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.

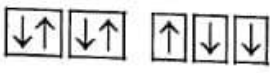
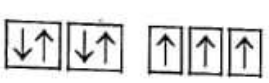
162. Nitrogen atom has 3 unpaired electrons in its ground state. It can be explained by

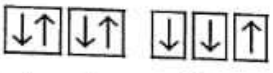
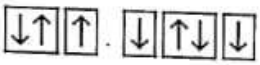
1) Auf - bau principle 2) Paulis principle
3) Hund's rule 4) None of these

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}

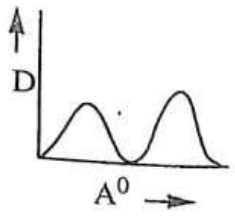
18. The set of quantum numbers 'n' and 'l' possible for the orbital shown in the radial probability curve are

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

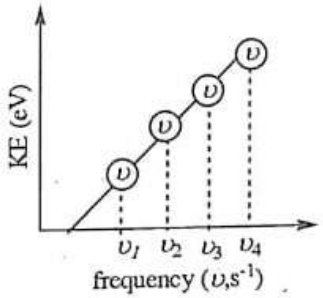
3) 8×10^{16} Hz 4) 1.2×10^{15} Hz

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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OBJECTIVE TYPE QUESTIONS

1. The first attempt to classify elements was made by
   (a) Mendeleef (b) New Lands
   (c) Lother Meyer (d) Dobereiner

2. The Law of triadsis applicable to
   (a) Chlorine, bromine and iodine
   (b) Hydrogen, oxygen and nitrogen
   (c) Sodium, neon and calcium
   (d) None of the Above

3. Lothar Meyer drew a graph showing the relation between..
   (a) Atomic Number, Atomic Weight
   (b) Atomic Number, Atomic Size
   (c) Atomic Weight, Atomic Size
   (d) Atomic Weight, Atomic volume

4. Law of octaves was enunciated by
   (a) J.W. Dobereiner (b) JAR Newlands
   (c) Lothar Meyer (d) D.I. Mendeleef

5. As we go from left to right in period 2 the gram atomic volume of the elements
   (a) Will change indefinitely
   (b) Increases at constant rate
   (c) Remains unchanged
   (d) First decreases and then Increases

6. Which of the following elements has the highest atomic volume?
   (a) Ha (b) Fr
   (c) Rn (d) Ra

7. The elements which occupy peaks in the atomic volume curve are
   (a) Cu, Ag, Au (b) Na, K, Rb
   (c) Cl, Br, I (d) Fe, Co, Ni

8. The telluric helix was given by
   (a) De chan courtois (b) Newlands
   (c) L. Meyer (d) Mendeleef

9. Which of the following atoms possesses the smallest volume?
   (a) S (b) Si
   (c) He (d) P

10. Law of Octaves applies to
   (a) B, C, N (b) As, K, Ca
   (c) Be, Mg, Ca (d) None of the above

11. The most important active step in the development of periodic table was taken by
    (a) Mendeleef (b) Dalton
    (c) Avogadro (d) Cavendish

12. Periodic law as enunciated by
    (a) Proust (b) Newlands
    (c) Dobereiner (d) Mendeleef

13. Which among the following elements was not present in Mendeleef's periodic table?
    (a) Rb (b) U
    (c) Ce (d) Fr

14. Increasing order of atomic weights was violated in case of?
    (a) H, He (b) Te, I
    (c) Cl, Ar (d) Fe, Co

15. D.I.Mendeleef arranged elements in a table according to
    (a) Increasing atomic weight
    (b) Increasing atomic number
    (c) Decreasing atomic weight
    (d) Alphabetical order

16. One of the most important defeats of the Mendeleef's periodic table is
    (a) Position of hydrogen (b) Position of K
    (c) Position of isotopes (d) Position of Co

17. The group that was added to the periodic table after Mendeleef is
    (a) VIII (b) I
    (c) O (d) IX

18. Select the correct sequence of the decreasing order of atomic weight of the following elements.
    (a) Fe > Ce > Ni (d) Ni > Co > Fe
    (c) Co > Ni > Fe (d) Co > Fe > Ni

19. Which of these does not reflect the periodicity of the elements?
    (a) Bonding behaviour (b) Electronegativity
    (c) Ionisation energy (d) Neutron/Proton ratio

20. As we go along period from left to right the atomic volume
    (a) First increases then decreases
    (b) First decreases then increases
    (c) Increases regularly
    (d) Decreases regularly

21. The elements in the upper right portion of the Mendeleef's periodic table are
    (a) Metals (b) Non – Metals
    (c) Metalloids (d) transitional metals

22. Electron configurations of elements X and Z are $1s^2 2s^2 2p^6 3s^2 3p^5$ and $1s^2 2s^2 2p^5$ respectively, The position of element X with respect to Z in the periodic table will be
    (a) Just below Z (b) Just above 2
    (c) To the left of Z (d) To the right of Z

23. What is the atomic number of the element which is in the same group of the P.T, as the element with atomic number 15?
    (a) 5 (b) 7
    (c) 11 (d) 17

24. Lanthanides are 14 elements in which the differentiating electron enters
    (a) s- subshell (b) p-subshell
    (c) d-subshell (d) f-subshell

25. The element with atomic number 19 will most likely combine chemically with the element whose atomic number is
    (a) 17 (b) 18
    (c) 21 (d) 20

26. The elements having 7 valence electrons are known as
    (a) Inert elements (b) lanthanide series
    (c) Trans uranic elements (d) halogens

27. Elements with similar chemical properties
    (a) Occur only within the same period
    (b) Have identical mass
    (c) Have identical no. of neutrons
    (d) Have the same no. of electrons in the outershell

28. Characteristics of the elements depend upon
    (a) Physical state (b) Electronic configuration
    (c) Atomic weights (d) density

29. Elements whose atoms have the general electronic configuration
    $4f^1$ - $^{14}5s^2 5p^6 5d^1 6s^2$_____are called as
    (a) Transition elements (b) Ianthanides
    (c) Inert gases (d) Representative elements

30. Lanthanum is a member of
    (a) S-block (b) p-block
    (c) d-block (d) f-block

31. The best reason to account for the general tendency of atomic sizes to decrease as the atomic numbers increase within a period of the periodic table is the fact that
    (a) Outer electrons repel inner electrons
    (b) Closer packing among the nuclear particles
    (c) The number of neutrons increases
    (d) The increasing nuclear charge exerts greater attractions on the outer electrons

32. The hydration energy of Mg^{2+} is larger than that of
    (a) Al^{3+} (b) Na^{+}
    (c) Be^{2+} (d) Mg^{3+}

33. Of the following the element whose atoms are larger than magnesium atoms is the element of atomic number
    (a) 10 (b) 11 (c) 3 (d)17

34. In which of the following are different iodine species placed in the correct order of decreasing size?
    (a) $I^{-} > I > I^{+}$ (b)$I^{+} > I^{-} > I$
    (c) $I > I^{+} > I^{-}$ (d)$I^{-} > I^{+} > I$

35. A property which gradually intervenes down a group in the periodic table is
    (a) Ionisation energy (b) Electron affinity
    (c) Size of the atom (d) Electronegativety

36. Which of the following has the smallest size?
    (a) N^{-3} (b) O^{-2}
    (c) Mg^{+2} (d) Na^{+}

37. Similar chemical proportion of Zx and Hf may be attrillumed to
    (a) Their similar electronic configuration
    (b) Identical ionisation energies
    (c) Similar atomic radio
    (d) Inert pair effect

38. Eka silicon is now known as
    (a) Scandium (b) Gallium (c) Germanium (d) Boron

39. The plot of $\sqrt{v}$ vs Z is
    (a) Straight line (b) Exponential Curve (c) Hyperbolic (d) Curve with –ve slope

40. The starting element and last element in the largest period in modern periodic table are
    (a) Rb and Xe (b) Cs and I (c) Cs and Rn (d) Fr and Kr

41. Which of the following pairs has both members from the same group of the periodic table
    (a) Mg-Ba (b) Mg-Na (c) Mg-Cu (d) Mg-Cl

42. Among s-block metals and transition metals, which are more metallic?
    (a) S-block metals (b) Transition metals
    (c) Both are equally metallic (d) Cannot be predicted

43. Atomic radii of fluorine and neon in angstrom units are respectively
    (a) 0.72, 1.62 (b) 0.72, 0.72 (c) 1.2, 1.2 (d) 1.62, 0.72

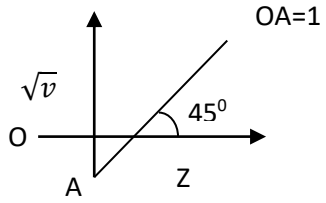
44. The size of the following species increases in the order
    (a) $Mg^{2+} < Na^{+} < F^{-} < Al^{3+}$ (b) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$
    (b) $Na^{+} < F^{-} < Al^{3+} < Mg^{2+}$ (d) $Na^{+} < Al^{3+} < Mg^{2+} < F^{-}$

45. Mercury is the only metal which is liquid at 0^0C, This is due to its
    (a) Very high ionisation energy and weak metallic bond
    (b) Low ionisation potential and high electro negativity
    (c) High atomic mass and small size
    (d) High electro negativity and low ionisation potential

46. Elements with high electronegitivity are generally
    (a) Good reductants (b) Hard Solids (c) Good Oxidants (d) Soft Solids

47. The formula of a metallic carbonate is MCO_3. The formula of that metallic perchlorate is
    (a) $MClO_4$ (b) M_2ClO_4 (c) M_3ClO_4 (d) $M(ClO_4)_2$

48. The frequency of the characteristics X ray of Kα line of metal target 'M' is 2500 cm^{-1} and the graph between $\sqrt{v}$ Vs 'z' is as follows, then atomic number of M is



    (a) 49 (b) 50 (c) 51 (d) 25

49. If Aufbau rule is not followed, K-19 will be placed in
    (a) s-Block (b) p-Block (c) d-Block (d) f-Block

50. Which of the following is an alloy of non-transition elements
    (a) Elektron (b) Brass (c) Bronze (d) German Silver

51. Variable valency is exhibited by
    (a) Normal elements (b) Metallic elements
    (c) Transitional elements (d) Non-metallic elements

52. Pair of ions with similar ionic radii
    (a) Li^+, Mg^{2+} (b) Li^+, Na^+ (c) Mg^2, Ca^{2+} (d)Mg^2, K^+

53. Which of the following show amphoteric behaviour
    (a) $Zn(OH)_2$ (b) BeO (c) Al_2O_3 (d) All of the above

MATCH THE FOLLOWING

54. Match the following lists and select the correct answer

(A)$1s^2$, $2s^22p^6$,$3s^23p^6$,$4s^1$	(1) d-block elements
(B) $1s^2$,$2s^22p^6$,$3s^23p^6$	(2) Halogen
(C) $1s^2$,$2s^22p^6$,$3s^23p^63d^6$,$4s^2$	(3) Alkali metal
(D) $1s^2$,$2s^2$,$2p^5$	(4) Noble gas

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

55. Match the following

Column – I	Column – II
(A) 7^{th} period	(1) Transition elements
(B) IIIB group	(2) Inner transition elements
(C) 1A	(3) Hydrogen
(D) VIIA	(4) Halogens

56. Match the following

Column – I	Column – II
(A) Sulphur atom	(1) Presence of unpaired electron(s) in p-orbital(s)
(B) Bromine atom	(2) All electron in *S* – orbital are period
(C) Rubidium atom	(3) MF_2 type compound formation (F = Fluorine) (M-given atom)
(D) Iron atom	(4) Magnetic moment $\sqrt{3}$ B.M

SELECT THE CORRECT STATEMENT

57. Select Correct statement:
    (a) Across a transition series (from Cr to Cu), there is only a small decrease in atomic radius from one element to another due to very small increase in effective nuclear charge
    (b) The rate of decrease in the size across the lanthanide series is less than the across the first transition series
    (c) Both are correct statements
    (d) None of the statement is correct.

