Atomic Structure

1. J.J. Thomson Model, Milliken oil Droplet Experiment

Q 1. Anode rays emits from
(A) From the cathode (B) from the anode
(C) Emits form the region near anode
(D) None of these

Q 2. The nature of anode rays depends on
(A) On the voltage applied
(B) on the gas taken in discharge tube
(C) Nature of the electrode
(D) none of these

Q 3. The nature & properties of the cathode rays depends on
(A) Nature of the electrode
(B) nature of the gas taken in the discharge tube
(C) voltage applied (D) none of these

Q 4. Which of the following statement is not correct regarding cathode rays?
(A) they carry negative charge
(B) the magnitude of charge/mass of these rays is considerably smaller than that of positive rays
(C) the rays produces mechanical effect
(D) the charge/mass ratio is independent of the nature of the gas taken in the discharge tube.

Q 5. Anode rays is obtained
(A) At higher pressure and lower voltage
(B) At higher pressure and higher voltage
(C) At higher voltage and lower pressure
(D) At lower pressure and lower voltage

Q 6. Anode rays can be ray of protons if
(A) The gas filled in the discharge tube is air
(B) The gas filled in the discharge tube is H_2 gas
(C) The gas filled in the discharge tube is O_2 gas
(D) It is always protons, no matter which gas is filled in the discharge tube

Q 7. The maximum value of specific charge (e/m) of canal rays is for which gas?
(A) He (B) N_2 (C) CO_2 (D) H_2

Q 8. According to Thomson model +ve charge & mass of the atom is present respectively at
(A) At centre & throughout the atom respectively
(B) Both are the concentrated at centre
(C) Both present throughout the atom
(D) Throughout the atom & at centre respectively

Q 9. The e/m value for electron in (Coul./Kg) is
(A) 1.758820×10^{-11} (B) 1.758820×10^{11}
(C) 1.758820×10^{12} (D) 1.758820×10^{13}

Q 10. The increasing order for the values of q/m for electron(e), proton(p), neutron(n) & alpha particle(a) [He^{2+} ion] is. **[IIT-1984]**
(A) e,p,n,a (B) n,p,e,a
(C) n,p,a,e (D) n,a,p,e

Q 11. The ratio of q/m of proton & α particle [He^{2+}] is
(A) 2:1 (B) 1:2
(C) 1:1 (D) 1:3

Q 12. From Discharge tube experiment it was concluded that
(A) mass of proton is in fraction
(B) matters contains electrons
(C) nucleus contains positive charge
(D) positive rays are heavier than protons

Q 13. An oil drop has 6.39×10^{-19} Coul. Charge. What will be the number if electrons in this drop?
(A) 2 (B) 4 (C) 8 (D) 16

Q 14. In an oil drop experiment, the following charges (in arbitrary units) were found on a series of oil droplets: 1.60×10^{-19}, 4.00×10^{-20}, 0.8×10^{-20}, 8.00×10^{-20}. Calculate the magnitude of the Charge on the electron (in the same units).
(A) 8×10^{-20} (B) 0.8×10^{-20}
(C) 4×10^{-20} (D) 1.6×10^{-19}

Q 15. In an oil drop experiment, the following charges (in arbitrary units) were found on a series of oil droplets: 2.30×10^{-15}, 6.90×10^{-15}, 1.38×10^{-14}, 5.75×10^{-15}, 3.45×10^{-15},1.96×10^{-14}. Calculate the magnitude of the charge on the electron (in the same units).
(A) 2.30×10^{-15} (B) 1.38×10^{-14}
(C) 1.15×10^{-15} (D) None of these

Q 16. **Assertion (A)**: A beam of electrons deflects more than a beam of α particles in an Electric Field.
Reason (R): Electrons posses -ve charge while α particles posses +ve charge . **[AIIMS 2013]**
(A) Both assertion and reason are true and the reason is the correct explanation of assertion
(B) Both assertion and reason are true and reason is not the correct explanation of assertion
(C) Assertion is true but the reason is false
(D) Both assertion and reason are false

2. Rutherford Model of Atomic Structure

Q 1. The conclusions of Rutherford scattering experiment does not include
(A) alpha particle can come within a distance of the order of 10^{-14} m of the nucleus
(B) the radius of the nucleus is less than 10^{-14} m
(C) Scattering follows coulomb's law
(D) the +vely charged parts of atom move with extremely high velocities

Q 2. Rutherford's alpha particle scattering experiment eventually led to the conclusion that **[IIT-1986]**
(A) mass and energy are related
(B) electrons occupy space around the nucleus
(C) neutrons are buried deep in the nucleus
(D) the point of impact with matter can be precisely determined

Q 3. Rutherford's experiment, which established the nuclear model of the atom, used a beam of
(A) β-particles, which impinged on a metal foil and got absorbed
(B) γ-rays, which impinged on a metal foil and ejected electrons
(C) helium atoms, which impinged on a metal foil and got scattered
(D) helium nuclei, which impinged on a metal foil and got scattered **[IIT-2002S]**

Q 4. Rutherford gave the idea of
(A) Circular Orbit (B) orbital
(C) elliptrical orbit (D) subshell

Q 5. Which of the following particles emits from the natural radioactive decay? **[AIEEE 2005]**
(A) Electrons (B) proton
(C) Y – rays (D) none of these

Q 6. For the same velocity of alpha particles highest deviation will be for
(A) Gold Foil (B) Cu-foil
(C) Al-foil (D) same for all cases

Q 7. Rtutherford experiment on scattering of alpha particles showed for the first time that atom has **[IIT – 1981]**
(A) Nucleus (B) Electron
(C) Proton (D) Neutron

Q 8. In Rutherford's experiment, the alpha particles are detected using a screen coated with
(A) Carbon Black (B) Platinum Black
(C) Zinc Sulphide (D) Tetrafluoro ethylene

Q 9. In Rutherford model of atom the K.E. of the electron is
(A) +Ve (B) –Ve
(C) Zero (D) None of these

Q 10. When an electron of charge e and mass m moves around Nucleus of nuclear charge +Ze with speed v in a circular orbit of radius r, the P.E. of the electrons is given by **[CBSE PMT 1994]**
(A) $\frac{z^2e^2}{r}$ (B) $-\frac{z\,e^2}{r}$ (C) $\frac{z\,e^2}{r}$ (D) $\frac{mv^2}{r}$

Q 11. In Rutherford experiment the K.E. was coming equal to
(A) Half times of P.E.
(B) Two times of that of T.E.
(C) Half times the magnitude of T.E.
(D) None of these

Q 12. In Rutherford atom $|T.E.|+|P.E.|=20.4eV$. Find the T.E. of the electron.
(A) – 6.8 eV (B) – 13.4 eV
(C) – 3.4 eV (D) None of these

Q 13. In Rutherford atom, sum of magnitude of K.E. & P.E. is 27.3 eV. The T.E. of the electron is
(A) – 27.3 eV (B) – 9.1 eV
(C) – 18.2 eV (D) None of these

Q 14. A beam of specific kind of particles of velocity 2.1×10^7 m/s is scattered by gold (Z = 79) nuclei. Find the specific charge (q/m) of this particle if distance of closest approach is 2.5×10^{-14} m
(A) $4.84\times10^{7}C/g$ (B) $4.84\times10^{-7}C/g$
(C) $2.42\times10^{7}C/g$ (D) $3.0\times10^{-12}C/g$

Q 15. An alpha particle approaches the target nucleus of copper (z =29) in such a way that the value of impact parameter is equal to zero. The distance of closest approach is equal to
(A) $29e^2/2\pi\varepsilon_0(KE)_\alpha$ (B) $4\pi\varepsilon_0(KE)_\alpha/29e^2$
(C) $(KE)_\alpha$ (D) data insufficient to calculate r min

