CHEMISTRY

BOOKS - R SHARMA CHEMISTRY (HINGLISH)

STRUCTURE OF ATOM

Example

1. Finding atomic makeup: One of the isotopes of uranium used in nuclear power plant is $._{92}^{235}U$. Ho many protons, neutrons, and electrons does an

atom of ${}_{92}^{235}U$ have?

Strategy: The number at the bottom left of the element's symbol is the atmoic number indicaring atom. from the mass number at the top left, we know the number of nucleous (protons plus neutrons). Thus, the number of neutrons equals the difference between the mass number (superscript) and atomic number (subscript).

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2. The numbers of electrons, protons, and neutrons in a species are equal to 18, 16, and 16, respectively.

Write the symol for the species in the standard format.

Strategy: Before usding the standard notation $_{}(Z)^{A}X$, find out wheter the species is a neutral atom, a cation, or an anion. if it is a neutral atom, Eq is valid, i.e.

Number of protons = Number of electrons = Atomic number

If the species is an ion, determine whether the number of protons is larger (cation, a positive ion) or smaller (anion, a negative ion) than the number of electrons. Number of neurtons is always given by Eq. i.e., $N = A - Z$, whether the species is neutral or charged.

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3. An element with mass number 81 contains $31.7\,\%$ more neutrons as compared to protons. Write the symbol for the isotope in the standard fromat.

Strategy: Let us assume that the number of protons $= p$. Then, Number of neutrons $(n) = p + 31.7\,\%$ of p

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4. A women on the deck of a ship anchored in the ocean observes that the crests of passing waves are $11m$ apart and that the crest hits the bow of the ship every $3.0s$. Calculate the velocity of the waves.

Strategy: According to Eq. we can calculate the velocity u, provided the values of wavelength λ and frequency v of the waves are known.

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5. The light-blue glow given off by mercury street-lamps has a wavelength of $436nm$. What is its

frequency in hertz?

Strategy: We given a wavelength and need to find the frequency. Wavelength and frequency are inversely related by the equation $\lambda v = c$, which can be solved for v. Remember to convert λ from nanometers to meters.

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6. Energy of radiation: Consider ultraviloet radiation of frequency $2.73 \times 10^{16} s^{-1}$and yellow light of frequency $5.26 \times 10^{14} s^{-1}$. Calculate the enegry, in joules, of an individual quantum of each.

Compare these photos by claculating the ration of their energies.

Strategy: Use each frequency to calculate the quantum enegry from the relationship, $E = hV$. then calculate the required ratio.

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7. The threshold frequency, v_0, of a metal is $6.7 \times 10^{14} s^{-1}$. Calculate the maximum kinetic enegry of a single electron that is emitted when a radiation of frequency $v = 1.0 \times 10^{-15} s^{-1}$ strikes the metal.

Strategy: Use the relatiship between v_0, v, and KE given in Eq.

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8. The work function for sodium metal is $2.46eV$. Determine the cutoff wavelength for sodium?

Strategy: The cutoff frequency v_0 is related to the work function through the relation $v_0 = W_0/h$. This corresponds to a cutoff wavelength of $\lambda_0 = \frac{C}{v_0} = \frac{C}{W_0/h} = \frac{hc}{W_0}$. wavelength grater than λ_0 for a metal with work function W_0 produce no photoelectric effect.

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9. When electromagnetic radiaiton of wavelength $300nm$ falls on the surface of sodium electrons are emitted with a kinetic enegry of $1.68 \times 10^5 Jmol^-$. What is the minimum enegry needed to remove an electorn from sodium?

Strategy: The minimum enegry required to remove an electron from target metal is called work function W_0 of the metal. It can be calculated from Eq., provided we know the energy of the incident photon and kinetic enegry of a single photoelectorn.

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10. Calculate the wavelength of the two spectral lines with the longest wavelengths (called the first two lines) in the visible region of the atomic spectrum of hydrogen,

Strategy: Use Balmer's formula, Eq. to calculate the wavelength of visible lines in the atmoic emission spectrum of hydrogen. To calculate the wavelengths of the first two lines, used the two smallest allowed integers, $n = 3$and $n = 4$, in the Balmer formula because λ is inversely related to n.

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11. What are the two longest wavelength lines (in nanometers) in the Lyman series of the hydrogen spectrum?