58. Which of the following statement is correct
    (a) Metallic radius refer to metals only and is greater than covalent radius
    (b) Metallic radius refer to metals only and is smaller than covalent radius
    (c) Generally covalent radius refers to non-metals as well as metals in bonded state (covalent bond).
    (d) Atomic radii of noble gases are expressed as van der Waal's radii which are smaller than metallic radii.

59. Which of the following is the correct statement
    (a) All the actinide elements are radioactive
    (b) Alkali and Alkaline earth metals are s-block elements
    (c) Chalcogens and halogens are p-block elements
    (d) The first member of the lanthanide series is lanthanium

60. Which of the following statements related to the modern periodic table is/are correct
    (a) The p-block has 6 vertical columns, i.e., groups
    (b) The d-block has 8 vertical columns
    (c) Each block contains a number of columns equal to the number of electrons that can occupy that sub shell
    (d) The block indicates value of azimuthal quantum number *(l)* for the last subshell that received electrons in building up the electronic configuration.

61. Which of the following is/are correct for Mendeleev's periodic table
    (a) There are nine groups including zero groups
    (b) All the groups are divided into two subgroups
    (c) The group number indicates the valency of the elements on oxygen scale
    (d) The group number indicates the oxidation number of the elements

62. Incorrect statement is
    (a) Fluorine has the highest electron affinity
    (b) Greater the nuclear charge, greater is the electron affinity
    (c) The electron affinity of Nitrogen is positive (energy is absorbed)
    (d) Chlorine has highest electron affinity

63. The statement that is false for the long form of the periodic table is
    (a) It reflects the sequence of filling the electrons in the order of sub energy level s, p, d and f
    (b) It helps to predict the stable valency states of the elements
    (c) It reflects trends in physical and chemical properties of the elements
    (d) It helps to predict the relative iconicity of the bond between any two elements
64. Which of the following statement is incorrect?
    (a) Oxide of aluminium, (Al_2O_2), and arsenic (AsO_3) are amphoteric
    (b) Oxide of chlorine (Cl_2O_3) is less acidic than oxide of nitrogen (N_2O_5).
    (c) Oxide of carbon (CO_2) is more acidic than oxide of silica (SiO_2)
    (d) The correct increasing order of basic character of various oxides is $H_2O<CuO<MgO<CaO$

65. Which of the following statements are correct?
    (a) F is the most electronegative and Cs is the most electropositive available element
    (b) The electro negativity of halogens decreases from F to I
    (c) The electron affinity of Cl is higher than that of F thought their electro negativity is the reverse
    (d) The electron affinity of noble gases low.

66. Pick out the correct statement(s) of the following
    (a) All atoms with an odd atomic number are necessarily paramagnetic.
    (b) All atoms with an even atomic number are necessarily diamagnetic
    (c) All atoms with an even atomic number may be paramagnetic and in some cases diamagnetic.
    (d) Atoms with an odd atomic number may be paramagnetic and in some cases diamagnetic.

67. Which of the following statement(s) is(are) correct?
    (a) Vander walls radius of iodine is more than its covalent radius
    (b) All isoelectronic ions belong to the same period of the periodic table
    (c) IE_1 of N is higher than that of O while IE_2 of O is higher than that of N
    (d) The electron gain enthalpy of N is positive while that of P is negative

68. Which of the following statements are correct
    (a) Cl has highest EA among all the known elements
    (b) Both Br and Hg are liquids at room temperature
    (c) Cl is most electronegative element in periodic table

(d) Atomic radius of noble gases is lowest in their respective periods

69. Amongst the following statements, which is (are) correct?
    (a) Electro negativity of sulphur is greater than that of oxygen.
    (b) Electron affinity of oxygen is smaller than that of sulphur
    (c) Electron affinity of fluorine is most negative
    (d) Electron affinity of Chlorine is most negative

70. Select correct order
    (a) $M^{2+}(g) < M^{4+}(g)$ (size)
    (b) $M^{4+}(g) < M^{3+}(g)$(ionization energy)
    (b) $M(g) < M^{+}(g)$(electron affinity)
    (d) $M^{3+}(g) < M^{2+}(g)$(Z/e ratio)

71. Identify the incorrect statement
    (a) Filling of 5d orbital begins with Hf in 5^{th} period
    (b) Filling of 5d orbital begins with La in 5^{th} period
    (c) Filling of 4f orbital begins with La in 6^{th} period
    (d) All of the above.

72. Choose the incorrect statement(s)
    (a) The maximum positive oxidation state shown by any elements is equal to the total number of electrons (s and p) in valence shell
    (b) The maximum oxidation state shown by elements in a group is also known as group oxidation number
    (c) Group oxidation number is the most common or most stable oxidation state for a particular element
    (d) All the elements in a group form some compounds in which they exhibit their group oxidation number.

FILL IN THE BLANKS-INTEGER TYPE QUESTIONS

73. All the four blocks and four types of elements are present in the _____period

74. The maximum number of valency electrons possible for atoms in the second period of periodic table is_____

75. Maximum number of elements are present in IIB group, Among them number of d-block elements is (are) _____

76. Liquid non-metallic elements is present in ___ period of long form of periodic table

77. The number of groups which contains only gaseous elements is _____

78. The number of elements present in each short period are _____

79. How many elements are possible for 1^{st} period of periodic table if azimuthal quantum number can have integral values from 0, 1, 2…(n+1)?

80. An element 'Y' belong to 1^{st} period and 1^{st} group in Modern Periodic Table. Then atomic number of 'Y' is_____

81. Number of possible ionisation potential values for carbon is _____

82. The IP_1, IP_2, IP_3, IP_4 and IP_5 of an element are 7.1, 14. 3, 103.4, 66.8, 162.2 ev respectively. The elements belongs to _____ group

83. The period with maximum electronegativity belongs to_____

84. The group in which all the elements are gases is _____

85. Nucleus of an element contains 9 protons. Its highest valency would be _____

86. Which electron gain enthalpy of elements is generally exothermic _____

QUESTIONS FROM PREVIOUS QUESTION PAPERS :

1. In which of the following options the order of arrangement does not agree with the variation of property indicated against it? [NEET – 2016]
   a. B < C < N < O (increasing first ionisation enthalpy)
   b. I < Br < Cl (increasing electron gain enthalpy)
   c. Li < Na < K < Rb (increasing metallic radius
   d. $Al^{3+} < Mg^2 < Na^+ < F^-$ (increasing ionic size)
2. Which one of the following order is correct for the bond dissociation enthalpy of halogen molecules? [NEET – 2016]
   a. $Cl_2 > Br_2 > F_2 > I_2$
   b. $Br_2 > I_2 > F_2 > Cl_2$
   c. $F_2 > Cl_2 > Br_2 > I_2$
   d. $I_2 > Br_2 > Cl_2 > F_2$
3. The species Ar, K^+ and Ca^{2+} contain the same number of electrons, In which order do their radii increase? [NEET – 2015]
   a. $Ar < K^+ < Ca^{2+}$
   b. $Ca^{2+} < Ar < K^+$
   c. $Ca^2 < K^+ < Ar$
   d. $K^+ < Ar < Ca^{2-}$
4. Metals are usually not found as nitrates in their ores"
   Out of the following two (a and b) reasons which is/are true for the above observation?
   I. Metal nitrates are highly unstable.
   II. Metal nitrates are highly soluble in water. [NEET – 2015]
   a. I and II are true
   b. I and II are false
   c. I is false but II is true
   d. I is false but II is true
5. Which of the following orders of ionic raddi is correctly represented? [NEEET – 2014]
   a. $H^- > H > H+$
   b. $Na^+ > F^- > O^{2-}$
   c. $F^- > O^{2-} > Na^+$

d. $Al^{3+} > Mg^{2+} > N^{3-}$

6. Be^{2+} is isoelectronic with which of the following ions? [NEET – 2014]
   a. H^+
   b. Li^+
   c. Na^+
   d. Mg^{2+}
7. The group having isoelectronic species is: [JEE – MAIN 2017]
   a. O^{2-}, F^-, Na^+, Mg^{2+}
   b. O^-, F^-, Na, Mg^+
   c. C. O^{2-}, F^-, Na, Mg^{2+}
   d. d. O^-, F^-, Na^+, Mg^{2+}
8. Which of the following atoms has the highest first ionization energy? [JEE – MAIN 2016]
   a. Sc
   b. Rb
   c. Na
   d. K
9. The increasing order of the ionic radii of the given isoelectronic species is ? [AIEEE – 2012]
   a. K^+, S^{2-}, Ca^2, Cl^-
   b. Cl^-, Ca^{2+}, K^+, S^{2-}
   c. S^{2-}, Cl^-, Ca^{2+}, K^+
   d. Ca^{2+}, K^+, Cl^-, S^{2-}
10. Which of the following order is correct for the first ionization energies of their elements? [EAMCET – 2009]
    a. B < Be < N < O
    b. Be < B < N < O
    c. B < Be < O < N
    d. B < O < Be < N
11. The atomic number of elements A, B, C and D are Z-1, Z, Z+1 and Z+2 respectively. If B is a noble gas choose the correct answer from the following elements [EAMCET – 2008]
    a. A has highest electron affinity
    b. C exist in +2 oxidation state
    c. D is an alkaline earth metal

    (1) a and b (2) b and c (3) a and c (4) a, b and c

12. An oxide of an element is a gas and dissolve in water to give an acidic solution. The element belongs to [EAMCET – 2007]
    a. II group b. IV group c. VII group d. Zero group