Q 16. If In Rutherford experiment the no. of alpha particle emitted by the radioactive substance is 1.5×10^6 per minute and the number of scattered back alpha particles are 15 per minute, then find the dimension of the nucleus from the given information
(A) $10^{-12.5}$ m (B) 10^{-15} m
(C) 10^{-14} m (D) 10^{-12} m

3. Development of Quantum Physics

Q 1. **Assertion (A)**: Black Body is an ideal body that emits and absorbs radiations of all frequencies.
Reason (R): The frequency of radaitons emitted by a body goes from lower to higher frequency with an increase in temperature. **[AIIMS 2016]**
(A) Both assertion and reason are true and the reason is the correct explanation of assertion
(B) Both assertion and reason are true and reason is not the correct explanation of assertion
(C) Assertion is true but the reason is false
(D) Both assertion and reason are false

Q 2. A sodium lamp emits yellow light of wavelength 5800 A°. The wave number of the yellow light is
(A) $1.72\times10^{6}m^{-1}$ (B) $1.72\times10^{-6}m^{-1}$
(C) $17.2\times10^{6}m^{-1}$ (D) $172\times10^{6}m^{-1}$

Q 3. The frequency of wave is $6\times10^{15}S^{-1}$. Its wave number would be
(A) $10^{5}cm^{-1}$ (B) $2\times10^{-5}cm^{-1}$
(C) $2\times10^{-7}cm^{-1}$ (D) $2\times10^{5}cm^{-1}$

Q 4. The value of Planck constant is $6.63\times10^{-34}J.S$ The speed of light is $3\times10^{17}nm.S^{-1}$. Which is the wavelength in nanometer of a quantum of light with frequency of $6\times10^{15}s^{-1}$ **[NEET 2013]**
(A) 10 (B) 25 (C) 50 (D) 75

Q 5. A FM radio station broadcasts on a frequency of 980 KHz. What is the wavelength of radiation broadcast by radio station?
(A) 306 m (B) 3.06 m
(C) 30.6 m (D) 3060 m

Q 6. The wavelength range of the visible spectrum extends from violet (400 nm) to red (750 nm). Express these wavelength in frequencies (Hz) **[NCERT Solved]**

Q 7. The radiation having maximum wavelength is **[IIT JEE 1985]**
(A) Ultraviolet rays (B) Radiowaves
(C) X-rays (D) Infra-red rays

Q 8. All type of electromagnetic radiation have same
(A) wavelength (B) Frequency
(C) Energy (D) velocity in vacuum

Q 9. The characteristic not associated with Planck's theory is
(A) radiations are associated with energy
(B) the magnitude of energy associated with a quantum is proportional to frequency
(C) radiant energy is neither emitted not absorbed continuously
(D) radiant energy is neither emitted not absorbed discontinuously

Q 10. Find the number of quanta of radiations of frequency 4.67×10^{13} S^{-1} that must be absorbed in order to melt 5 g of ice. The energy required to melt 1 g of ice is 333 J.
(A) 5.28×10^{21} (B) 5.38×10^{21}
(C) 5.38×10^{22} (D) None of these

Q 11. The energy of photon having radiation of wavelength 3000 A° is
(A) $6.63\times10^{-19}J$ (B) $6.63\times10^{-18}J$
(C) $6.63\times10^{-16}J$ (D) $6.63\times10^{-49}J$

Q 12. A 1 KW radio transmitter oeprtes at a frequency of 880 Hz. How many photons/Sec does it emit?
(A) 1.71×10^{21} (B) 1.71×10^{33}
(C) 6.02×10^{23} (D) 2.85×10^{26}

Q 13. A 100 watt bulb emits monochromatic light of wavelength 400 nm. Calculate the no of photons emitted per second by the bulb.**[NCERT Solved]**

Q 14. A bulb emits light of λ =4500 A^0. The bulb is rated as 150 watt and 8% of this energy emitted as light. How many photons are emitted by the bulb per second? **[IIT-JEE 1995]**
(A) 27.2×10^{16} (B) 27.2×10^{18}
(C) 13.6×10^{18} (D) 13.6×10^{20}

Q 15. A near ultra violet photon of wavelength 300 nm is absorbed by a gas and then remitted as two photons. One photon is of red light with wavelength 760 nm. What would be the wavelength of the second photon?

Q 16. The Bond energy of X_2 is 160 KJ/mol. Find the minimum frequency of photon needed to break this bond.

Q 17. The energy required to break 1 mole of Cl-Cl bonds in Cl_2 is 353 KJ/mol. The longest wavelength of light capable of breaking a single Cl-Cl bond is **[JEE Main 2010]**
(A) 594 nm (B) 640 nm
(C) 700 nm (D) 339 nm

Q 18. The energy absorbed by each molecule of A2 of a subsatance is $4.4\times10^{-19} J$ and bond energy per molecule is $4.0\times10^{-19} J$. The K.E. of the molecule per atom will be **[CBSE PMT 2009]**
(A) $2.0\times10^{-20} J$ (B) $2.2\times10^{-19} J$
(C) $2.0\times10^{-19} J$ (D) $4.0\times10^{-20} J$

Q 19. Molecule dissociates into atoms after absorbing light of 4500 A^0. If one quantum of radiation is absorbed by each molecule, calculate the kinetic energy of iodine atoms. (Bond energy of I_2 = 240 KJ / mole) **[IIT-JEE 1995]**

Q 20. Suppose 10^{-17} J of light is needed by interior of the human eye to see an object. How many photons of green light (λ = 550 nm) are needed to generate the minimum amount of energy?

Q 21. In an astronomical observations, signals observed from a distant stars are generally weak. If the photon detector receives a total of $3.15\times10^{-18} J$ of the radiations of 600 nm. Find the no. of photons detected by detector? **[NCERT]**

Q 22. Life time of the molecules in the excited state are often measured by using a pulsed radiation source of duration nearly in nano second range. If the radiation soruce has a duration of 2 ns and the number of photons emitted during the pulse radiation is 2.5×10^{15}. Calculate the energy of the source. **[NCERT]**

4. Photoelectric Effect

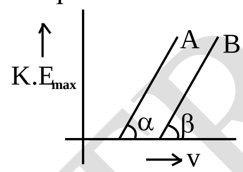
Q 1. The element that usually show photoelectric effect are
(A) Alkali Metals (B) Haloegens
(C) Transition metals (D) Inner-transition metals

Q 2. Which of the following metal is most likely to exhibit photoelectric effect?
(A) Gold (B) Potassium
(C) Chromium (D) Cesium

Q 3. The maximum kinetic energy of photoelectrons is inversely proportional to ………….. of incident radiation.
(A) Intensity (B) Wavelength
(C) Frequency (D) Amplitude

Q 4. The thereshold wavelength (λ^0) for ejection of electron from metal is 330 nm, then work function for the photoelectric emission is
(A) $1.2\times10^{-18} J$ (B) $1.2\times10^{-20} J$
(C) $6.0\times10^{-19} J$ (D) $6.0\times10^{-12} J$

Q 5. For two different metals A & B graphs between K.E.max of photoelectrons and υ are given as



Which is incorrect for A & B?
(A) $(\upsilon_0)_A < (\upsilon_0)_B$ (B) $\alpha = \beta$
(C) $(\upsilon_0)_A = (\upsilon_0)_B$ (D) All are correct

Q 6. Which of the following is not correct about photoelectric effect?
(A) photoelectric effect takes place only when wavelength of the incident radiation is greater than the critical wavelength.
(B) the number of photoelectrons emitted is directly proportional to the intensity of the incidenet radiation.
(C) the maximum kinetic energy of the photoelectrons emitted is directly proportional to the frequeny of the incident radiation.
(D) if frequency of the incident radiation is equal to the critical frequency, the K.E. of photoelectrons is zero.