Strategy: The Lyman series is given by the Balmer-Rydberg equation with $n = 1$ and $m > 1$. Since the left side of Eq. is a fraction that has λ in the denominator, the value of λ (the wavelength) increases as the value of the term on the right side of the equation decreases. Since the value of $1/n^2$ is now fixed and we need to subtract $1/m^2$ from this, the wavelength λ is the greatest when $1/m^2$

is the largest or when m is the smallest, i..e., when $m = 2$ and $m = 3$.

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12. What is the shortest wavelength (in nanometers) in the Lyman series of the hydrogen spectrum?

Strategy: The Lyman series is given by the Balmer - Rydberg equation with $n = 1$ and $m > 1$. The shortest-wavelength line occurs when $1/m^2$ is zero or when m is infinitely large (i.e., if $m = \infty$, then $1/m^2 = 0$).

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13. The wavelength of one line in the visible region o fthe atmoic spectrum of hydrogen is $6.5 \times 10^{-7} m$. This radiation is emitted when electron in a hydrogen atom goes from a high enegry state to a lower energy state. Calculate the difference in enegry between the two states.

Strategy: According to the Bohr frequency rule, if the electron jumps from one orbit whose quantum number is n_1 to a second orbit whose quantum number is n_f, the difference in enegry (ΔE) is related to the frequency (v) of the radiation which

in turn is related to the wavelength (λ):

? $\Delta E = hv$ and $v = \dfrac{c}{\lambda}$

Thus, $\Delta E = \dfrac{hc}{\lambda}$

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14. Calculate the radius of the first Bohr orbit for the hydrogen atom

Strategy: The radius of the first Bohr orbit for the Hatom can be obtained directly from Eq.

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15. Calculate the radii of the first two Bohr orbits of Li^{2+}.

Strategy: Use Eq. and proper values of n and Z. The atmoic number of Li is 3.

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16. Calculate the enegry of an electron in the first Bohr orbit if a hydrogen atom.

Strategy: Use Eq. to obtain directly the energy of the lowest stationary state (or ground state).

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17. Calculate the enegry of an electron in the second Bohr orbit of an H atom.

Strategy : Use Eq. and proper values of n and Z. Atomic number of the H-atom is 1.

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18. Calculate the velocity of an electron in the first Bohr orbit of a hydrogen atom

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19. Calculate the velocity of an electron in the second Bohr orbit of Be^{3+}.

Strategy: Use Eq. with proper values of n and Z. Atomic number of the Be atom is 4.

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20. The electron in the hydrogen atom makes a transition from the $n = 2$ energy level (or state) to the ground state (corresponding to $n = 1$). Find the frequency of the emitted photon.

Strategy: Use Eq. directly to obtain $\bar{v}$, with $n_f = 1$ (ground state) and $n_i = 2$. Then find the frequncy.

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21. The Balmer series for the hydrogen atom corresponding to electronic transition that terminate in the state of quantum number $n = 2$. Find the longest-wavelength photons emitted and determine its enegry.

Strategy: The longest-wavelength photon is associated with the smallest enegry difference. Its emission in the Balmer series results from the transition form $n_i = 3$to $n_f = 2$.

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22. Calaculate the ionization enthalpy of the hydrogen atom is its ground state.

Strategy: The ionization enthalpy $\left(\Delta_f H\right)$ is the minimum enegry required to take the electron from the ground state to the first unbound state so that the electron effectively escapes from the influence of the nucleus. This corresponds to exciting the electron from $m = 1$ enegry state to $n = \infty$ enegry state.

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23. Calaculate the wavelength of the particle in the following tow cases: (i) The fastest serve in tennis is about 130 miles per hour, or $58ms^{-1}$. Calculate the wavelength associated with a $6.0 \times 10^{-2}kg$ tennis bell travelling at this speed. (ii) Calculate the wavelength associated with an electorn moving at $58ms^{-1}$.

Strategy : The de Broglie relationship says that the wavelength λ of an object with mass $m$moving at a velocity v can be calculated by the equation $\lambda = h/mv$.

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24. Assume that we are travelling at a speed of $90 kmh^{-1}$ in a small car with a mass of $1250 kg$. If the unceratinty in the velocity of the car is $1\,\%\,\left(\Delta v = 0.9 kmh^{-1}\right)$, what is the uncertainty (in metars) in the position of the car?