13. In the long form of the periodic table, the valence shell electronic configuration of $5s^2$, $5p^4$ corresponds to the element present in [JEE Main-2015]
    a. Group 16 and period 6
    b. Group 17 and period 5

c. Group 16 and period 5
d. Group 17 and period 6

14. Choose the incorrect formula out of the four compounds for an element X below. [JEE Main – 2015]
    a. X_2, Cl_3
    b. X_2, O_3
    c. $X_2(SO_4)_3$
    d. XPO_4
15. Which of the following series correctly represents relations between the elements from X to Y? [JEE Main – 2014]

    X→Y
    a. $_3Li \rightarrow _{19}K$ Ionization enthalpy increases
    b. $_9F \rightarrow _{35}Br$ Electron gain enthalpy with negative sign increases
    c. $_6C \rightarrow _{32}Ge$ Atomic radii increases
    d. $_{18}Ar \rightarrow _{54}Xe$ Noble character increases

16. Which one of the following has largest ionic radius ? [JEE Mains – 2014]

    (a) Li^+ (b) $O^{2-}{}_2$ (c) B^{3+} (d) F^-

17. Similarity in chemical properties of the atoms of elements in a group of the periodic table is most closely related to [JEE Mains – 2014]
    a. Atomic numbers
    b. Atomic masses
    c. Number of principal energy levels
    d. Number of valence electrons

CHAPTER 4

STATES OF MATTER

VERY SHORT ANSWER QUESTIONS:

1. Write different molecular forces experienced by molecules of a gas?
2. State Boyle's law?
3. State Charle's law?
4. State Avagadro's law?
5. What are isotherms?
6. What are isobars?
7. What are STP conditions?
8. What is gram molar volume?
9. What is an ideal gas?
10. Why the gas constant 'R' is called universal gas constant?
11. Why ideal gas equation is called equation of state?
12. Give the values of R in different units?
13. Which of the gases diffuse faster among H_2, O_2 and CH_4?
14. What is meant by effusion?
15. Write any two applications of Graham's law?
16. What is aqueous tension?
17. What is partial pressure? How is it related to total pressure?
18. Give an equation to calculate the kinetic energy of gas molecules?
19. What is Boltzmann's constant? Write its value.
20. What is RMS speed?
21. What is average speed?
22. What is most probable speed?
23. Give the ratio of the most probable speed, average speed an RMS speed.
24. Write Vanderwaal's equation.
25. What is compressibility factor?
26. What is Boyle's temperature?
27. What is critical temperature? Give its value for CO_2.
28. Define vapour pressure of a liquid.
29. What is surface tension? Give its units.
30. What is coefficient of viscosity? Give its units.
31. What is effect of temperature on the surface tension of liquids?
32. How viscosity of liquids does vary with temperature?

NUMERICALS:

1. A gas of volume 1000mL is kept in a vessel at a pressure of 10^3 Pascal's at 27^0C. If the pressure is to 10^5 Pascal's at the same temperature, find the volume occupied by the gas.
2. The volume of a given mass of gas is 100mL at 100^0C. If the pressure is kept constant, at what temperature the volume of gas will become 200mL.
3. At 25^0C and 760mm of Hg pressure a gas occupies 600mL volume. What will be its pressure at a height, when temperature is 10^0C and volume if gas is 640mL?
4. Calculate total pressure of a mixture of 8gm of oxygen, 14gms of nitrogen present in 11.2 lit vessel at 0^0C
5. Find the relative rates of diffusion of hydrogen and oxygen gases under the similar conditions of temperature and pressure
6. The total pressure of mixture of N_2 and O_2 gases is 600mm of Hg. If the molecules ratio of N_2:O_2 is 3:1, find the partial pressure of N_2 in the mixture
7. The density of a gas is 2.5gm/L at 127^0C and 1atm pressure. Find the molecular weight of the gas
8. When 2gms of a gas A is introduced into an evacuated flask kept at 25^0C, the pressure if found to be 1atm. If 3gms of another gas B is added to the same flask the total pressure then becomes 1.5atm. Assuming ideal behavior, find the ratio of molecular weights of A and B
9. Calculate the kinetic energy of 2 moles of nitrogen gas at 27^0C in calories
10. Calculate the kinetic energy of 4gms of CH_4 at -73^0C in SI units
11. Calculate the RMS, average speed and most probable speed of CO_2 gas at 27^0C

FILL IN THE BLANKS:

1. The force of attraction or repulsion between interacting particles (atoms/ molecules) are known as _____
2. The attractive forces between interactive particles are known as _____
3. The force of attraction between two temporary dipoles is known as _____
4. The weak electrostatic force of attraction between hydrogen atom of one polar molecule and more electro negative atom of another polar covalent molecule is known as _____
5. When thermal energy of molecules predominates intermolecular attractive forces then the state of matter changes from _____ to _____
6. The lowest hypothetical temperature at which gases are supposed to occupy zero volume is known as _____

7. The line obtained when a graph is drawn between pressure versus temperature at constant volume is known as _____
8. The standard temperature and standard pressure values are _____ and _____ respectively.
9. The gram molar volume of any gas at STP is _____ liters'
10. The ratio between gas constant and Avagadro's number is known as _____
11. The speed possessed by maximum number of gas molecules is known as _____
12. Vanderwaal's equation or one mole of CO_2 gas at high pressure and low temperature will be _____
13. The value of compressibility factor (Z) for an ideal gas is _____
14. The force acting per unit length perpendicular to the line drawn on surface of a liquid is known as _____
15. The regular gradation in velocity in passing from one layer to next layer is known as _____

TRUE/ FALSE:

1. Gases show ideal behavior at high temperature and low pressure. (True/ False)
2. The poisonous gases can be diluted by the process of diffusion. (True/ False)
3. All gas molecules move with same speed. (True/ False)
4. The motion of gases molecules are affected by gravitational forces. (True/ False)
5. The pressure of the gas is due to collision between the molecules. (True/ False)
6. The pressure of the gas is due to collision of molecules with the walls of the container. (True/ False)
7. The intermolecular forces present in inert gases are dispersion forces. (True/ False)
8. The value of R depends on temperature, volume and number of gas molecules. (True/ False)
9. The value of R depends on units of measurement. (True/ False)
10. The gas constant per molecule is called Boltzmann's constant. (True/ False)
11. The average kinetic energy of a gas at a particular temperature depends upon nature of the gas. (True/ False)
12. Volume of a gas increases by four times when Temperature is doubled and Pressure is reduced to half. (True/ False)
13. According to Avagadro's law equal volumes of different gases under similar conditions consist of equal number of molecules. (True/ False)
14. According to Avagadro's law equal volumes of different gases under similar conditions consist of equal number of atoms. (True/ False)
15. The rate of diffusion of a gas at constant temperature and pressure is inversely proportional to its density. (True/ False)

16. RMS speed depends on density at a given temperature. (True/ False)
17. As molecular weight of gas increases the RMS velocity of gas also increases. (True/ False)
18. Average speed doesn't depend upon pressure of the gas. (True/ False)
19. On increasing the temperature the most probable speed decreases. (True/ False)
20. On increasing the temperature the fraction of molecules possessing most probable speed increases. (True/ False)
21. According to kinetic molecular theory of gases there are no inter molecular attractions. (True/ False)
22. On heating a liquid its surface tension decreases. (True/ False)
23. With raise in temperature of a liquid its viscosity increases. (True/ False)

MATCH THE FOLLOWING:

LIST 1	LIST 2
A. Boyle's law	1. $P_i=P_T*X_i$
B. Charle's law	2. $V_1=n_1(\frac{V_2}{n_2})$
C. Avagadro's law	3. $V_1=p_2(\frac{V_2}{p_1})$
D. Dalton's law	4. $V_t= V_o\ (1 + \frac{t}{273})$

A. (__) B. (__) C. (__) D.(__)

LIST 1	LIST 2
A. $R=8.314\ JK^{-1}mol^{-1}$	1. STP conditions
B. V=22.711 lit	2. SI unit
C. P=1bar, T=273.15K	3. CGS unit
D. $R=0.8314\ X\ 10^8\ ergK^{-1}mol^{-1}$	4. Gram molar volume

A. (__) B. (__) C. (__) D.(__)

LIST 1	LIST 2
A. Effusion	1. Collision of molecules with the walls
B. Pressure of gas	2. $r\ \alpha\frac{1}{\sqrt{d}}$
C. Absolute zero temperature	3. $-273\ ^0C$
D. Velocity of gas molecules	4. Vector quantity

A. (__) B. (__) C. (__) D.(__)

LIST 1	LIST 2
A. Spontaneous mixing of gases	1. Unaffected by gravity

B. Movement of gas molecules	2. Diffusion
C. Gas with highest rate of diffusion	3. H_2
D. Gas with lowest rate of diffusion	4. UF_6

A. (__) B. (__) C. (__) D.(__)

LIST 1	LIST 2
A. Average speed	1. $\sqrt{\frac{2RT}{M}}$
B. Most probable speed	2. $\sqrt{\frac{3RT}{M}}$
C. RMS speed	3. $\sqrt{\frac{8RT}{\prod M}}$
D. Kinetic energy of gases	4. $\frac{3}{2}$ nRT

A. (__) B. (__) C. (__) D.(__)

LIST 1	LIST 2
A. $\sqrt{\frac{U_1^2+U_2^2+\cdots+U_n^2}{n}}$	1. Most probable speed
B. $\frac{U_1+U_2+\cdots+U_n}{n}$	2. RMS speed
C. $\sqrt{\frac{2P}{d}}$	3. Average speed
D. $\frac{3}{2}$ KT	4. Average kinetic energy

A. (__) B. (__) C. (__) D.(__)

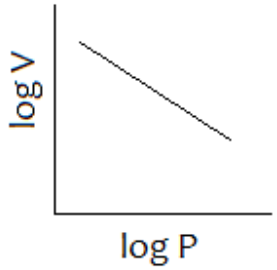
LIST 1	LIST 2
A. Ion- dipole forces	1. HCl in benzene
B. Dipole- dipole forces	2. NaCl in aqeous solution
C. Dipole- induced dipole forces	3. SO_2 gas
D. Dispersion forces	4. N_2 gas

MULTIPLE CHOICE QUESTIONS:

1. Which of the following is not included in Vanderwaal's forces?
   a. Dipole-dipole forces
   b. Dipole- induced dipole forces
   c. Ion -dipole forces
   d. Induced dipole- induced dipole forces
2. The Dipole-dipole interaction energy between stationary polar molecules is proportional to (r= distance between two molecules)

a. $\frac{1}{r}$
b. $\frac{1}{r^2}$
c. $\frac{1}{r^3}$
d. $\frac{1}{r^6}$

3. The energy of hydrogen bond varies between
   a. 1-10 KJ/mole
   b. 10-100 KJ/mole
   c. 100-1000 KJ/mole
   d. >500 KJ/mole
4. The Boyle's law can be expressed graphically as

a.