Q 7. The threshold frequency of a metal is $1\text{x}10^{15}$ s^{-1}. The ratio of maximum kinetic energies of the photoelectrons when the metal is irradiated with radiation of frequency $1.5\text{x}10^{15}$ S^{-1} & $2.0\text{x}10^{15}$ S^{-1} respectively, would be
(A) 3:4 (B) 1:2 (C) 2:1 (D) 4:3

Q 8. Photoelectric emission is observed from a surface for frequencies ν_1 & ν_2 of the incident radiation ($\nu_1 > \nu_2$). If the maximum kinetic energies of the photoelectrons in the two cases are in the ratio 1: K then thereshold frequency ν_0 is given by
(A) $(\nu_1 - \nu_2)/(k-1)$ (B) $(k\,\nu_1 - \nu_2)/(k-1)$
(C) $(k\,\nu_2 - \nu_1)/(k-1)$ (D) $(\nu_2 - \nu_1)/k$

Q 9. If λ_0 is the threshold wavelength for photoelectrons emission, λ is the wavelength of light falling on the surface of a metal and m is the mass of electron, then the velocity of ejected electrons is given by

(A) $\left[\frac{2h}{m}(\lambda-\lambda_0)\right]^{1/2}$ (B) $\left[\frac{2hc}{m}(\lambda_0-\lambda)\right]^{1/2}$

(C) $\left[\frac{2hc}{m}(\frac{\lambda_0-\lambda}{\lambda_0\lambda})\right]^{1/2}$ (D) $\left[\frac{2hc}{m}(\frac{1}{\lambda_0}-\frac{1}{\lambda})\right]^{1/2}$

Q 10. When electromagnetic radiation of wavelength 300 nm falls on the surface of sodium, electrons are emitted with K.E. $1.68\times10^5\ J/mol$. what is the minimum energy needed to remove an electrons from sodium? What is the maximum wavelength that will cause a photoelectrons to be emitted? **[NCERT Solved]**

Q 11. Light of wavelength λ shines on a metal surface with intensity X. The metal emits Y electrons per second of average energy Z. what will happen to Y & Z if X is doubled (keeping λ constant)
(A) Y will be doubled and Z will become half
(B) Y will remain same & Z will be doubled
(C) both Y & Z will be doubled
(D) Y will be doubled but Z will remain same

Q 12. UV light of wavelength 80 nm & 70 nm falls on hydrogen atoms in their ground state & liberates electrons with K.E. 1.8 eV & 4 eV respectively. Calcualte Planck's constant.

Q 13. If the binding energy of e^- in a metal is 250 KJ/mole. What is the threshold frequency of the striking photons?

Q 14. If the photon of the wavelength 150 Pm strikes an atom, one of its inner bound electrons is ejected out with a velocity of 1.5×10^7 m/s, calculate the energy with which it is bound to the nucleus. **[AIIMS 2010]**

Q 15. Ejection of the photoelectrons from metal in the photoelectric effect experiment can be stopped by applying 0.5 V when the radiation of 250 nm is used. The work function of the metal is **[JEE Main 2019]**
(A) 4 eV (B) 4.5 eV
(C) 5 eV (D) 5.5 eV

Q 16. The ejection of photoelectrons from the silver metal in the photoelectric affect experiment can be stopped by applying a voltage of 0.35V when radation of wavelength 256.7 nm is used. Calculate work function of Ag metal. **[NCERT]**

5. De-Broglie Hypothesis

Q 1. Wave particle duality is valid for
(A) electrons (B) pen
(C) ball (D) valid for all

Q 2. The de-broglie wavelength of a particle moving miwth momentum of 3.3 x 10^{-24} Kg.m.s^{-1} is
(A) 0.02 A° (B) 0.5 A°
(C) 2 A° (D) 500 A°

Q 3. A cricket ball of mass 200 g is thrown with a speed of 3.0×10^3 cm/sec. What will be its de-broglie wavelength?
(A) $1.1\times10^{-32}\ cm$ (B) $2.2\times10^{-32}\ cm$
(C) $0.55\times10^{-32}\ cm$ (D) $11.0\times10^{-32}\ cm$

Q 4. The speed of a proton is one hundredth of the speed of light in vacuum. What is its de-Broglie wavelength? Assume that one mole of proton has a mass equal to 1 g.
(A) $13.31\times10^{-3}\ A^o$ (B) $1.33\times10^{-3}\ A^o$
(C) $13.13\times10^{-2}\ A^o$ (D) $1.31\times10^{-2}\ A^o$

Q 5. Assuming the velocity to be same, the wavelength of the particle waves associated with which of the following particles would be maximum? **[NCERT Examplar]**
(A) electron (B) proton
(C) alpha particle (D) deutron

Q 6. Which of the following particles have shortest wavelength when accelerated by 1 million eV?
(A) Neutron (B) Be^{3+}
(C) alpha particle (D) Electron

Q 7. If K.E. of a proton is increased nine times then the wavelength associated with it would becomes
(A) 3 times (B) 9 times
(C) 1/3 times (D) 1/9 times

Q 8. If Ee, Eα & Ep represent K.E. of an electron, alpha particle, a proton respectively, each moving with same de-Broglie wavelength then
(A) Ee = Eα = Ep (B) Ee > Ep > Eα
(C) Eα > Ep > Ee (D) Ee = Ep > Eα

Q 9. An electron beam can undergo diffraction by crystals. through what potential should a beam of e^- be accelerated so that its wavelength becomes equal to 1.54 A^0.

Q 10. An electron diffraction experiment was performed with a beam of electrons accelerated by a potential difference of 10.0 KV. What was the wavelength of electron beam?

Q 11. The wavelength of a photon is 1.4 A^0. If collides with an e^- and its wavelength after collision is 2.0A^0. Calculate the energy of the scattered electron.

Q 12. A molecule of O_2 & that of SO_2 travel with same speed. What is the ration of their wavelength?

Q 13. Photoelectrons are liberated by ultraviolet light of wavelength 3000 A° from a metallic surface for which the photoelectric threshold wavelength is 4000 A°. The de-broglie wavelength of electrons emitted with max K.E. is **[AIIMS 2016]**

(A) 1.2 nm (B) 3.215 nm
(C) 7.28 A° (D) 1.65 A°

Q 14. The de-broglie wavelength of He – atom at room temperature is **[AIIMS 2009]**

(A) $6.6\times10^{-34}m$ (B) $4.39\times10^{-10}m$
(C) $7.34\times10^{-11}m$ (D) $2.235\times10^{-20}m$

6. Bohr Model of Atomic Structure

Q 1. In which of the following orbits, the angular momentum of an electron of He+ will be $\frac{h}{\pi}$?

(A) First (B) Second
(C) Third (D) Fourth

Q 2. Which of the following orbits of H atom should have the values of their radii in the ratio 1:4?

(A) K & L (B) L & N
(C) M & N (D) A & B both are correct

Q 3. If radius of first Bohr orbit is a_0, then radius of third orbit is

(A) $3a_0$ (B) $6a_0$
(C) $9a_0$ (D) $(1/9)a_0$

Q 4. The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen

(A) He^+(n = 2) (B) Li^{2+}(n=2)
(C) Li^{2+}(n = 3) (D) Be^{3+}(n = 2)

Q 5. The distance between the 3rd & 2nd orbit of H atom is

(A) $2.645\times10^{-8}cm$ (B) $2.116\times10^{-8}cm$
(C) $1.058\times10^{-8}cm$ (D) $0.529\times10^{-8}cm$

Q 6. What should be the ratio of radii of the first orbit of electron in Na^{10+} and H atom?