Strategy: Heisenberg's uncertainty relasionship states that the uncertainity in an object's position, Δx, times the uncertainty in its momentum, Δp_x, is equal to or greater than the quantity $h/\pi 4$. In the present case, we need to find Δx when Δv is known. We need to convert Δv into ms^{-1}).

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25. The mass m of an electron is $9.1 \times 10^{31} kg$ and the velocity v of an electron in the first Bohr orbit of a hydrogen atom is $2.2 \times 10^{6} ms^{-1}$. Assuming that the velocity is known within $10\,\%\,(\Delta v = 0.22 \times 10^{6} ms^{-1})$, calculate the uncertainty in the electron's position in a hydrogen atom.

Strategy: According to Heisenberg's principle, the uncertainty in the postion (Δx) of any moving particle multiplied by the uncertainity of momentum (Δp_x) can never be less than $h/4\pi$. In the given case, Δv is known and we need to find Δx.

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26. Calculate the orbital angular momentum of an electron in a p state of hydrogen.

Strategy: Orbital angular momentum in related to azimuthal quantum number. Use Eq. directly to calculate the orbital angular momentum.

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27. Determine the number of enegry states in the hydrogen atom corresponding to the principle quantum number n $= 2$ and calculate the energies

of these states.

Strategy: An energy state of the hydrogen atom can be respresented by the wave function ψ_{n,l,m_l}, which can be specified by sunstituting the values of the three quantum numbers.

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Follow Up Test 1

1. Which of the following is given the credit for discovering the electron?

A. William Crookes

B. G.J.Stoney

C. J.J. Thomosn

D. Michael Faraday

Answer: C

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Follow Up Test

1. Cathod rays are not waves but are composed of electrically charged particles as they are deflected by

A. magnetic fields

B. electric fields

C. both magnetic and electric fields

D. neither magnetic nor electric fields

Answer: C

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2. Thomson found that cathode rays move at about_____the speed of light.

A. one-fifth

B. one-sixth

C. one-fourth

D. one-third

Answer: A

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3. An electron is a fundamental subatomic particle which carries one unit negative charge and has a mass nearly equal to $1/186$ the mass of an_____atom.

A. He

B. H

C. Be

D. Li

Answer: B

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4. The forerunner of today's television tube is the

A. Xray tube

B. anode ray tube

C. cathode ray tube

D. picture tube

Answer: C

5. A strong fluoresence, i.e., emission of light is observed is bombarded by the electrons.

A. zinc sulphide

B. sodium sulphide

C. hydrogen sulphide

D. magnesium sulphide

Answer: A

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6. Canal ray particles have e/m ratio many times smaller than those of electrons due to their

A. much lower charges

B. much lower masses

C. much higher charges

D. much greater masses

Answer: D

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7. When difference elements are present in the discharged tube positive ions with different_____are observed.

(i) charges (ii) masses (iii) e/m ratios

A. $(i), (iii)$

B. $(ii), (iii)$

C. $(i), (ii), (iii)$

D. $(i), (ii)$

Answer: C

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8. In Millikan's experiment, static electric charge on the oil droplets two obtained by shining X rays. If the static electric charges on an oil drople is $-1.282 \times 10^{-18} C$, the number of electrons captured by the droplet is

A. 8

B. 6

C. 7

D. 5

Answer: A

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9. Which of the following forces act on oil drops in Millikan's experiment?

A. Gravitational

B. Electrostatic

C. Viscous

D. All of these

Answer: D

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10. It is possible to take an X ray photograph (radiograph) of the bones of a living person because

A. bones are white in color

B. bones are very hard

C. bones are more opaque than the surrounding flesh

D. bones are flexible

Answer: C

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11. Which of the following is incorrect?

A. The gamma (γ) rays are high-enegry radiations.

B. Like X rays, gamma rays are neutral in nature and do not consist of charged particles.

C. Two of the three types of rays emitted by radioactive elements can get deflected when passed between two oppositely charged metal plates.