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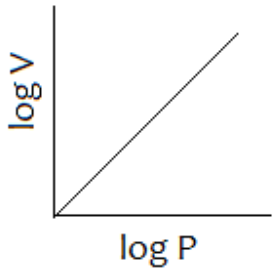

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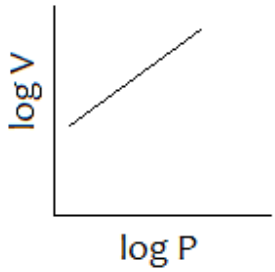
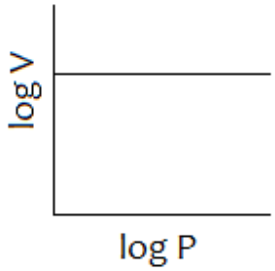




d.

5. Four one litre flasks are separately filled with gases H_2, O_2, F_2, and CH_4. Under the similar conditions the ratio of molecules in these flasks respectively are
   a. 2:2:2:5
   b. 1:1:1:1
   c. 1:2:3:4
   d. 1:2:2:1
6. Dalton's law of partial pressure is applicable to
   a. $NO+O_2$
   b. H_2+Cl_2
   c. NH_3+HCl
   d. CO_2+O_2
7. To which of the following mixtures Dalton's law is not applicable to
   a. N_2+O_2
   b. CO_2+O_2
   c. $CO+O_2$
   d. $He+ O_2$
8. Among the following gaseous elements with atomic numbers given below, which will exhibit greater rate of diffusion
   a. Z=7
   b. Z=8
   c. Z=10
   d. Z=17
9. Density of neon gas will be highest at
   a. STP
   b. 0^0C, 2atm
   c. 273^0C, 1atm
   d. 273^0C, 2atm
10. The density of CO_2 gas at 27^0C, 1atm is _____ gm/L
    a. 1.78
    b. 152
    c. 196

d. 1.20

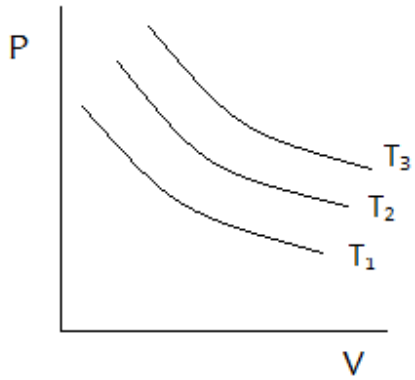
11. The kinetic energy of n moles of an ideal gas is given by expression
    a. $\frac{3}{2}$ RT
    b. $\frac{3}{2}$ nRT
    c. $\frac{2}{3}$ RT
    d. $\frac{2}{3}$ nRT
12. A real gas deviates most from ideal gas behavior at
    a. High T, low P
    b. High T, High P
    c. low T, high P
    d. low T, low P
13. The gas which cannot be liquefied is
    a. H_2
    b. He
    c. Ar
    d. Ideal gas
14. Hydration of different ions is an example of
    a. Dipole- dipole forces
    b. Dipole- induced dipole forces
    c. ion- dipole forces
    d. Dispersion forces
15. The volume of a given mass of a gas is 100 ml at 100^0C. If the pressure is kept constant at what temperature will the sample have the volume of 200mL
    a. 50^0C
    b. 473^0C
    c. 200^0C
    d. 400^0C
16. How much pressure should be increased in order the decrease the volume of a gas b 5% at constant temperature?
    a. 25%
    b. 10%
    c. 4.26%
    d. 5.26%
17. What will be pressure required to compress 500dm^3 of air at 1bar to 200dm^3 at 30^0C?
    a. 2 bar
    b. 2.5 bar
    c. 0.4 bar

d. 5 bar

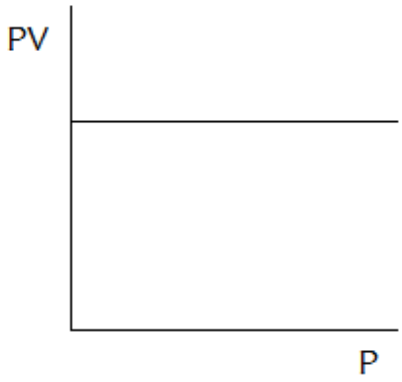
18. x moles of N_2 gas at STP conditions occupy a volume of 10 lit then the volume of 2x moles if CH_4 and 1.5atm is
    a. 20 lit
    b. 26.6 bar
    c. 5 bar
    d. 16 bar
19. Equal masses CH_4,H_2 are mixed in an empty container at 25^0C, the fraction of total pressure exerted by H_2 is
    a. $\frac{1}{9}$
    b. $\frac{1}{2}$
    c. $\frac{8}{9}$
    d. $\frac{3}{4}$
20. An open flask has He gas at 2atm and 327^0C. The flask is heated to 527^0C at the same pressure. The fraction of original gas remaining in the flask
    a. $\frac{3}{4}$
    b. $\frac{1}{4}$
    c. $\frac{1}{2}$
    d. $\frac{2}{5}$
21. If 2g of He gas diffuses from a porous plate in 4 minutes. How many grams of CH_4 would diffuse through the same plate in same time under similar conditions?
    a. 4 g
    b. 16 g
    c. 8 g
    d. 2 g
22. SO_2 molecule is twice as heavy as O_2 molecule. Hence at 25^0C the ratio of average kinetic energy of SO_2 and O_2 is
    a. 2:1
    b. 1:2
    c. 1:1
    d. 4:1
23. The critical temperature of a substance is defined as
    a. The temperature above which the substance decomposes
    b. The temperature above which a substance can exist only as a gas
    c. Melting point of substance

d. Boiling point of substance

24. The internal resistance to flow in liquid is called
    a. Fluidity
    b. Specific resistance
    c. Viscosity
    d. Surface tension
25. From the graph the correct order of temperature is

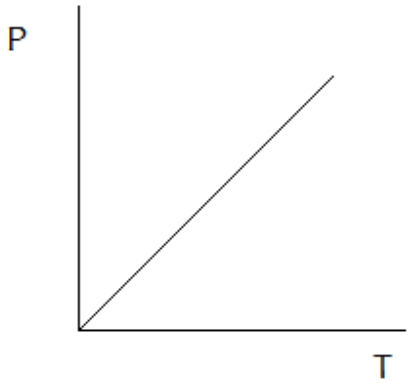


    a. $T_1<T_2<T_3$
    b. $T_1=T_2=T_3$
    c. $T_1>T_2>T_3$
    d. $T_1<T_2>T_3$
26. Which of the following indicates isotherms?

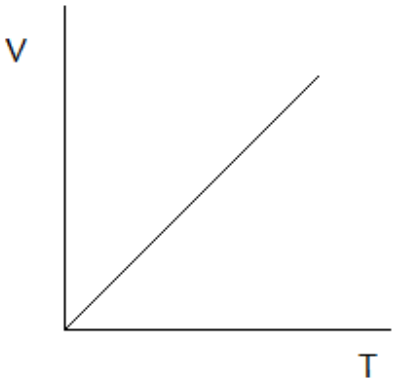


    a.

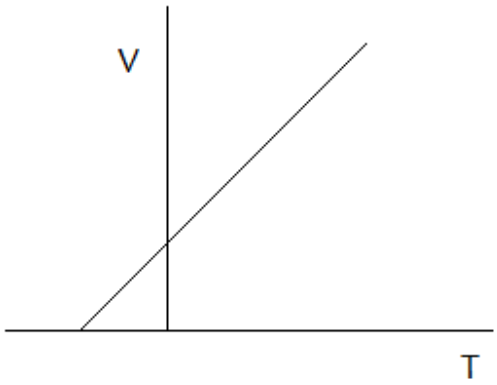
b.



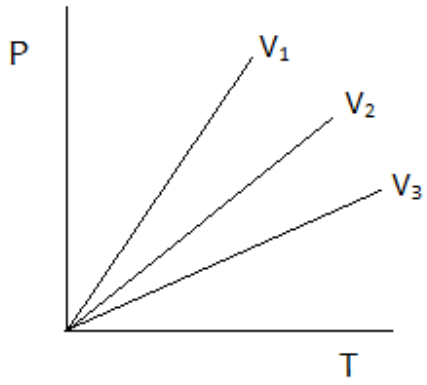
c.



d.



27. Under isochoric conditions the graph between pressure and temperature are shown below. Then the volume of gases are related as



a. $V_1=V_2=V_3$
b. $V_1>V_2>V_3$
c. $V_1<V_2<V_3$
d. $V_2<V_1<V_3$

28. With increase of temperature
    a. Surface tension and viscosity increases
    b. Surface tension and viscosity decreases
    c. Surface tension and viscosity both decreases
    d. Surface tension and viscosity both increases
29. The molecular weight of two ideal gases A and B are 100, 200. One gram of A occupies V lit at STP. What is the volume occupied by one gram of B at STP in lit?
    a. $\frac{V}{2}$
    b. 2V
    c. 4V
    d. V
30. If 6g of a gas occupies a volume of 2.8 lit at STP, the molecular weight of gas is (in grams)
    a. 24
    b. 16
    c. 32
    d. 48
31. Find the volume of gas mixture with 2 moles of He, a mole of H_2 and 2 moles of SO_2 at 1atm and 273^0C in lit
    a. 112
    b. 280
    c. 224
    d. 448
32. Which of the following gases occupy least volume at STP

a. 20g of H_2
b. 30g of He
c. 40g of CH_4
d. 128g of SO_2

33. Select the correct statement about vapour pressure of a given liquid at room temperature
    a. It increases with increase in pressure of liquid vapour
    b. It decreases with decrease of surface area of the liquid
    c. It does not depend on the nature of liquid
    d. It remains constant
34. Which of the following statements are correct
    a. Evaporation is a spontaneous process occurring at all temperatures
    b. During evaporation vapour pressure of liquid equal to atmospheric pressure
    c. Boiling is a spontaneous process and can occur at boiling point
    d. Vapour pressure of liquid increases with increase in surface area of liquid
35. The temperature at which methane molecules have the same average kinetic energy as that of oxygen molecule at 27^0C
    a. 327^0C
    b. 27^0C
    c. 927^0C
    d. 627^0C

11. GROUP 14 ELEMENETS

Introduction to Group -14

This group includes the following elements:

Carbon (C), Silicon (Si), Germanium (Ge), Tin (Sn) and Lead (Sb).

