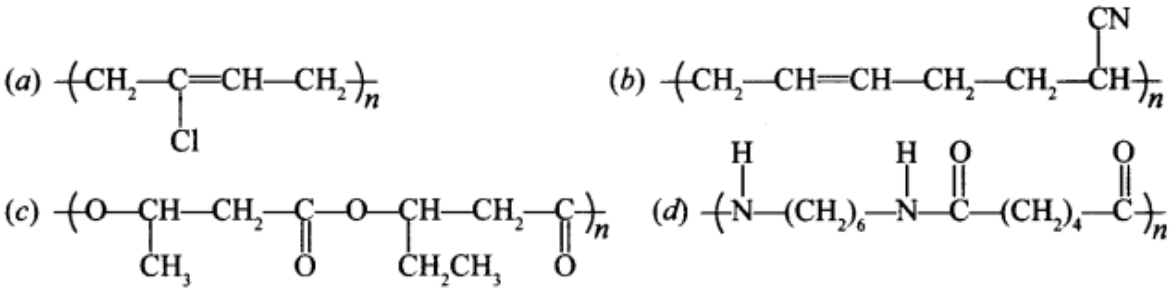
47. Ebonite is
(A) highly vulcanised rubber (B) Natural rubber (C) Synthetic rubber (D) Polropene
Answer: A

48. The monomer of polystyrene is
(a)C2H â€”CH=CH2 (b)CH2=CHCl (c)C6H5CH=CH2 (d)CH2=CHâ€”CHO
Answer: c

49. PHBV has _____ type of linkages
(a) Amide
(b) Ester

(c) Diene
(d) Nitrile
Answer: b

50.Which of the following polymer is biodegradable? [NCERT Exemplar]



Answer: c

51. Match the polymer of column I with correct monomer of column II.

Column I	Column II
(a) High density polythene	(i) Isoprene
(b) Neoprene	(ii) Tetrafluoro- ethene
(c) Natural rubber	(iii) Chloroprene
(d) Teflon	(iv) Acrylonitrile
(e) Acrilan	(v) Ethene

Answer:
(a) (v)
(b) (in)
(c) (i)
(d) (ii)
(e) (iv)

52. Match the polymers given in Column I with their chemical names given in Column II.

Column I	Column II
(a) Nylon 6	(i) Polyvinyl chloride
(b) PVC	(ii) Polyacrylonitrile
(c) Acrilan	(iii) Polycaprolactum
(d) Natural rubber	(iv) Low density polythene
(e) LDP	(v) cis-polyisoprene

Answer:
(a) (iii)
(b) (i)
(c) (ii)
(d) (v)
(e) (iv)

53. Match the polymers given in Column I with their commercial names given in Column II.

Column I	Column II

(a) Polyester of glycol and phthalic acid	(i) Novolac
(b) Copolymer of 1, 3-butadiene and styrene	(ii) Glyptal
(c) Phenol and formaldehyde resin	(iii) Buna-S
(d) Polyester of glycol and terephthalic acid	(iv) Buna-N
(e) Copolymer of 1, 3-butadiene and acrylonitrile	(v) Dacron

Answer:
(a) (ii)
(b) (iii)
(c) (i)
(d) (v)
(e) (iv)

54. Match the polymers given in Column I with their main applications given in Column II.

Column I	Column II
(a) Bakelite	(i) Unbreakable crockery
(b) Low density polythene	(ii) Non-stick cook-wares
(c) Melamine- formaldehyde resin	(iii) Packaging material for shock absorbance
(d) Nylon 6	(iv) Electrical switches
(e) Polytetrafluo- roethane	(v) Squeeze bottles
(f) Polystyrene	(v) Tyre, cords

Answer:
(a) (iv)
(b) (v)
(c) (i)
(d)(vi)
(e) (ii)
(f) (iii)

55. Match the polymers given in Column I with the preferred mode of polymerisation followed by their monomers.

Column I	Column II
(a) Nylon-6,6	(i) Free radical Polymeriaation
(b) PVC	(ii) Ziegler-Natta polymerisation or coordination polymerisation
(c) HDP	(iii) Anionic polymerisation
	(iv) Condensation polymerisation

Answer:
Explaination:
(a) (iv)
(b) (i)
(c) (ii)

56. Match List-I and List-II and select the correct answer using the codes below the lists:

	List-I		**List-II**
(i)	PMMA	(1)	Polyester
(ii)	Terylene	(2)	PTEF

(iii)	Teflon	(3)	Synthetic Rubber
(iv)	Neoprene	(4)	Polyacrylate

	(i)	(ii)	(iii)	(iv)
(a)	2	3	1	4
(b)	2	3	4	1
©	4	1	3	2
(d)	4	1	2	3

Answer: d

57. Match the polymers in List 1 with its use in List 2

List-I (Polymer)	List-(II) (use)
1)Urea formaldehyde resin	a) Unbreakable cups
2)Nylon-6	b) TV cabinets
3)Polystyrene	c) Oil Seals
4)GRN	d) Tyre cords

	1	2	3	4
A)	a	d	b	c
B)	a	b	d	c
C)	a	b	c	d
D)	d	c	b	a

Answer: A

58.

List-I	List-II
1) PHBV	a) Synthetic fibres
2) Teflon	b) Orthopaedic devices
3) Nylon-66	c) For making laminates
4) Bakelite	d) non-sticking utensils
	e) Automobile tyres

	1	2	3	4
A)	b	d	a	c
B)	a	c	b	d
C)	c	b	a	d
D)	d	a	c	b

Answer: A

59.

List-I	List-II
1. Natural Polymer	a. PVC
2. Synthetic Polymer	b. Nylon-66
3. Condensation Polymer	c. Silk
4. Addition Polymer	d. Polyethylene

1	2	3	4

A) b c d a
B) c b a d
C) c d b a
D) c b d a
Answer: C

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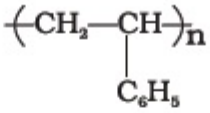
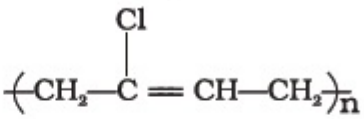
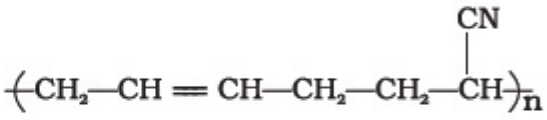
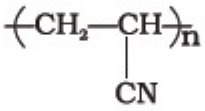
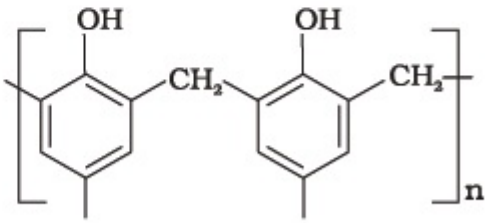
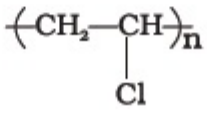
(i)	Acrilan	(a)	
(ii)	Polystyrene	(b)	
(iii)	Neoprene	(c)	
(iv)	Novolac	(d)	
(v)	Buna—N	(e)	
		(f)	

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