D. As regards penetrating power, γ rays are the least, followed by αparticles and β particles.

Answer: D

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12. Alpha (α) particles are

A. He atoms

B. He^{2+} ions

C. He^{+} ions

D. He^{-} ions

Answer: B

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13. Studies on the phenomenon of radioactivity supported the conclusion that the

(i) atom was divisible

(ii) atom could spilt into netural particles

(iii) atom could split into charged particles

(iv) atom was indivisible

A. $(i), (iii)$

B. $(ii), (iii)$

C. (i)

D. (iv)

Answer: A

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14. Which of the following is incorrect for Thomson's model of the atom?

A. The stability of the atom was due to the balance between the repulsive forces between the electrons and their attraction towards the cnetre of the positive sphere.

B. In Thomson's model, the positive charge of the atom was so diffuse that the positive α particles were expected to pass through

without and deflection or with very little deflection.

C. Thomson's model could be visualized as a watermelon of positive charge with seeds (electrons) embedded into it.

D. Mass of the atom is considered to be unevenly spread over the atom.

Answer: D

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15. Rutherford's experiment on the scattering of α particles slowed for the first time that the atom has

A. protons

B. nucleus

C. neutrons

D. electrons

Answer: B

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16. Rutherford's scattering experiment is related to the_____of the nucleus.

A. size

B. mass

C. color

D. none of these

Answer: A

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17. Rutherfords experiments , which established the nuclear model of atom , used a beam of:-

A. helium atoms, which impinged on a gold foil and got scattered

B. β particles, which impinged on a gold foil and got scattered

C. helium nuclei, which impinged on a gold foil and got scattered

D. γ rays, which impinged on a gold foil and got scattered

Answer: C

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18. The radius of an atomic nucleus is of the order of

A. $10^{8-}cm$

B. $10^{-10}cm$

C. $10^{-15}cm$

D. $10^{-13}cm$

Answer: D

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19. Ordinary "lead" pencils actually are made of a form of carbon called graphite. If a pencil line is $0.35mm$ wide and the diameter of a carbon atom is $1.5 \times 10^{-10}m$, how many C atom wide is the line?

A. 2.3×10^6 atoms

B. 7.8×10^6 atoms

C. 5.6×10^6 atoms

D. 9.7×10^6 atoms

Answer: A

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20. Rutherford's α particle scattering experiment eventually led to the conclusion that

A. neutrons are buried deep in the nucleus

B. the point of impact with matter can be precisely determined

C. electrons occupy space around the nucleus

D. mass and energy are related

Answer: C

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21. Which of the following symbols are not acceptable ?

(i) ${}_{35}^{79}\cdot Br$ (ii) ${}^{79}\cdot Br$

(iii) ${}_{79}^{35}\cdot Br$ (iv) ${}_{35}\cdot Br$

A. $(ii), (iv)$

B. $(iii), (iv)$

C. $(ii), (iii), (iv)$

D. $(ii), (iii)$

Answer: B

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22. The increasing order (lowest first) for the values of e/m (charge//mass) for electron (e), proton (p), neutron (n), and alpha particle (α) is

A. n, p, α, e

B. e, p, n, α

C. n, p, e, α

D. n, α, p, e

Answer: D

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23. Which of the following characterize Xrays?

(i) X rays have wavelengths shorter than ultraviolet rays.

(ii) The radiation can ionize gases.

(iii) They are deflected by electric and magnetic fields.

(iv) They cause ZnS to fluoresce.

A. $(i), (ii), (iii), (iv)$

B. $(ii), (iv)$

C. $(i), (ii), (iv)$

D. $(ii), (iii), (iv)$

Answer: C

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24. An isotone of $._{32}^{76}Ge$ is

(i) $._{33}^{77}As$ (ii) $._{34}^{77}Se$

(iii) $._{34}^{78}Se$ (iv) $._{32}^{77}Ge$

A. $(i), (iii)$

B. $(ii), (iv)$

C. $(i), (iv)$

D. $(iii), (iv)$

Answer: A

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25. Many elements have non-intergral atomic masses because

(1)the constituents neutrons, protons, and electrons, commbine to give fractional masses

(2) they have isotopes

(3) their isotopes have nonintergal masses

(4) their isotopes have different masses

A. $(i), (ii), (iii), (iv)$

B. $(ii), (iii), (iv)$

C. $(ii), (iv)$

D. $(iii), (iv)$

Answer: B

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26. The sun of the number of neutrons and protons in the isotope of hydrogen is

A. 6

B. 5

C. 4

D. 3

Answer: D

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27. The atomic nucleus contains

(i) protons (ii) neutrons

(iii) quarks (iv) leptons

A. $(i), (ii)$

B. $(i), (ii), (iii), (iv)$

C. $(i), (ii), (iv)$

D. $(i), (ii), (iii)$

Answer: D

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28. Decrease in atomic numebr is not observed during

A. alpha emission

B. beta emission

C. positron emission

D. electron capture

Answer: B

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29. Which of the following is incorrect?