General Electronic configuration of this group: ns^2np^2

Carbon is the 17th most abundant element by mass in the earth's crust. In elemental state it is as coal, graphite and diamond. Its combination with other elements provides an astonishing array of materials ranging from living tissues to drugs and plastics. Organic chemistry is devoted to carbon containing compounds.

Silicon is the second most abundant element on the earth's crust and is present in nature in the form of silica and silicates. Silicon is very important component of ceramics, glass and cement. Ultrapure form of germanium and silicon are used to make transistors and semiconductor devices.

Physical Properties of group 14

1. **Atomic size**: If we compare its size with group 13, then size of group 13 elements is bigger than group 14. As group 14 elements are smaller due to increased nuclear charge.

   Along group: As we move down size increases, as each time a new shell is being added.

2. **Ionization energy**:Ionization of group 14 is higher than group 13, due to its small size.

   Along group: Ionization energy decreases because size increases. If we look at the trend of ionization energy we see certain abnormality:

   C > Si > Ge >Sn <Pb

   As we move from tin to lead,the ionization energy increase due to poor shielding effect of 4f orbital in Lead .

3. **Melting point and Boiling point**

   The boiling point of group 14 is higher than group 13. As they form covalent bonds because of their small size.

   As we move down the group melting and boiling point decreases due to increase in size, bonds formed are not so strong.

   C > Si > Ge >Sn >Pb

4 .**Metallic character**

- The tendency to lose electrons depends upon ionization energy or, we can say that less is the ionization energy, more is the metallic character.
- If we compare for group 13 and group 14, we see that group 13 is more metallic due to big size and low ionization energy.
- Down the group metallic character increases as size increase and ionization energy decreases. Therefore, the order is:
- C Si Ge Sn Pb

Carbon silicon germanium Tin lead

(non metals) (metalloid) (metals)

5. **Oxidation states**

This group can show oxidation states +4 and +2.

Carbon: Due to high ionization energy, sharing is preferred in case of it. So, oxidation state shown is 4.

- Silicon,Ge, Tin : They commonly show +4.
- Lead: Show +2 due to inert pair effect.
- All these elements have special property that is,if they are present in +2 oxidation state they act as reducing agents and in +4 they acts as oxidising agent.

Example: Tin (Sn^{+2}) act as reducing agent, But if Sn is in +4 then it act as oxidizing agent .

Chemical properties of group 14

The reactivity goes on increasing down the group due to decrease in ionization energy.

1. **Reactivity towards oxygen** : They form two types of oxides

- Monoxides (MO)Dioxides (MO_2)
- Monoxides : CO,SiO,GeO,SnO,PbO
- Dioxides: CO_2,SiO_2,GeO_2,SnO_2,PbO_2
- In monooxides CO is Neutral, SiO is not so stable, GeO is weakly acidic, SnO and PbO are Amphoteric.
- In dioxides $CO_2$and SiO_2 are acidic, $GeO_2$is Amphoteric and SnO_2 and PbO_2 are weakly basic.

Out of them, CO Is strongest reducing agent because it has ability to accept oxygen and form stable oxide that is carbon dioxide.The solid form of carbon dioxide is called **dry ice** and the commercial name of dry ice is **drikold**. Out of them PbO_2 is strongest oxidizing agent .

2. **Reaction with halogens**: These group elements form tetra halides and di halides.

The halides formed are:

CCl_4 $SiCl_4$ $GeCl_4$ $SnCl_4$ $PbCl_4$
$SnCl_2$ $PbCl_2$

Tetra halides are tetrahedral in shape.Stability of halides of formula EX_2, increases down the group due to inert pair effect. Out of all dihalides $SnCl_2$ and $PbCl_2$ are stable.CCl_4 can't be hydrolyzed easily whereas $SiCl_4$ can be easily hydrolysed. The reason being, that carbon has no d orbital.As a result carbon cant increase its oxidation number beyond 4.On the otherhand Si has d orbitals therefore, it can easily form bond with water by extending its octet. That is the reason it can be hydrolyzed.

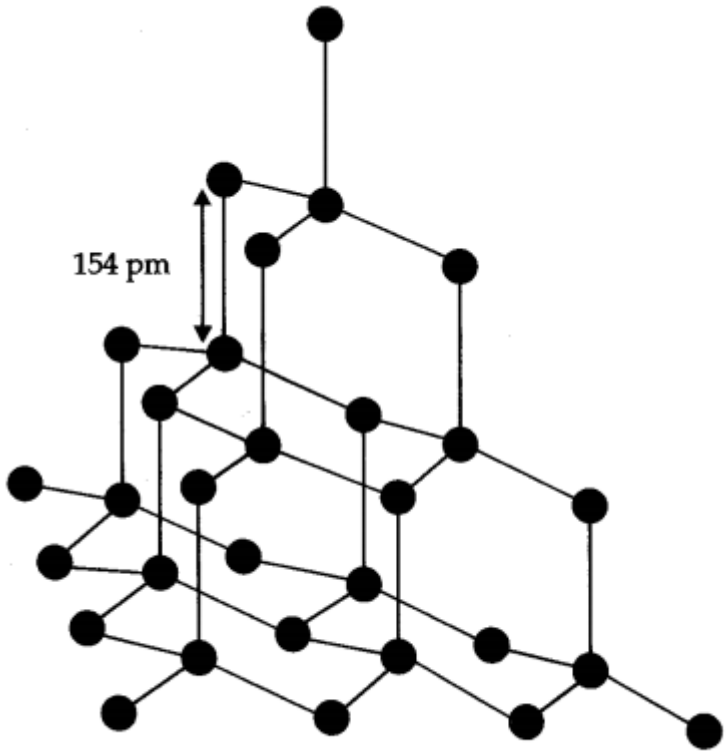
3. **Reaction with hydrogen** : These group elements formed hydrides of formula (EH_4). Sn and Pb do not form as they are less reactive towards hydrogen.Carbon has maximum tendency to form hydrides in this family. These hydrides have covalent and a tetrahedral geometry.

AllotropesofCarbon:-

The property of an element to exist in two or more forms which have different physical properties but identical chemical properties is called allotropy and different forms are called allotropes. Carbon exists in two allotropic forms:
(i) Crystalline (ii) Amorphous
Crystalline form of carbon: Diamond, Graphite, Fullerenes Diamond: In diamond each carbon atom undergoes sp^3 hybridisation. Each carbon is tetrahedrally linked to four other carbon atoms. The C—C bond length is 154 pm.

Properties:

(i) It is the hardest substance on earth.
(ii) It is used as an abrasive for sharpening hard tools in making dyes and in manufacture of tungsten filaments.



The structure of diamond

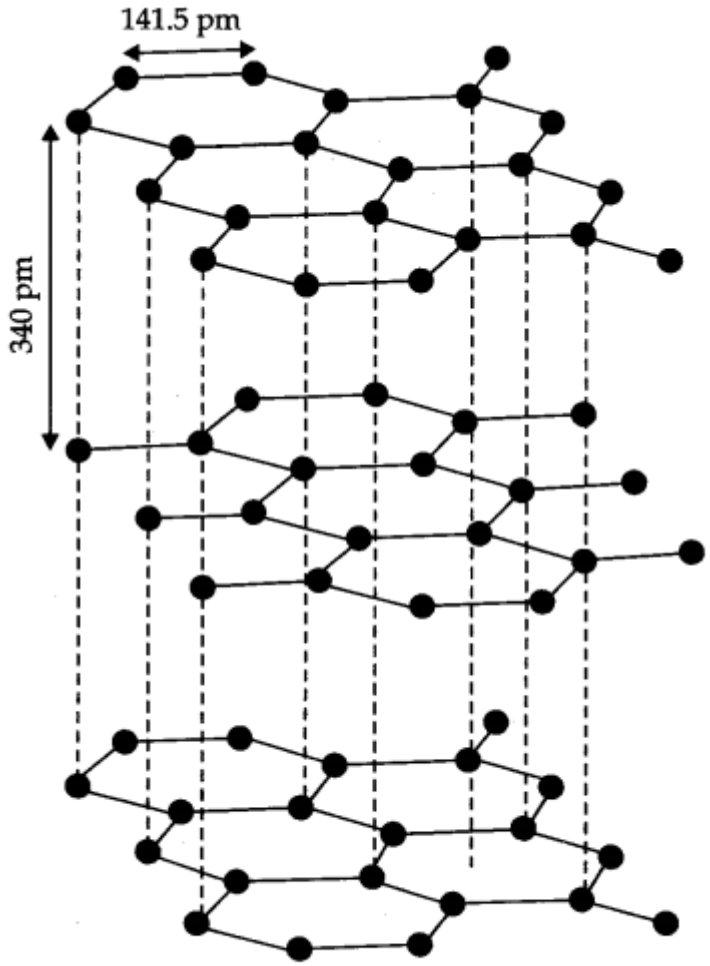
Graphite: In graphite, carbon is sp^2-hybridized. Graphite has a two-dimensional sheet like structure consisting of a number of hexagonal rings fused together. Layers are held by van der Waals forces and distance between two layers is 340 pm.

Properties:

(i) Graphite conducts electricity along the sheet.

(ii) It is very soft and slippery.

(iii) Used as a dry lubricant in machines running at high temperature, where oil cannot be used as a lubricant.



The structure of graphite

Fullerenes: Fullerenes was discovered collectively by three scientists namely E. Smalley, R.F. Curl and H.W. Kroto.

Preparation:

Fullerenes is prepared by heating of graphite in an electric arc in the presence of inert gas such as helium or argon.

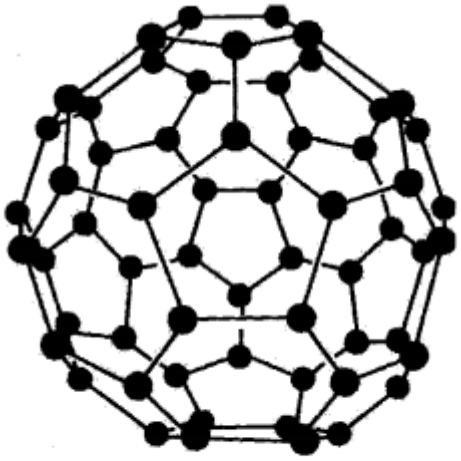
The sooty material formed by the condensation of vapourised C^n small molecules consists of mainly with smaller quantity of C_{70} and traces of other fullerenes consisting of even number of carbon atoms up to 350 or above.

Fullerenes are cage like molecules. C_{60} molecule has a shape like soccer ball and called Buckminsterfullerenes. It is the most stable.

It contains 20 six-membered rings and 12 five-membered rings.

Six-membered rings are fused to both the other six-membered rings and five-membered rings but the five-membered rings are connected only to six-membered rings.