(A) 11:1 (B) 1:11
(C) 1:1 (D) 1:2

Q 7. If the velocity of electron in the first orbit of H atom is X, then velocity in third orbit will be

(A) 3X (B) X/3
(C) 9X (D) None of these

Q 8. The ratio of velocities of the electrons in the fifth orbit of Li^{2+} & He^+ should be

(A) 3:2 (B) 2:3
(C) 3:5 (D) 3:4

Q 9. What should be energy in the first excited state of Be^{3+} ion?

(A) – 54.4 eV (B) – 3.4 eV
(C) – 0.85 eV (D) – 13.6 eV

Q 10. The energy of an electron in the first orbit of H atom is –13.6 eV. The possible energy values of the excited state in Bohr orbits of Li^{2+} ion is/are

(A) –3.4 eV (B) – 30.6 eV
(C) – 13.6 eV (D) All of these

Q 11. Which of the following is the energy of a possible excited state of Hydrogen? **[JEE Main 2015]**

(A) +13.6 eV (B) – 6.8 eV
(C) – 3.4 eV (D) + 6.8 eV

Q 12. What should be the correct order of energies of the first orbits of H, He^+, Li^{2+}, if these are represented as E1, E2 & E3 respectively?

(A) E1 < E2 < E3 (B) E3 < E2 < E1
(C) E3 < E2 > E1 (D) E1 = E2 = E3

Q 13. Which orbit of H atom have its energy – 50 units, if the energy of its first orbit is –800 units?

(A) 4th orbit (B) 2nd orbit
(C) 3rd orbit (D) None of these

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

(A) either 12.09 eV or 3.4 eV
(B) either 2.55 eV or 10.2 eV
(C) either 13.6 eV or 3.4 eV
(D) either 3.4 eV or 0.85 eV

Q 15. The de-broglie wavelength of the electron in the ground state of H-atom is **[AIIMS 2002]**

(A) 33.28 nm (B) 3.328 nm
(C) 0.3328 nm (D) 0.0332 nm

Q 16. If the total energy of an electron in a hydrogen like atom in an excited state is - 3.4 eV, then the de Broglie wavelength of the electron is
(A) 6.6×10^{-10} (B) 3×10^{-10}
(C) 5×10^{-9} (D) 9.3×10^{-12}

Q 17. The correct expression derived for the energy of an electron in the nth energy level is **[IIT-JEE 2008]**
(A) $E_n = \frac{2\pi^2 me^4}{n^2h^2}$ (B) $E_n = -\frac{2\pi^2 me^4}{nh^2}$
(C) $E_n = -\frac{2\pi^2 me^2}{n^2h^2}$ (D) $E_n = -\frac{2\pi^2 me^4}{n^2h^2}$

Q 18. The Kinetic energy of an electron in the second Bohr orbit of a Hydrogen atom is (a_o is Bohr radius) **[IIT-JEE 2012]**
(A) $\frac{h^2}{4\pi^2 ma_o^2}$ (B) $\frac{h^2}{16\pi^2 ma_o^2}$
(C) $\frac{h^2}{32\pi^2 ma_o^2}$ (D) $\frac{h^2}{64\pi^2 ma_o^2}$

Q 19. If reference point for P.E. measurement is taken at 1st orbit then find the T.E. of electron in 2nd excited state of H-atom
(A) – 1.5 eV (B) – 28.7 eV
(C) 28.7 eV (D) 25.7 eV

7. Ionisation Energy, H – Spectrum

Q 1. In two H atoms X & Y the electrons move around the nucleus in circular orbits of radius r & 4r respectively. The ratio of the time taken by them to complete one revolution is
(A) 1:4 (B) 1:2
(C) 1:8 (D) 2:1

Q 2. Time taken to complete one revolution is proportional to (N: principle quantum no)
(A) N^3 (B) N^2
(C) N^2 (D) independent from N

Q 3. Time taken for an electron to complete one revolution in the bohr orbit of hydrogen atom is
(A) $\frac{4\pi^2 mr^2}{nh}$ (B) $\frac{nh}{4\pi^2 mr}$
(C) $\frac{2\pi mr}{\pi^2 h^2}$ (D) $\frac{h}{2\pi mr}$

Q 4. How much energy is required to ionize H atom if the electrons occupies n = 5 orbit? Compare your answer with I.E. of H atom. **[NCERT]**

Q 5. The ionization energy of He^+ is $19.6\times10^{-18} J$. The energy of first stationary state of Li^{2+} ion is
(A) $-4.9\times10^{-28} J$ (B) $-9.8\times10^{-18} J$
(C) $-8.9\times10^{-17} J$ (D) $-4.41\times10^{-17} J$

Q 6. The Ionisation Energy of H atom in ground state is X KJ. The energy required for an electron to jump from 2nd orbit to the 3rd orbit will be
(A) X/6 (B) 5X
(C) 7.2X (D) 5X/36

Q 7. The ionization potential of H atom is 13.6 eV. The energy required to excite an electron to n = 2 state is **[JEE Main 2008 Based]**
(A) 6.8 eV (B) 10.2 eV
(C) 0.34 eV (D) 3.4 eV

Q 8. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionize the sodium atom. Calculate the ionization energy of the Sodium in KJ/mol. **[NCERT]**

Q 9. An electron in a hydrogen atom in its ground state absorbs 1.5 times as much energy as the minimum required for it to escape from the atom. What is the wavelength of the emitted electron?
(A) $4.7\times10^{-9} m$ (B) $4.7\times10^{-10} m$
(C) $5.7\times10^{-10} m$ (D) None of these

Q 10. The wave number of the limiting line in Lyman series of Hydrogen is 109678 cm^{-1}. The wave number of the limiting line in Blamer series of He^+ would be
(A) 54839 cm^{-1} (B) 219356 cm^{-1}
(C) 109678 cm^{-1} (D) 438712 cm^{-1}

Q 11. Which of the following should be correct value of wave number of the first line of Balmer series of H atom?
(A) 5R/36 (B) – 5R/36
(C) R/9 (D) – R/9

Q 12. The wavelength of a spectral line emitted by Hydrogen atom in the Lyman Series is $\frac{16}{15R}$ cm. Find the value of n_2. **[AIIMS 2011]**
(A) 2 (B) 3 (C) 4 (D) 1

Q 13. Which of the following transition in H atom should emit a radiation of highest frequency?
(A) n = 5 to n = 2 Balmer
(B) n = 3 to n = 2 Balmer
(C) n = 4 to n = 2 Balmer
(D) n = 3 to n = 1 Lyman

Q 14. What electronic transition in Li^{2+} ion will produce the radiation of the same wavelength as the first line in the lyman series of Hydrogen?
(A) n = 4 to n = 2 (B) n = 9 to n = 6
(C) n = 9 to n = 3 (D) n = 6 to n = 3

Q 15. The frequency of one of the line in Paschan series of a Hydrogen atom is $2.34\times10^{14}\,Hz$. The quantum number n_2 which produces this transition is
(A) 3 (B) 4 (C) 6 (D) 5

Q 16. What is the frequency and wavelength of a photon emitted during a transition from n = 5 to n = 2 state in the H atom? **[NCERT Solved]**

Q 17. Electromagnetic radiations with the highest wavelength result when an electron in a H atom falls from n = 5 to
(A) n = 1 (B) n = 2 (C) n = 3 (D) n = 4