A. The mass of an H atom is $1.66 \times 10^{-27} kg$.

B. Isotopes of an element duffer in the number of nucleous in their nuceli.

C. Elements of same mass number but different atomic number are known as isobars.

D. In a given electric field, β particles are deflected more than α particles having large charge.

Answer: B

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30. Avogardo's number is the number of atomic mass units in one

A. gram

B. miligram

C. Kilogram

D. decigarm

Answer: A

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31. Mass sepctrometers are instruments that measure

(i) the charge-to mass ratio of charged particels

(ii) mass of isotopes

(iii) isotopic abundance

A. (iii)

B. (i)

C. $(ii), (iii)$

D. $(i), (ii), (iii)$

Answer: D

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32. A beam of Ne^{+} ions in the mass spectrometer is split into_____segments.

A. two

B. three

C. four

D. no splitting at all

Answer: B

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33. The electromagnetic spectrum consists of a continuous range of wavelengths and frequencies, form_____at the lowest frequency end to____at the highest frequency end.

A. radio waves, gamma rays

B. microwaves, X rays

C. microwaves, gamma rays

D. radio waves, X rays

Answer: A

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34. Electromagnetic waves in the_____region have a wave length that is approximately the same as the diameter of an atom $\left(10^{-10}m\right)$.

A. gamma rays

B. Xrays

C. ultraviolet rays

D. microwaves

Answer: B

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35. Different kinds of electromagnetic radiations are simply electromagnetic waves with different

(i) wavelengths (ii) frequencies

(iii) speeds

A. $(i), (ii), (iii)$

B. $(i), (iii)$

C. $(ii), (iii)$

D. $(i), (ii)$

Answer: D

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36. The intensity of radient enegry, according to the wave theory, is proportional to the square of the

A. wave amplitude

B. wavelength

C. frequency

D. speed

Answer: A

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37. Which of the following are not electromagnetic waves?

(i) sound waves (ii) radiowaves

(iii) X rays (iv) water waves

A. $(ii), (iii)$

B. $(i), (iv)$

C. $(i), (ii)$

D. $(iii), (iv)$

Answer: B

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38. Each type of electromagnetic radiation is spread over a specific range of wavelengths (and frequencies). The visible region ranges from

A. $500nm$ to $800nm$

B. $400nm$ to $750nm$

C. $400nm$ to $700nm$

D. $500nm$ to $850nm$

Answer: C

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39. Which of the electromagnetic waves result from charges within the nucleus of the atom?

A. Long radio waves

B. Visible light waves

C. X rays

D. Gamma rays

Answer: D

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40. In 1873, James Maxwell proposed that visible light consists of electromagnetic waves. According to Maxwell's theory, an electromagnetic wave has an electric. Field component and a magnetic field compound. Which of the followong is incorrect regarding the two components?

A. They have the same wavelength.

B. They have the same frequency.

C. They are coplanar.

D. They travel with the same speed.

Answer: C

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41. Which of the following is not correct?

A. A wave is a vibrating disturbance by which enegry is transmitted.

B. The speed of a wave depends on the type of wave and the neture of the medium through which the wave is traveling (for example, air water, or vaccum).

C. Wave from repeats itself at regular intervals.

D. Waves having different wavelengths and frequencies will also have different wave amplitudes.

Answer: D

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42. Which of the following is not correct?

A. The fundamental sources of electromagnetic waves are accelerating electric charges.

B. Electromagnetic waves carry momentum and hence, can exert pressure on surfaces.

C. Electromagnetic waves carry energy.

D. Electromagnetic waves are longitudinal waves.

Answer: D

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43. Calculate the wavenumber of yellow radiaiton having wave length 5800Å.