All the carbon atoms are equal and they undergo sp^2-Kybridization.



The structure of C_{60}, Buckminster-fullerene:
Note that molecule has the shape of a soccer ball (football).

Properties:
(i) Fullerenes being covalent are soluble in organic solvents.
(ii) It also forms platinum complexes.
Amorphous allotropic forms of carbon:

coke: It is a greyish black hard solid and is obtained by destructive distillation.
Wood charcoal: It is obtained by strong heating of wood in a limited supply of air.
Animal charcoal: It is obtained by the destructive distillation of bones.
Uses of carbon:
(i) Graphite fibre are used for making superior sports goods such as tennis and badminton rackets, fishing rods.
(ii) Being good conductor graphite is used for making electrodes for batteries and industrial electrolysis.
(iii) Being highly porous, activated charcoal is used for absorbing poisonous gases in gas masks. It is used to decolourize sugar.
(iv) Carbon black is used as black pigment in black ink and as filler in automibile tyres.
(v) Coke is extensively used as reducing agent in metallurgy.
(vi) Diamond is a precious stone.
• **Some Important Compounds of Carbon and Silicon**
Carbon Monoxide
Preparation: It is prepared by direct oxidation of C in limited supply of oxygen.

$$2C(s) + O_2(g) \xrightarrow{\Delta} 2CO(g)$$

On small scale it is prepared by dehydration of formic acid with Con $\cdot H_2SO_4$ at 373 K.

$$HCOOH \xrightarrow[Con.\ H_2SO_4]{373K} H_2O + CO$$

Properties:
(i) Carbon monoxide is a colourless and odourless gas.

(ii) It is almost insoluble in water.
(iii) It is powerful reducing agent and reduces almost all metal oxides except alkali and alkaline earth metal oxides.
(iv) In CO molecule there are one σ (sigma) and two π bonds between carbon and oxygen.
: C = O :
(v) It is highly porous in nature. It forms a complex with haemoglobin which is about 300 times more stable than the oxygen-haemoglobin complex. This prevents haemoglobin in the red blood corpuscles from carrying oxygen round the body, there by causing suffocation ultimately leading to death.

Carbon Dioxide

Preparation: It is prepared by complete combustion of carbon and carbon containing fuels in

$$C(s) + O_2(g) \xrightarrow{\Delta} CO_2(g)$$

$$CH_4(g) + 2O_2(g) \xrightarrow{\Delta} CO_2(g) + 2H_2O(g)$$

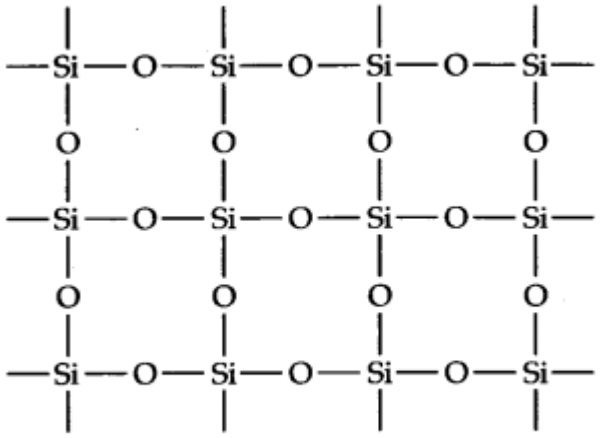
Properties:
(i) It is a colourless and odourless gas.
(ii) It is slightly soluble in water. When $C0_2$ dissolves in water only some of the molecules react with water to form carbonic acid.
(iii) It is not poisonous like CO.
But increase in combustion of fossil fuels and decomposition of limestone for cement manufacture increase of $C0_2$ in the atomosphere is one of the main reasons of green house effect.

Silicon dioxide ($Si0_2$)

Silicon dioxide, commonly known as silica, occurs in various crystallographic forms.
For example, Quartz, Cristobalite and thermite are some of the crystalline forms of silica.

Structure:

Silicon dioxide is a covalent three dimensional network solid.
Each silicon atom is covalently bonded in a tetrahedral manner to four oxygen atoms.
Each oxygen atom in turn covalently bonded to another silicon atoms as shown below:



Three dimensional structure of SiO_2

Properties:

(i) In normal form silica is very less reactive.

(ii) At elevated temperature it does not reacts with halogens, dihydrogen and most of the acids and metals. But it reacts with HF and NaOH.

$Si0_2 + 2NaOH$ ——> $Na_2Si0_3 + H_2O$

$Si0_2 + 4HF$ ———> $SiF_4 + 2H_20$

Uses:

(i) Quartz is extensively used as a piezoelectric material.

(ii) Silica gel is used as adsorbent in chromatography.

(iii) An amorphous form of silica, kieselghur is used in filtration plants.**Silicone**

They are synthetic organo-silicon compounds containing repeated R_2SiO units held by Si-O-Si linkages.

These compounds have the general formula $(R_2SiO)_n$ where R is methyl or aryl group .**Preparation** The methyl chloride reacts with Silicon in presence of Copper at temperature 573k.As a result, we get different types of methyl substituted cholrosilane of formulas:$MeSiCl_3$, $MeSiCl_2$, Me_3SiCl and also Me_4

$CH_3Cl + Si$ --> $(CH_3)_2SiCl_2$

methyl chloride dichloromethylsilane

$(CH_3)_2SiCl_2 + H_2O$ --> $(CH_3)_2Si(OH)_2$

Dichloromethylsilane

- If we carry out hydrolysis of dichlorodimethylsilane followed by polymerization we get straight chain polymers

Properties

- Siliconesare chemically inert, resistant to oxidation and thermal decomposition.
- Silicones are surrounded with non polar alkyl group that are water repelling in nature.
- They are heat resistant and possess high dielectric constant.

Uses

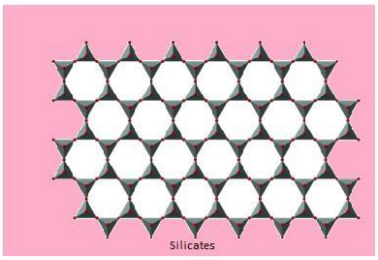
- They are used in making water proof papers, wool,textile, wood etc by coating them with thin film of silicones.
- They are used as electric insulators.
- They are used as lubricants at high as well as at low temperature, as there is very little change in their viscosity with temperature.
- They are used in surgical implants.

Silicates

Their basic structural units are SiO_4^{4-}.The important man made silicates are :

- Glass
- Cement

If we look at its structure



We observe that these tetrahedrons are linked together by corners and give rise to long chains, ring, sheet or three dimensional structure . The negative charges present are neutralized by positive charges of metal ions.

Zeolites

- They are widely used as catalyst in petrochemical industries for cracking of hydrocarbons.
- In them basically the Silicon atoms in three dimensional structures is replaced by Aluminum ions.
- As a result, the overall structure carries the negative charge .
- To balance this negative charge some cations like sodium ion etc are added in the structure

1. ZSM-5 a type of zeolite converts alcohols directly to gasoline.
2. Hydrated zeolite is used as permutit in ion exchange method for softening of hard water.

<u>Multiple choice questions</u>:-

1.linear shape of CO_2 is due to ---------- (ii)

i) sp^2 hybridisation of carbon ii) sp hybridisation of carbon

iii) (p – p) π bonding between C&O iv) sp^3 hybridisation

2.which of the following statements are not correct? (iv)

i) Fullerenes have dangling bonds ii) Fullerenes are cage like molecules
iii)Graphite is thermodynamically more stable allotrope of carbon
iv) Graphite is slippery and hard, so it is used as a dry lubricant in machines.

3. which is the hardest element among the following? (iv)
i) Iron ii) Silicon iii) Aluminium iv) Carbon
4.which of the following is solid at room temperature? (iii)
i) CO ii) CO_2 iii) SiO_2 iv) OF_2
5. which of the following is more stable? (i)
i) Pb^{2+} ii) Sn^{4+} iii) Ge^{4+} iv) Si^{4+}
6. write the neutral oxide in the following? (i)
i) CO ii) SiO_2 iii) GeO_2 iv) CO_2
7. Black lead is (iii)
i) Gas carbon ii) Diamond iii) Graphite iv) Petrolium coke
8. Carborundum is the commercial name of ------- (ii)
i) Al_2O_3 ii) SiC iii) H_3PO_4 iv) CO_2
9. The ratio of Si and O atoms in silica is (i)
i) 1 : 2 ii) 2 : 1 iii) 1 : 4 iv) 4 : 1
10. In SiO2 each silicon atom is bonded with how many oxygen atoms? (iii)
i) 2 ii) 1 iii) 4 iv) 3
11) Which of the following does not show catenation? (iv)
i) C ii) Si iii) Ge iv) Pb
12) The element which form neutral as well as acidic oxide? (iii)
i) Si ii) Sn iii) C iv) Pb
13) Which of the following is used as refrigerant? (iv)
i) SO_2 ii) SiC iii) $CHCl_3$ iv) CF_2Cl_2
14. How many number of free electrons present on each carbon atom in graphite?
i) 1 ii) 2 iii) 3 iv) 0 (i)
15. In C-60 all carbon atoms are (i)
i) sp^2 hybridised with soccer ball shape ii) sp^3 hybridised with square antiprism
iii) sp^2 hybridised with diamond shape iv) sp^2 hybridised with graphite like shape
16. Metalloid among the following? (iii)
i) C ii) Bi iii) Ge iv)Pb
17. The hybridisation of carbon in diamond, graphite and acetylene are respectively
i) sp^3, sp, sp^2 ii) sp^3, sp^2, sp, iii) sp, sp^2, sp^3 iv)sp^2 , sp^3, sp, (ii)
18. Which of the following is used in the preparation of aerated water? (ii)
i) SO_2 ii) CO_2 iii) CO iv) HCl
19. Which gas is essential constituent of almost all fuel gases? (iii)
i) N_2 ii) CO_2 iii) CO iv) SO_2
20. What is the gas liberated when SiO2 is reacted with sodium carbonate?
i) O_3 ii) CO_2 iii) CO iv) O_2(ii)
21. Which of the following is used as acidic flux in metallurgy? (ii)
i) SO_2 ii) SiO_2 iii) CaO iv) NaO
22. Purest form of silica is (iv)
i) Flint ii) Jaspar iii) sand stone iv) Quartz
23. Hybridisation of silicon atom in silica is (iii)
i) sp^3d ii) sp^2 iii) sp^3 iv) sp
24. In silicones silicon is strongly linked to (i)
i) oxygen ii) carbon iii) nitrogen iv) sulphur
25. Which of the following is used in cosmetic surgery? (i)
i) Silicones ii) Silica iii) Zeolites iv) Silicates
26. The basic structural unit of silicates is (iv)
i) SiO_3^{4-} ii) SiO_4^{2-} iii) SiO^{2-} iv) SiO_4^{4-}