Q 18. Calculate the wave number of the emission lines when the excited electrons in H atom in n = 6 drops to the ground state? **[NCERT]**

Q 19. The spectrum of He is expected to be similar to that of **[CBSE PMT 1988]**
(A) H (B) Na (C) Li^+ (D) He^+

Q 20. If diameter of carbon atom is 0.15 nm, calculate the number of carbon atoms which can be placed side by side in a straight line across length of scale length 20 cm. **[NCERT]**

8. Problems on Bohr Model

Q 1. Out of 0.27 moles of helium, 90% undergoes excitations He^+ ions. Spectral analysis shows that 85% ions exist in the 3rd excited level, 10% exist in 2nd level and remaining in the ground state. Calculate the energy released when all the He^+ ions de-excite from 3rd level to the ground state.
(A) 109.5 kJ (B) 125.9 kJ
(C) 113.3 kJ (D) 96.5 kJ

Q 2. What is the maximum number of emission lines when the excieted electrons of a H atom in n = 6 drops to the ground state? **[NCERT]**

Q 3. What is the maximum no. of wavelength /lines that one can get from transition between n = 6 to n = 2 state.
(A) 6 (B) 10
(C) 8 (D) 15

Q 4. The emission spectrum of He^+ ion is the consequence of transition of electron from orbit n2 to n1. Given: $2n_2 + 3n_1 = 18$ & $2n_2 - 3n_1 = 6$, then what will be the total number of photons emitted when electron transits to orbits n1.
(A) 10 (B) 15
(C) 20 (D) 21

Q 5. The value of (n1+ n2) and ($n1^2 - n2^2$) for He+ ion in atomic spectrum are 4 & 8 respectively. The wavelength of emitted photon when jump from n2 to n1 is
(A) $\frac{32}{9}R_H$ (B) $\frac{9}{32}R_H$
(C) $\frac{9}{32R_H}$ (D) $\frac{32}{9R_H}$

Q 6. Imagine an atom made up of a proton and a hypothetical particle double of the mass of electron but having same charge as electron. Apply the Bohr atomic model and consider all possible transitions of this hypothetical to the first excited level. The longest wavelength photon that will emitted has wavelength λ equal to
(A) $\frac{9}{5R_H}$ (B) $\frac{36}{5R_H}$ (C) $\frac{18}{5R_H}$ (D) $\frac{4}{R_H}$

Q 7. Imagine an atom made up of a proton and a hypothetical particle same mass of electron but having double charge as electron. Apply the Bohr atomic model and consider all possible transitions of this hypothetical to the first Energy level. The longest wavelength photon that will emitted has wavelength λ equal to
(A) $\frac{1}{12R_H}$ (B) $\frac{1}{4R_H}$ (C) $\frac{9}{5R_H}$ (D) $\frac{1}{3R_H}$

Q 8. The wavelength of a spectral line for an electronic transition is inversely related to
(A) the no of electron undergoing the transition

(B) the nuclear charge of the atom
(C) the difference in the energy of the energy levels involved in the transition
(D) the velocity of the electron undergoing the transition

Q 9. Bohr model can explain:
(A) the spectrum of hydrogen atom only
(B) spectrum of an atom or ion containing one electron only
(C) the spectrum of hydrogen molecule
(D) the solar spectrum

Q 10. Which of the following statements do not form a part of Bohr's model of hydrogen atom? **[CBSE PMT 1989]**
(A) Energy of the electrons in the orbits are quantized.
(B) The electron in the orbit nearest to Nucleus has the lowest energy
(C) Electrons revolve in different orbits around the Nucleus
(D) The position and velocity of electrons in the orbit can not be determined simultaneously.

Q 11. Zeeman effect is splitting of spectral line in presence of
(A) Magnetic Field (B) Electric Field
(C) Electromagnetic field (D) Gravitational Field

Q 12. Which of the following is not demerit of Bohr Model?
(A) Bohr model did not explain angular momentum quantisation principle
(B) Bohr model violate Heisenberg uncertainty Principle
(C) Bohr model assume electron as wave
(D) Bohr model is not valid for more than one electron system.

Q 13. Sommerfeld model gives which of the following quantum number?
(A) Principle quantum number
(B) Azimuthal quantum number
(C) Magnetic field quantum number
(D) both B & C

9. Quantum Model, Heisenberg Principle

Q 1. Electron wave inside atom is
(A) standing wave (B) travelling wave
(C) matter wave (D) both A & C

Q 2. In 3rd orbit, no of e wave formed is equal to
(A) 1 (B) 2
(C) 3 (D) 3/2

Q 3. In 5th excited state, no. of electrons wave formed is equal to
(A) 5 (B) 6
(C) 7 (D) 10

Q 4. If the de-Broglie wavelength of the electron in nth Bohr orbit in a Hydrogenic Atom is equal to 1.5πao (ao is Bohr Radius), then value of n/Z is **[JEE Main 2019]**
(A) 0.40 (B) 0.75
(C) 1.50 (D) 1.0

Q 5. Heisenberg uncertainity principle is not applicable to
(A) electron (B) proton
(C) ball (D) neutron

Q 6. Which of the following principle is responsible to rule out the existence of definite paths or trajectories of electrons?
(A) Pauli's exclusion Principle
(B) Heisenberg's uncertainty principle
(C) Hund's rule of maximum multiplicity
(D) Aufbau Principle

Q 7. The mass of a particle is $1.1\times10^{-27}\,Kg$. What will be minimum uncertainty in its velocity, if the uncertainty in its position is $3.0\times10^{-10}\,cm$
(A) 3.2×10^{4} m/s (B) 1.6×10^{4} m/s
(C) 5.0×10^{4} m/s (D) 6.4×10^{4} m/s

Q 8. The mass of a particle is $9\times10^{-28}\,g$. What will be minimum uncertainty in its velocity, if the uncertainty in its momentum is $1.0\times10^{-18}\,g.cm.s^{-1}$ **[CBSE PMT 2008]**
(A) 1.0×10^{9} cm/s (B) 1.0×10^{6} cm/s
(C) 1.0×10^{5} cm/s (D) 1.0×10^{11} cm/s

Q 9. The position of both, an electron and a He atom is known within 1.0 nm. Further the momentum of the electron is known within $5.0\times10^{-26}\,Kg.m.s^{-1}$. The minimum uncertainty in measurement of momentum of the He atom is **[CBSE PMT 1998]**

(A)50 kg.m/s (B) 80 Kg.m/s
(C) 80.0×10^{-26} Kg.m/s (D) 5.0×10^{-26} Kg.m/s

Q 10. If uncertainty in position & momentum of electron are equal then uncertainty in its velocity would be **[CBSE PMT 2008]**
(A) $\sqrt{\frac{h}{\pi}}$ (B) $\frac{1}{2}\sqrt{\frac{h}{\pi}}$
(C) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ (D) $2m\sqrt{\frac{h}{\pi}}$

Q 11. If uncertainty in its position of electron is zero, the uncertainty in its momentum would be
(A) zero (B) h/2p
(C) h/4p (D) Infinity

Q 12. The uncertainty in the velocities of two particles, A & B are 0.05 and 0.02 m/s respectively. The mass of B is five times to that of mass of A. what is ratio of uncertainties in their position ($\frac{\Delta X_A}{\Delta X_B}$) **[AIIMS 2008]**
(A) 2 (B) 1/4 (C) 4 (D) 1

Q 13. The uncertainty in the position of an electron if the uncertainty in its velocity is 0.1 % would be (ve = 2.2×10^{6} m/s)
(A) 20 nm (B) 22 nm
(C) 26 nm (D) 28 nm