A. $1.724 \times 10^4 cm^{-1}$

B. $2.742 \times 10^4 cm^{-1}$

C. $4.271 \times 10^4 cm^{-1}$

D. $2.174 \times 10^4 cm^{-1}$

Answer: A

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44. Each photon of light has a particaular amount (a quantum) of enegry. The amount of energy possessed by a photon depends on the_____of the light.

(i) speed (ii) frequency

(iii) wavelength

A. $(i), (ii), (iii)$

B. $(i), (ii)$

C. $(ii), (iii)$

D. $(i), (iii)$

Answer: C

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45. Enegry of one mole of photons of radiation whose frequency is $5 \times 10^4 Hz$ is____$kJmol^{-1}$.

A. 288.54

B. 478.56

C. 789.01

D. 199.51

Answer: D

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46. A 100 watt buble emits monochromatic light of wavelength 400 nm. Then the number of photons emitted per seccond by the buble is nearly -

A. 2.012×10^{20}

B. 3.475×10^{20}

C. 7.860×10^{20}

D. 5.786×10^{20}

Answer: A

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47. Find the ratio ofenergy of a photon of 2000Å wavelength radiation to that of 4000Å radiation .

A. $\frac{1}{4}$

B. 4

C. 2

D. $\frac{1}{2}$

Answer: B

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48. Which of the following are high-enegry radiations?

(i) Ultraviolet rays (ii) Infrared rays

(iii) X rays (iv) γ rays

A. $(i), (ii), (iii), (iv)$

B. $(iii), (iv)$

C. $(i), (iii), (iv)$

D. $(ii), (iii), (iv)$

Answer: C

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49. The maximum kinetic energy of the photoelectrons is related to the stopping potential (v_0) thorugh the relation

A. $KE_{\max} = eV_0$

B. $KE_{\max} = e/V_0$

C. $KE_{\max} = eV_0^2$

D. $KE_{\max} = e\sqrt{V_0}$

Answer: A

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50. A sodium (Na) surface is illuminated with light of wavelength $300nm$. The work function for Na metal is $2.46eV$. The kinetic enegry of the ejected photoelectrons is

A. $3.67eV$

B. $0.68eV$

C. $1.64eV$

D. $2.02eV$

Answer: C

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51. The ejection of the photoelectron from the silver metal in the photoelectric effect exeriment can be stopped by applying the voltage of $0.35V$ when the radiation $256.7nm$ is used. Calculate the work function for silver metal.

A. $4.45eV$

B. $7.86eV$

C. $5.36eV$

D. $6.78eV$

Answer: A

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52. The sodium lamp has some advantage over the mercury lamp such as

(i) for a given input of electricity, the sodium lamp gives off greater light intensity than does the mercury lamp.

(ii) yellow light has a longer wavelength than bluish-green light.

(iii) human eye exhibits its greatest reponse for yellow color.

A. $(i), (iii)$

B. $(ii), (iii)$

C. $(i), (ii), (iii)$

D. $(i), (ii)$

Answer: C

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53. Which of the following is correct?

(i) A fluorescent lamp, like the ones commonly found in offices, is a discharged tube in which the inner surface is coated with a fluoresecnet material such as zinc sulphide which is also used on TV screen.

(ii)The fluorescent tube is filled with ercury vapor at low pressure. Excitation of the Hg atoms by electron bombardment cause the emission of light in the green, blue, and ultraviolet (UV) regions.

(iii) When the light strike the inner glass wall, most of the UV light is abosorbed by the fluorescent material, which then emits a multitude of longer wavelengths that combine to produce white light.

(iv) Fluorescent lamps are more enegry-efficient and, hence, cheaper to operate than tungsten lamp (ordinary light bulbs).

A. $(i), (iv)$

B. $(ii), (iii), (iv)$

C. $(i), (ii), (iii)$

D. $(i), (ii), (iii), (iv)$

Answer: D

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54. Which of the following gases can be used to make neon signs?