27. Zeolites act as (ii)
i) Atomic sieves ii) Molecular sieves iii) Radical sieves iv) Ionic sieves
28. The most common semiconductor is (iii)
i) Se ii) Fe iii) Ge iv) C
29. Glass is soluble in (ii)
i) H_2SO_4 ii) HF iii) $HClO_4$ iv) aqua-regia
30. Which of the following is not stable? (ii)
i) $[SiF_6]^{2-}$ ii) $[SiCl_6]^{2-}$ iii) $[GeCl_6]^{2-}$ iv) $[Sn(OH)_6]^{2-}$
31. Which of the following is not correct?(iv)
i) SiCl4 is easily hydrolysed ii) GeF_4 is more stable than GeF_2
iii) SnF_4 is ionic iv) PbF_4 iscovalent
32. The species present in solution when CO_2 dissolved in water (i)
i)CO_2, H_2CO_3, HCO_3^-, CO_3^{2-} ii)CO_2, H_2CO_3,
iii) H_2CO_3, CO_3^{2-} iv)HCO_3^-, CO_3^{2-}
33. A and B are the compounds of carbon. A on passing over red hot coke, is converted to B. A and B are (iii)
i) CH_4& C_2H_6 ii) CO & CO_2 iii) CO_2& CO iv) CCl_4& $CHCl_3$
34. Which of the following exist as covalent crystals in the solid state? (iii)
i) Iodine ii) Sulphur iii) Silicon iv) Phosphorous
35. When air is passed over red hot coke volume of the mixture (P constant) increased by (ii)
i)25% ii)20% iii)30% iv)40%
36. Which of the following is the pure form of carbon ? (ii)
(i) Diamond(ii) Fullerene
(iii) Graphite (iv) All three forms are equally pure
37. The electronic configuration of four different elements is given below. Identify the group 14 element among these (iii)
(i) [He] $2s^1$ (ii) [Ne] $3s^2$ (iii) [Ne] $3s^2$ $3p^2$ (iv) [Ne] $3s^2 3p^1$
38.PbF_4, $PbCl_4$ exist but $PbBr_4$ and PbI_4 do not exist because of (ii)
(i) large size of Br– and I–(ii) strong oxidising character of Pb4+
(iii) strong reducing character of Pb4+(iv) low electronegativity of Br– and I–
39. Lead pipes are readily corroded by (iii)
(i) H_2SO_4(ii) HCl (iii) CH_3COOH (iv) pure water
40. The elements commonly used for making transistors are (iv)
(i) C and Si (ii) Ga and In (iii) P and As (iv) Si and Ge
41. Glass is a (iii)
(i) liquid (ii) solid (iii) supercooled liquid
(iv) transparent organic polymer
42. R_3 SiCl on hydrolysis forms (ii)
(i) R_3SiOH (ii) R_3Si-O-SiR_3 (iii)R_3 Si O (iv) None of these
43. Which of the following statements is false? (iii)
(i) Water gas is a mixture of hydrogen and carbon monoxide
(ii) Producer gas is a mixture of CO and nitrogen
(iii) Water gas is a mixture of water vapour and hydrogen
(iv) Natural gas consists of methane, ethane and gaseous hydrocarbons.

44. CO_2 is used for extinguishing fire because (iii)
ia) it has a relatively high critical temperature
(ii) in solid state, it is called dry ice
(iii) it is neither combustible nor a supporter of combustion
(iv) it is a colourless gas.

45. The correct statement with respect to CO is (ii)
(i) it combines with H_2O to give carbonic acid
(ii) it reacts with haemoglobin in RBC
(iii) it is powerful oxidising agent
(iv) it is used to prepare aerated drinks

46. Which of the following shows bond in silicone : (ii)
(i) Si – Si – Si – Si (ii) – Si – O – Si – O – Si
(iii) Si – C – Si – C – Si (iv) Si – C – Si – O – Si

47. Which type of zeolite is used to convert alcohols directly into gasoline ?
(i) ZSM – 3 (ii) ZSM – 5 (iii) ZSM – 2 (iv) All of these (ii)

48. The element that does not form a monoxide is (iv)
(i) lead (ii) tin (iii) germanium (iv) silicon

49. The percentage of s-character of the hybrid orbitals of carbon in graphite and diamond are respectively (i)
(i) 33, 25 (ii) 50, 50 (iii) 67, 25 (iv) 33, 67

50. Red lead is (ii)
(i) PbO (ii) Pb_3O_4 (iii) PbO_2 (iv) Pb_4O_3

51. The C-C bond length is maximum in (i)
(i) diamond (ii) C_{60} (iii) C_{70} (iv) graphite

52. The halide which is not hydrolysed is (iii)
(i) $SiCl_4$ (ii) SiF_4 (iii)CCl_4 (iv) $PbCl_4$

53. The substance which is used as smoke screen in warfare is (i)
(i) $SiCl_4$ (ii) PH_3 (iii)PCl_3 (iv)acetylene

54. Method used for obtaining high pure silicon used as semi-conductor Material is (iv)
(i) oxidation (ii) electro chemical reduction
(iii)crystallisation (iv) zone refining

55. The structure and hybridisation of $Si(CH_3)_4$ (iii)
(i) bent, sp (ii) trigonal, sp^2
(iii) tetrahedral, sp^3 (iv) octahedral,sp^3d^2

MATCHING TYPE QUESTIONS

56. Match the columns (ii)

Column-I	Column-II
(A) Borax-bead	(p) Alum

(B) Inorganic benzene (q) Diborane
(C) Antiseptic (r) Metaborate
(D) Bridged hydrogens (s) Borazole
(i) A – (p), B – (r), C – (q), D – (s) (ii) A – (r), B – (s), C – (p), D – (q)
(iii) A – (s), B – (r), C – (p), D – (q) (iv) A – (q), B – (r), C – (s), D – (p)

57. match the columns (iii)

Column-I	column-II
a)phosgene	p) sodium silicate
b)water glass	q) a poisonous gas
c)CO	r) Fire extinguisher
d)CO2	s) metal carbonyls

(i) A – (p), B – (r), C – (q), D – (s) (ii) A – (r), B – (s), C – (p), D – (q)
(iii) A – (q), B – (p), C – (s), D – (r) (iv) A – (q), B – (r), C – (s), D – (p)

58. match the columns (iv)

Column-I	column-II
a)Diamond	p) metal electrode
b)Graphite	q) sp hybridised
c)Silica	r) acid flux
d)CO2	s) cutting of glass

(i) A – (p), B – (r), C – (q), D – (s) (ii) A – (r), B – (s), C – (p), D – (q)
(iii) A – (q), B – (p), C – (s), D – (r) (iv) A – (s), B – (p), C – (r), D – (q)

59. Match columns (ii)

Column-I	Column-II
(A) Graphite fibres	(p) Abrasive for sharpening hard tools
(B) Carbon black	(q) Formation of light weight composites
(C) Charcoal	(r) Used in water filters to remove organic contaminators
(D) Diamond	(s) As filler in automobile tyres

(i) A – (s), B – (q), C – (r), D – (p) (ii) A – (q), B – (s), C – (r), D – (p)
(iii) A – (q), B – (r), C – (s), D – (p)(iv) A – (p), B – (r), C – (s), D – (q)

60. Match the columns (ii)

Column-I	Column-II
(A) Carbon	(p) Metal
(B) Silicon	(q) Non-metal
(C) Germanium	(r) Metalloid
(D) Tin	
(E) Lead	

(i) A -(q), B -(q), C -(r), D -(p), E -(p) (ii) A -(q), B -(r), C- (r), D -(p), E -(p)
(iii) A -(q), B -(r), C- (r), D- (p), E -(q) (iv) A -(q), B -(q), C- (q), D -(r), E- (p)

ASSERTION-REASON TYPE QUESTIONS

Directions : Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

(c) Assertion is correct, reason is incorrect

(d) Assertion is incorrect, reason is correct

61. Assertion : Pb^{4+} compounds are stronger oxidizing agents than Sn^{4+} compounds. (c)

Reason : The higher oxidation states for the group 14 elements are more stable for the heavier members of the group due to 'inert pair effect'.

62. Assertion : PbI_4 of lead does not exist. (a)

Reason : Pb–I bond initially formed during the reaction does not release enough energy to unpair $6s^2$ electrons.

63. Assertion : Graphite is thermodynamically most stable allotrope of carbon.

Reason : $\Delta_f H^o$ of graphite is taken as zero. (a)

64. Assertion: Silicones are water repelling in nature. (b)

Reason: Silicones are organosilicon polymers, which have (-R2SiO-) as repeating unit.

65. Assertion: Si-Si bond is stronger than Si-O bond. (a)

Reason: Silicon form Si = Si double bond easily

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Environmental Chemistry

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Synopsis

Environmental Chemistry plays some major role in keeping the environment clean. Chemical species present in the environment are either naturally occurring or generated by human activities, environmental pollution is the effect of undesirable changes occurring in the surroundings that cause harmful effects on plants, animals and human beings. Pollutants exist in all three States of matter. We have discussed only those pollutants which are produced due to human activities and which can be controlled. Atmospheric pollution is generally studied as tropospheric and stratospheric pollution. Troposphere is the lowest region of the atmosphere (10Km) in which man along with other organisms including plants exist. The Stratosphere extends above the troposphere up to 50 kilometres above sea level. The Ozone layer is one of the important constituents of the stratosphere. Tropospheric pollution is basically due to various oxides of Sulphur, nitrogen, carbon halogens and also due to particulate pollutants. The gaseous pollutants come down to the earth in the form of acid rain. 75% of solar energy reaching Earth is absorbed by the Earth surface and the rest is radiated back to the atmosphere. These gases mentioned above track the heat which causes global warming.It is important to realise that these very gases are also responsible for the life on the earth as they trap up the requisite amount of solar energy for the sustenance of life. The increase in the greenhouse gases is raising the temperature of the earth's atmosphere which, if not checked, it may eventually result in melting of polar ice caps and consequently may submerge the coastal land mass. Many human activities are producing chemicals, which are responsible for the depletion of the Ozone layer. Through the Ozone hole ultraviolet radiations can penetrate into the earth's atmosphere causing mutation of genes. Water is the elixir of life but the same water if polluted by pathogens, organic wastes, toxic heavy metals, pesticides,etc., will turn into poison. Therefore one should take care to follow International standards to maintain purity levels of drinking water. Industrial waste and excessive use of pesticides cause pollution of land masses and water bodies. Judicious use of chemicals required for agricultural practices can lead to sustainable development. Strategies for controlling environmental pollution can be: (i) waste management ie; reduction of the waste and proper disposal, also recycling of materials and energy, (ii) adopting methods in day to day life, which results in the reduction of environmental pollution. The second method to prevent pollution is restoring to a new branch of

chemistry, which is in its infancy, known as green chemistry. It utilizes the existing knowledge and practices so as to bring about reduction in the production of pollutants.