Q 14. The position of proton is measured with an accuracy of ± 10^{-11} m. If the speed of proton is equal to speed of light, what will be the uncertainty of proton in 1 sec.
(A) 300 m (B) 0.30 A°
(C) 3150 m (D) None of these

Q 15. Uncertainty in position of a minute particle of mass 25 g in space is 10^{-5} m. What is the uncertainty in its velocity **[IIT-JEE 2002]**
(A) 2.1×10^{-34} m/s (B) 0.5×10^{-34} m/s
(C) 2.1×10^{-28} m/s (D) 0.5×10^{-23} m/s

Q 16. The uncertainty in position of an electron is equal to its de-Broglie wavelength. The minimum percentage error in its velocity will be
(A) 4 (B) 8
(C) 22 (D) 18

Q 17. What is the uncertainty in location of a photon of wavelength 5000 A° if wavelength is known to an accuracy of 1 pm?
(A) $7.96\times10^{-14}m$ (B) $0.02m$
(C) $3.9\times10^{-8}m$ (D) None of these

Q 18. Uncertainty in position of the electron is in the order of λ. Making use of Heisenberg's uncertainty principle, it will be found that uncertainty in velocity V is of the order of
(A) V/2π (B) V
(C) 2πV (D) none of these

Q 19. Wave Mechanical model of the atom depends on
(A) de-Broglie concepts of dual nature of electron
(B) Heisenberg uncertainty Principle
(C) Schrodinger wave equation
(D) All of these

10. Schrodinger equation & Quantum Number

Q 1. The solution of $H\Psi = E.\Psi$ involves
(A) Finding the value of Ψ
(B) Finding the value of E
(C) Finding the value of H
(D) Finding both E & Ψ

Q 2. Hamiltonian operator 'H' is the sum of two energy operators, these are
(A) Mechanical & Potential
(B) Kinetic & Mechanical
(C) Kinetic & Potential
(D) Thermal & Potential

Q 3. Which of the following quantum number is not obtained by solution of $H\Psi = E.\Psi$
(A) Principle quantum number
(B) Azimuthal quantum number
(C) spin quantum number
(D) magnetic field quantum number

Q 4. The orbital angular momentum for 2S orbital is
(A) 0 (B) h/π
(C) h/2π (D) 2h/π

Q 5. The orbital angular momentum of 3S, 3P & 3d orbitals electrons has the order
(A) 3S > 3P > 3d (B) 3S < 3P < 3d
(C) 3S = 3P = 3d (D) None of these

Q 6. For given value of 'n' no of orbitals is equal to
(A) n^2 (B) $2n^2$

(C) n –1 (D) $n^2(n-1)$

Q 7. In a single electron system, degeneracy of 3rd orbit is

(A) 5 (B) 7

(C) 9 (D) 3

Q 8. In a single electron system, the correct energy order of 3S, 3P & 3d orbitals are

(A) 3S = 3P = 3d (B) 3S < 3P < 3d

(C) 3S > 3P > 3d (D) None of these

Q 9. The number of orbitals with $n = 5, l \geq 2$ is

(A) 24 (B) 25

(C) 21 (D) 12

Q 10. The number of orbitals with $n = 6, |m_l| = 1$ is

(A) 8 (B) 10

(C) 12 (D) 5

Q 11. The number of orbitals with $n = 6, l \leq 3, m_l \geq 0$ is

(A) 10 (B) 9

(C) 12 (D) 25

Q 12. The number of orbitals with $n = 5, -1 \leq m_l \leq 2$ is

(A) 16 (B) 12

(C) 18 (D) 20

Q 13. Which of the following set of quantum numbers is not possible for orbital?

(A) $n = 5, m_l < 5$ (B) $n = 6, l \geq 6, m_l \leq 6$

(C) $n = 6, m_l \geq 4$ (D) $n = 5, l < 6$

11. Wave function, Node

Q 1. The radial part of wave function depends on

(A) principle quantum number

(B) Azimuthal quantum number

(C) Magentic field quantum number

(D) both A & B

Q 2. Which of the following function depends on only one quantum number

(A) Ψ (B) R

(C) Θ (D) φ

Q 3. For S-orbitals, since Ψ (orbital) is independent of angles, the probability (Ψ^2) is

(A) Also independent of angles

(B) spherically symmetric

(C) both A & B are correct

(D) both A & B are incorrect

Q 4. $|\Psi^2|$ represents

(A) probability density of finding electrons

(B) Probability of finding electron

(C) Node around nucleus

(D) None of these

Q 5. Orbital picture of S-orbitals is obtained by dot representation of

(A) dot representation of $|\Psi^2|$ vs r curve

(B) dot representation of Ψ vs r curve

(C) dot representation of Ψ vs (r, Θ, φ) curve

(D) by taking pircture of orbitals

Q 6. In orbital picture, sign represents sign of

(A) orbital (Ψ) (B) $|\Psi^2|$

(C) Probability (D) None of these

Q 7. The Schrodinger wave equation for hydrogen atom is

$$\Psi_{2s} = \frac{1}{4\sqrt{(2\pi)}}\left(\frac{1}{a_0}\right)^{3/2}\left(2 - \frac{r}{a_0}\right)e^{-r/a_0}$$

where a_0 is the Bohr radius . If the radial node in 2s be at r_0, then find r_0 in terms of a_0.

(A) a_0 (B) $2a_0$

(C) $4a_0$ (D) None of these

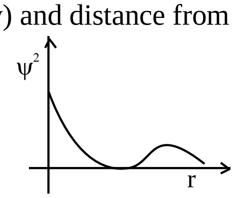
Q 8. The Schrodinger wave equation for hydrogen like species is

$$\Psi = \frac{1}{4\sqrt{(2\pi)}}\left(\frac{1}{a_0}\right)^{3/2} r\left(2 - \frac{3r}{a^0}\right)e^{-\frac{r}{a^0}}.\cos\theta$$

where a_0 is the Bohr radius . Which orbital above equation represent?

(A) 3S (B) 3d (C) 3P (D) 4d

Q 9. The following graph between $|\Psi^2|$ (Probability density) and distance from the nucleus represents



(A) 2S (B) 3S

(C) 1S (D) 2P

Q 10. Which of the statement is/are correct?

(A) no. of total nodes in an orbital = n –1

(B) no. of radial nodes in an orbital = n–ℓ–1

(C) no. of angular nodes in an orbital = ℓ

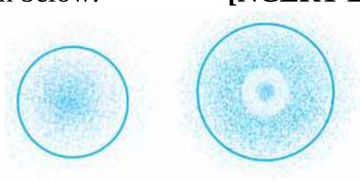
(D) All

Q 11. Which orbital has two angular nodal plane?
(A) S (B) P (C) d (D) f

Q 12. The number of nodal planes in Px orbital is
(A) 1 (B) 2 (C) 3 (D) 0

Q 13. The nucleus of an atoms located at X=Y=Z= 0. If probability of finding an S-orbital electron in a tiny volume around X=a, Y=Z= 0 is 1×10^{-5} , what is the probability of finding the electron in the same sized volume around X=Z= 0, Y= a, is
(A) 1×10^{-5} (B) 1×10^{-5} a
(C) 1×10^{-5} a^2 (D) 1×10^{-5} a^{-1}

Q 14. The probability density plots of 1s & 2s orbitals are given below. **[NCERT Examplar]**


1S 2S

The density of dots in a region represents the probability density of finding electrons in the region. On the basis of above diagram, which of the following statements is incorrect?
(A) 1S & 2S orbitals are spherical in shape.
(B) The probability density of finding electron is maximum near nucleus.
(C) The probability density of finding electrons at a given distance is equal in all direction.
(D) The probability density of electrons for 2S orbital decreases uniformly as distance from the nucleus increases.