Multiple Choice Questions

1. The uppermost region of the atmosphere is

(A.) Stratosphere (B.) Troposphere (C.) Exosphere (D.) Ionosphere

2. Which of the following is a primary pollutant

(A.) CO (B.) PAN (C.) Aldehydes (D.) H_2SO_4

3. Which of the following is not regarded as a pollutant

(A.) NO_2 (B.) CO_2 (C.) O_3 (D.)Hydrocarbons

4. Choose the biodegradable pollutant of the following

(A.) Cow Dung (B.) DDT (C.) Alkyl benzene Sulphonate (D.) Mercury

5. The medium present in the environment which consumes some amount of certain pollutant is called a

(A.) receptor (B.) target (C.) sinkl (D.)none of these

6. Photochemical smog is

(A.) Summer during morning time (B.) Summer during day time
(C.) Winter during morning time (D.) Winter during day time

7.Phosphate pollution is caused by

(A.) weathering of phosphate rocks only (B.) agricultural fertilizers only
(C.) phosphate rocks and sewage (D.) sewage and agricultural fertilizers

8. The gas leaked from a storage tank of the union carbide plant in Bhopal gas tragedy was

(A.) Phosgene (B.) Methyl isocyanate (C.) methylamine (D.) ammonia

9. Organo mercury compounds are

(A.) Herbicides (B.) Fungicides (C.) soil conditioners (D.) fumigants

10. A biosphere is composed of

(A.) living organisms (B.) living organisms + lithosphere (C.) living organisms + lithosphere + atmosphere (D.) living organisms + lithosphere + atmosphere + hydrosphere

11. Which of the following protects life on earth from harmful effects of uv radiation

(A.) N_2 (B.) CO_2 (C.) O_2 (D.) O_3

12. Which of the following is responsible for the depletion of the ozone layer in the upper strata of the atmosphere?

(A.) Polyhalogens (B.) Ferrocene (C.) Fullerenes (D.) Freyons

13. What is DDT among the following

(A.) Greenhouse gas (B.) A fertilizer (C.) Bio-degradable pollutant
(D.) non - biodegradable pollutant

14. TLV indicates the permissible level of toxic substances that can

(A.) be present in a mine (B.) not be present in an industry
(C.) be tolerated by a worker in his surrounding atmosphere (D.) all the three

15. The killer disease cause of mercury is

(A.) Minamata (B.) Photochemical smog (C.) Acid rain (D.) greenhouse effect

16. The medium which reacts with pollutants is called

(A.) Sink (B.) receptor (C.) contaminant (D.) speciation

17. COD is a measure of

(A.) organic substances in water (B.) oxides of sulphur,phosphorus,nitrogen in water
(C.) inorganic pollutants in water (D.) salinity of water

18. The heat balance on the earth is maintained by

(A.) Atmosphere (B.) Hydrosphere (C.) Lithosphere (D.) Biosphere

19. The region which is greatly affected by air pollution is
(A.) Troposphere (B.) Stratosphere (C.) Mesosphere (D.) Thermosphere
20. Major sources of CO pollution are

(A.) motor vehicles (B.) forest fires (C.) volcanic action (D.) all of them

21. The compound used in refrigerators instead of NH_3 and SO_2 is

(A.) Teflon (B.) SF_6 (C.) Freon (D.) BF_3

22. The gas which caused yellowing of the taj mahal is

(A.) H_2S (B.) SO_2 (C.) CO_2 (D.) NO_2

23. The higher rate of heart disease in smokers is due to

(A.) NO (B.) NO_2 (C.) H_2S (D.) CO

24. Which one of the following statements is false

(A.) O_3 layer is destroyed by CFCs (B.) O_3 is involved in photochemical smog
(C.) A product of photochemical smog is CO (D.) smog reduces visibility

25. Abnormal calcification of bones and teeth is known as

(A.) Chlorosis (B.) Biomass (C.) Fluorosis (D.) calcination

26. Which of the following is a biodegradable pollutant

(A.) Plastic (B.) Sewage (C.) Asbestos (D.) Mercury

27. The best chemical used for the purpose of bleaching of clothes in the process of laundry is

(A.) Chlorine (B.) H_2O_2 (C.) SO_2 (D.) O_3

28. Carbon monoxide is harmful in man because

(A.) It forms carbolic acid (B.) It generates CO_2
(C.) It is a carcinogenic (D.) It competes with O_2 for hemoglobin

29. Which is a degradable pollutant

(A.) DDT (B.) Aluminium Foil (C.) Domestic Wastes (D.) Mercury Salts

30. Odd pollutant amongst the following is

(A.) SO_2 (B.) CO_2 (C.) CO (D.) Acid rain

31. Lichens do not like to grow in cities

(A.) Because of the absence of right type of algae and fungi (B.) Because of lack of moisture
(C.) Because of SO_2 Pollution (D.) Because natural habitat is missing

32. Thermal pollution is done with the help of

(A.) Phytoplankton (B.) Lichens (C.) Fungi (D.) None of the above

33. Black- foot disease is caused due to groundwater contaminated with excess of

(A.) Nitrate (B.) Fluoride (C.) Arsenic (D.) Sulphur

34. Which of the following is a secondary pollutant

(A.) CO (B.) PAN (C.) SO_2 (D.) Aerosol

35. Byssinosis; a disease is caused by

(A.) fly ash (B.) cement dust (C.) cotton fibres (D.) lead particles

36. The sink for dead plants and animals is

(A.) Sea Water (B.) River (C.) Microorganisms (D.) Atmosphere

37. Which of the following is a primary pollutant

(A.) CO (B.) PAN (C.) Aldehydes (D.) H_2SO_4

38. Gas commonly used in refrigerators is

(A.) T.E.L (B.) C_8H_{18} (C.) CCl_2F_2 (D.) CCl_3NO_2

39. Formula of enamel of teeth is

(A.) $3Ca_2(PO_4)_2.Ca(OH)_2$ (B.) $3Ca_2(PO_4)_2.CaF_2$ (C.) $Ca_2(PO_4)_2$ (D.) CaF_2

40. Herbicides are

(A.) $NaClO_3$ (B.) Na_3AsO_3 (C.) Both 1 & 2 (D.) DDT

FILL IN THE BLANKS

1. The oxides responsible for acid rains are _____.
2. Greenhouse effects caused by _____gases.
3. Asthma, Bronchitis,emphysema in human beings caused by _____ gas.
4. The irritant red haze in the traffic and congested places is due to the oxides of_____.
5. Classical smog is a mixture of _____.
6. Photochemical smog can also be called as _____.
7. The lowest region of atmosphere in which the human beings along with other organisms live is called _____.
8. The bacteria which cause gastrointestinal diseases _____.
9. Fluoride concentration above _____ ppm causes harmful effects to bones and teeth.
10. The common compounds of photochemical smog are _____.

TRUE OR FALSE

1. Classical smog can also be called oxidising smog.
2. BOD greater than 17 ppm indicates high pollution and is harmful.
3. The amount of D.O in warm water is higher than in cold water.
4. Polar stratospheric clouds are clouds formed over antarctica.
5. Plantation of some plants like pine helps in controlling photochemical smog.
6. London smog is formed in summer during day time.
7. Fishes grow as well in warm as in cold water.
8. Acid rains dissolved heavy metals such as Cu,Pb,Hg and Al from soil, rocks and sediments.
9. During formation of smog the level of ozone in the atmosphere goes down
10. Photochemical smog occurs in day time whereas the classical smog occurs in early morning hours.

MATCH THE FOLLOWING

1.

(A.) SO_2	(P.) Secondary Pollutant
(B.) PAN	(Q.) Biodegradable
(C.) Cow Dung	(R.) Non- Biodegradable
(D.) DDT	(S.) Primary pollutant

2.

(A.) Oxides of Sulphur	(P.) Global warming
(B.) Nitrogen Dioxide	(Q.) Damage to kidney
(C.) Carbon Dioxide	(R.) ‘Blue baby’ Syndrome
(D.) Nitrate in drinking water	(S.) Respiratory disease
(E.) Lead	(T.) Red haze in traffic and congested area

3.

(A.) Phosphate fertilizers in water	(P.) BOD level of water increases
(B.) Methane in air	(Q.) Acid rain
(C.) Synthetic detergents in water	(R.) Global warming
(D.) Nitrogen oxides in air	(S.) Eutrophication

4.

(A.) Greenhouse gases	(P.) CO
(B.) Silent killer gas	(Q.) CO_2
(C.) Photochemical smog	(R.) CFCs
(D.) Acid rains	(S.) O_3,NO_2
	(T.) N_2O_5 , SO_3

5.

(A.) Freons	(P.) Rise in temperature of earth's surface
(B.) Ozone	(Q.) Forms holes in ozone layer
(C.) Carbon Dioxide	(R.) Protects life from UV radiation
(D.) Sulphur Dioxide	(S.) Increase in fluoride ion concentration
	(T.) Acid rain

6.

(A.) 50% H_2SO_4 $K_2Cr_2O_7$	(P.) Skin Cancer
(B.) Chemical formula in pollutant	(Q.) Sink of CO_2
(C.) Ozone depletion	(R.) Speciation
(D.) Sea water	(S.) determination if COD

7.

(A.) Biodegradable	(P.) Mist pollutant
(B.) Non-biodegradable	(Q.) Algae pollutant
(C.) Viable particulates	(R.) Domestic sewage
(D.) Non-viable particulates	(S.) Plastic materials

SHORT ANSWER QUESTIONS

1. Define the following terms atmosphere and Biosphere.
2. What is C.O.D
3. Define Troposphere and Stratosphere
4. Which oxides cause acid rains? What is pH value?
5. Name two adverse effects caused by acid rains
6. What is PAN? What effect is caused by it.
7. How is ozone formed in the stratosphere?
8. What is the greenhouse effect? How is it caused?
9. Name two adverse effects caused by greenhouse effect
10. Define the terms receptor and sink.
11. How is photochemical smog formed
12. How is ozone layer depleted
13. What are the harmful effects caused by ozone layer depletion
14. List out the industrial wastes that cause water pollution
15. What is eutrophication
16. Define B.O.D
17. What are smoke and mist?
18. What Agro chemicals are responsible for water pollution
19. What are lithosphere and hydrosphere
20. What is classical smog. What are its chemical charecteristics