Q 15. For given 'n' orbital have total no of nodes equal to
(A) n –1 (B) n^2(n –1)
(C) n(n –1) (D) None of these

Q 16. The total no of radial node in orbital with n = 3 is equal to
(A) 1 (B) 6 (C) 5 (D) 9

Q 17. Total no. of nodes with orbitals having quantum numbers $n=5, l\geq 2$ is
(A) 4 (B) 84 (C) 42 (D) None of these

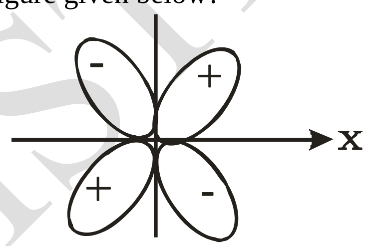
Q 18. The no. of angular nodes with orbitals having quantum no. $n=5, |m_l|=2$ is
(A) 24 (B) 18 (C) 6 (D) None of these

12. Probability of finding e^-, Orbital Picture

Q 1. The probability of finding an electron residing in a Px orbital is not zero
(A) in YZ Plane (B) in XY Plane
(C) in Y direction (D) in Z direction

Q 2. The maximum probability of finding an electron in d_{xy} orbital is
(A) along the X-axis (B) along the Y-axis
(C) at an angle of 45° from X–axis & Y–axis
(D) at an angle of 90° from X–axis & Y–axis

Q 3. The shape of which one of the orbitals corresponds to the angular wave function shows in the figure given below?



(A) $d_{x^2-y^2}$ (B) d_{z^2}
(C) d_{xy} (D) d_{xz}

Q 4. The 'd' orbital which has the maximum electronic probability density lying along two axes is known as
(A) $d_{x^2-y^2}$ (B) d_{z^2}
(C) d_{xy} (D) d_{xz}

Q 5. Which of the following orbital has conical node?
(A) $d_{x^2-y^2}$ (B) d_{z^2}
(C) p_z (D) d_{xz}

Q 6. The shape of orbital with the value of l = 2, m = 0 is **[AIIMS 2013]**
(A) spheircal (B) double dumbbell
(C) Trigonal Plananr (D) Square Planar

Q 7. Which of the following statements is incorrect?
(A) Probabilities are found by solving Schrödinger wave equation
(B) Energy of the electron at infinite distance is zero and yet it is maximum
(C) Some spectral lines of an element may have the same wave number
(D) The postion and momentum of a rolling ball can be measured accurately

Answer the Q.N. 194 to 196 from following paragraph

The hydrogen like species Li^{2+} is in spherically symmetric state S_1 with one radial node. Upon absorbing light the ion undergoes transition to state S_2. The state S_2 has one radial node and its energy is equal to the ground state energy of H-atom.

Q 8. The state S_1 is
(A) 1S (B) 2S (C) 2P (D) 3S

Q 9. Energy of state S_1 in units of the H-atom ground state energy is
(A) 0.75 (B) 1.50 (C) 2.25 (D) 4.50

Q 10. The orbital angular momentum quantum number of the state S_2 is
(A) 0 (B) 1 (C) 2 (D) 3

Q 11. Correct statement regarding 3Py orbital is
(A) Angular part of wave function is independent of ϴ & φ
(B) No. of maxima when a curve is plotted between $4\pi r^2 R^2(r)$ vs r is 2
(C) XY plane acts as nodal plane
(D) Magnetic quantum number must be –1

Q 12. For 1S-orbital in H atom $\psi_{1S} = K.e^{-r/a_o}$
The maximum probability of finding electron exist at distance ……from Nucleus
(A) a_o (B) 0
(C) $2a_o$ (D) infinite

Q 13. The most probable radius (in pm) for finding the electrons in He^+ is **[AIIMS 2005]**
(A) 0 (B) 52.9
(C) 26.45 (D) 105.8

Q 14. For an electron in a Hydrogen atom, the work function, Ψ is proportional to $\exp(r/a_0)$, where a_0, is the Bohr radius. What is the ratio of the probability of finding the electron at the nucleus to the probability of finding it at a_0.
(A) e (B) e^2
(C) 1/e (D) 0

Q 15. Which one of the following gives an electron a greater probability of being found close to the nucleus?
(A) 3s (B) 3p (C) 3d (D) 4s

Q 16. Which of the following orbitals have most probable distance closest to Nucleus?
(A) 3S orbital (B) 3P orbital
(C) 3d orbital (D) 4P orbital

Q 17. In multielectron system, energy of orbital depends on
(A) n – value (B) n & l – values
(C) l – values (D) None of these

Q 18. In a multielectron system, which of the following orbitals described by the three members will have the same energy in the absence of Magnetic & Electric fields? **[AIEEE 2004]**
(P) n = 0, l = 0, m = 0 (Q) n = 2, l = 0, m = 0
(R) n =2, l = 1, m = 1 (S) n = 3, l =2, m = 1
(A) S & T (B) R & S
(C) Q & R (D) P & Q

Q 19. The degeneracy of hydrogen atom that has energy equal to $-R_H/9$ is **[AIIMS 2016]**
(A) 6 (B) 8 (C) 5 (D) 9

Q 20. In He atom, degeneracy of 2^{nd} excited state is
(A) 3 (B) 9 (C) 2 (D) 4

Q 21. In Li atom, degeneracy of 4^{th} Energy level is
(A) 16 (B) 4 (C) 1 (D) 4

13. Electronic Configuration

Q 1. Aufbau principle is a subprinciple of
(A) Energy minimization principle
(B) Energy Maximistion principle
(C) Energy conservation principle
(D) None of these

Q 2. **Assertion (A)**: The energy of an electron is largly determined by its principle quantum number.
Reason (R): Priniciple quantum number 'n' is a measure of the most probable distance of finding electrons around the Nucleus. **[AIIMS 2013]**
(A) Both assertion and reason are true and the reason is the correct explanation of assertion
(B) Both assertion and reason are true and reason is not the correct explanation of assertion
(C) Assertion is true but the reason is false
(D) Both assertion and reason are flase

Q 3. As per Aufbau principle, the energies of 3p, 3d, 4s and 4p orbitals are such that
(A) 3p < 3d < 4s < 4p (B) 3p < 4s < 3d < 4p
(C) 3d < 3p <4s < 4p (D) 3d < 3p < 4p < 4s

Q 4. If n = 6, the correct sequence for filling of electrons will be **[CBSE PMT 2011]**
(A) $nS \longrightarrow (n-1)d \longrightarrow (n-2)f \longrightarrow nP$
(B) $nS \longrightarrow (n-2)f \longrightarrow nP \longrightarrow (n-1)d$
(C) $nS \longrightarrow nP \longrightarrow (n-1)d \longrightarrow (n-2)f$
(D) $nS \longrightarrow (n-2)f \longrightarrow (n-1)d \longrightarrow nP$

Q 5. **Assertion (A)**: A spectral line will be observed for a $2p_x - 2p_y$ transition.
Reason (R): The energy is released in the form of wave of light when electrons drops from $2p_x$ to $2p_y$ orbtial. **[AIIMS 2008, 1996]**
(A) Both assertion and reason are true and the reason is the correct explanation of assertion
(B) Both assertion and reason are true and reason is not the correct explanation of assertion
(C) Assertion is true but the reason is false
(D) Both assertion and reason are flase

Q 6. The quantum numbers +1/2 and −1/2 for the electron spin represents **[IIT-2001S]**
(A) rotation of electron in clockwise & anticlockwise direction respectively
(B) rotation of electron in anticlockwise and clockwise direction respectively
(C) magnetic moment of the electron pointing up and down respectively
(D) two quantum mechanical spin states which have no classical analogue

Q 7. If the nitrogen atom has the 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. Yes $1s^7$ is not observed because it violates **[IIT-2002S]**
(A) Heisenberg uncertainty principle
(B) Hund's rule
(C) Pauli exclusion principle
(D) Bohr postulate of stationary orbits

Q 8. If an electron has a spin quantum number of +1/2 and a magnetic quantum number of –1, it can't be present in **[CBSE PMT 1994]**
(A) f-orbtial (B) d-orbtial
(C) p-orbital (D) s-orbital

Q 9. If electronic configuration of oxygen atom is written as

2p
$1s^2, 2s^2$ [↑↓] [↑↓] [ ]

(A) Hund's rule
(B) Pauli exclusion principle
(C) Both Hund's rule & Pauli principle
(D) None of these

Q 10. The electronic configuration of an element is $1s^2,2s^2 2p^6,3s^2 3p^6 3d^5,4s^1$. This represents its
(A) excited state (B) ground state
(C) cationic state (D) anionic form

Q 11. Which one of the following set of quantum numbers represents an impossible arrangement?

	n	l	m_l	m_s
(A)	3	2	−2	½
(B)	4	0	0	½
(C)	3	2	-3	½
(D)	5	3	0	-½

Q 12. The maximum number of electrons present in an orbit that is represented by azimuthal quantum number l = 3, will be **[AIIMS 1996]**
(A) 8 (B) 2 (C) 14 (D) 6

Q 13. Consider ground state electronic configuration of Cr (24). The no. of electrons in azimuthal quantum no of l = 1 & 2 are respectively **[AIEEE 2004]**
(A) 16 & 4 (B) 12 & 5
(C) 12 & 4 (D) 16 & 5

Q 14. How many sub-shells are associated with n = 4? How many electrons will be present in subshell having m_s value of -1/2 for n = 4 ? **[NCERT]**

14. Electronic Configuration, Magnetic Moment

Q 1. An atom has four unpaired electrons. The total spin of this atom is
(A) ±1 (B) ±1.5 (C) ±2 (D) ±4

Q 2. The following transition occurs when Li atom are sprayed into hot flame. The various steps are numbered for identification.
$$2S \xrightarrow{I} 2P \xrightarrow{II} 3d \xrightarrow{III} 3P \xrightarrow{IV} 4S \xrightarrow{V} 3P$$
Which of the these transition results in emission of light?
(A) I, II & V (B) III & V
(C) III, IV & V (D) All

Q 3. If (n+l) values is more than 3 and less than 6, what will be the possible no of orbitals
(A) 9 (B) 10 (C) 6 (D) 13

Q 4. A transition element X has configuration $[Ar]3d^5$ in its +3 oxidation state. Its atomic number is
(A) 22 (B) 25 (C) 26 (D) 19

Q 5. Which has maximum no of unpaired d-electrons?
(A) Fe^{3+} (B) Cu^{2+}
(C) Co^{2+} (D) Mn^{2+}

Q 6. What is the no of possible exchange in $3d^4$ configuration?
(A) 4 (B) 6 (C) 8 (D) 3

Q 7. Which has maximum magnetic moment?
(A) Mn^{3+} (B) Cu^{2+}
(C) Fe^{3+} (D) V^{3+}

Q 8. An ion Mn^{a+} has the magnetic moment equal to 4.9 B.M. The value of a is
(A) 3 (B) 4 (C) 2 (D) 5

Q 9. An aqs solution containing V^{x+} ion has magnetic moment of $(15)^{1/2}$ B.M. The value of X is
(A) 5 (B) 2 (C) 4 (D) 1

Answer Key

1. J.J. Thomson Model, Milliken oil Droplet Experiment

(1). C (2). B (3). D
(4). B (5). C (6). B
(7). D (8). C (9). B
(10). B (11). A (12). B
(13). B (14). B (15). C
(16). B

2. Rutherford Model of Atomic Structure

(1). D (2). B (3). D
(4). A (5). A (6). A
(7). A (8). C (9). A
(10). B (11). D (12). A
(13). B (14). A (15). A
(16). A

3. Development of Quantum Physics

(1). A (2). A (3). D
(4). C (5). A
(6). 4.0×10^{14} Hz to 7.50×10^{14} Hz
(7). B (8). D (9). D
(10). C (11). A (12). B
(13). 2.012×10^{20} S^{-1} (14). B (15). 496 nm
(16). 4 x 10^{14} Hz (17). D
(18). A (19). 2.165×10^{-20}J
(20). 28 photons (21). 10 photons
(22). 8.282×10^{-10}J

4. Photoelectric Effect

(1). A (2). D (3). B
(4). C (5). C (6). A
(7). D (8). B (9). C
(10). 2.31×10^{5}J/mol, 517 nm (11). D
(12). 6.57 x 10^{-34} J.S (13). 6.26×10^{14} s^{-1}
(14). 7.767×10^{3} eV (15). B
(16). 4.48 eV

5. De-Broglie Hypothesis

(1). D (2). C (3). A
(4). B (5). A (6). B
(7). C (8). B
(9). 63.3 Volts (10). 0.123 A^0
(11). 4.26×10^{-16}J (12). 2:1 (13).A
(14). C

6. Bohr Model of Atomic Structure

(1). B (2). D (3). C
(4). D (5). A (6). B
(7). B (8). A (9). A
(10). D (11). C (12). B
(13). A (14). B (15). C
(16). A (17). D (18). C
(19). C

7. Ionisation Energy, H – Spectrum

(1). C (2). A (3). A
(4). 2.18×10^{-18} J (5). D
(6). D (7). B (8). 494 KJ/mol
(9). B (10). C (11). A
(12). C (13). D (14). D
(15). D (16). 6.91×10^{14} Hz , 434 nm
(17). D (18). 1.524×10^{5} m^{-1}
(19). C (20). 1.33×10^{9}

8. Problems on Bohr Model

(1).D	(2). 15	(3). B
(4). A	(5). C	(6). C
(7). D	(8). C	(9). B
(10). D	(11). A	(12). C
(13). D		

9. Quantum Model, Heisenberg Principle

(1). D	(2). C	(3). B
(4). B	(5). C	(6). B
(7). B	(8). A	(9). D
(10). C	(11). D	(12). A
(13). C	(14). C	(15). C
(16). B	(17). B	(18). A
(19). D		

10. Schrodinger equation & Quantum Number

(1). C	(2). C	(3). C
(4). A	(5). B	(6). A
(7). C	(8). A	(9). C
(10). B	(11). A	(12). A
(13). B		

11. Wave function, Node

(1). D	(2). D	(3). C
(4). A	(5). A	(6). A
(7). B	(8). C	(9). A
(10). D	(11). C	(12). A
(13). A	(14). D	(15). B
(16). C	(17). B	(18). B

12. Probability of finding e^-, Orbital Picture

(1). B	(2). C	(3). C
(4). A	(5). B	(6). B
(7). C	(8). B	(9). C
(10). B	(11). B	(12). A
(13). C	(14). D	(15). A
(16). C	(17). B	(18). A
(19). D	(20). A	(21). C

13. Electronic Configuration

(1). A	(2). A	(3). B
(4). D	(5). D	(6). D
(7). C	(8). D	(9). A
(10). B	(11). C	(12). C
(13). B	(14). S, p, d, f and 16	

14. Electronic Configuration, Magnetic Moment

(1). C	(2). B	(3). D
(4). C	(5). C	(6). B
(7). C	(8). A	(9). B