(i) Neon (ii) Argon

(iii) Krypton

A. $(i), (ii), (iii)$

B. (i)

C. $(i), (ii)$

D. $(i), (iii)$

Answer: A

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55. Line spectrum is the characteristic of a sample of atoms in the

A. gas phase

B. liquid phase

C. solid phase

D. plasma state

Answer: A

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56. When a narrow beam while light is passed through a glass prism, the different wavelength travel thorugh the glass at

A. same speed

B. differebt speeds (rates)

C. same intensity

D. same frequency

Answer: B

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57. Rutherford's nuclear model of atom was rejected because it failed to explain

(i) the line spectra of atoms

(ii) the alpha particle scattering experimeny results

(iii) the stability of atom

A. $(i), (ii), (iii), (iv)$

B. $(ii), (iii)$

C. $(i), (iii)$

D. $(i), (ii)$

Answer: C

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58. The___of lines are the only linesin the hydrogen spectrum which appear in the visible region of the electromagnetic spectrum.

A. Pfund series

B. Brackett series

C. Paschen series

D. Balmer series

Answer: D

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59. The wavelength of the various lines in the hydrogen atomic emission spectrum can be related by a mathematical equation:

$$\frac{1}{\lambda} = R\left(\frac{1}{n^2} - \frac{1}{m^2}\right)$$

What is the value of n for the Pfund series of lines?

A. 6

B. 5

C. 4

D. 3

Answer: B

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60. What is the value of m in the Rydberg formula for the third spectral line of the Lyman series?

A. 0

B. 1

C. 4

D. 3

Answer: C

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61. According to Bohr's frequency rule, the frequency of radiotion obsorbed or emitted when transtion occurs between two stationary states that differ in enegry by ΔE is given by

A. $\Delta E.\ h^2$

B. $\Delta E / h$

C. $\Delta E.\ h^2$

D. $\Delta E.\ \sqrt{h}$

Answer: B

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62. Bohr's radius (a_0) is the radius of the_____stationary state of hydrogen atom.

A. highest

B. second

C. first

D. zero

Answer: C

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63. Enegry associated with an electron of hydrogen atom is given by the expression

A. $R_H\left(\frac{1}{n^2}\right)$

B. $-R_H n^2$

C. $R_H n^2$

D. $-R_H\left(\frac{1}{n^2}\right)$

Answer: D

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64. Which of the following is correct?

(i) The energy of an electron in an H atom has a negative sign for all possible orbits.

(ii) The enegry of an electron in the atom is lower than the enegry of a free electron at rest.

(iii) A free electron at rest is an electron that is

infinitely far away form the nucleus and is assigned the enegry value of zero.

(iv) As the electron gets closer to the nucleus (as n decreases), E_n becomes larger in absolute value and more and more negative.

A. $(i), (ii), (iii), (iv)$

B. $(ii), (iii), (iv)$

C. $(i), (ii), (iii)$

D. $(i), (ii), (iv)$

Answer: A

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65. Bohr's theory can be applied to the hydrogen-like species $\left(He^{+}, Li^{2+}, Be^{3+}\right.$, and so on). With the increase of Z (atomic number), the value of enegry becomes____and that of radius becomes_____.

A. less negative, larger

B. more positive, smaller

C. less positive, large

D. more negative, smaller

Answer: D

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66. The magnitude of velocity of the electron_____with increase of positive charge on the nucleus and__with increase of pricipal quantum number.

A. increases,increases

B. increases, decreases

C. decreases, increases

D. decreases, decreases

Answer: B

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67. If in a gaseous sample of one mole of Hatoms in the ground state the electron in very H atom is excited to the $5th$ orbit, then how many spectral lines would appear in its absorption spectrum?

A. 6.022×10^{23}

B. Infinite

C. Just one

D. Ten

Answer: C

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68. If in a gaseous sample of one mole of hydorgen atoms, the electron in every H atom is present in the $5th$ orbit, then how many spectral lines would appear in its emission spectrum?

A. Ten

B. Five

C. Seven

D. Four

Answer: A

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69. What is the wavelength of a photon emitted during a transition form the $n_i = 5$ state to the $n_f = 2$ state in the H atom?

A. $568nm$

B. $786nm$

C. $434nm$

D. $678nm$

Answer: C

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70. Which of the following is cprrect regarding Bohr's theory?

(i) Elecrtronic energy is quantized.

(ii) Bohr showed the physical meaning of the two whole numbers n and m in the Balmer-Rydeberg equation.

(iii) Electrons can only be in certain discrete orbits.

(iv) Electrons absorb or emit enegry in discrete amounts as they more form one orbit to anothe.

A. $(i), (ii), (iii), (iv)$

B. $(i), (ii), (iii)$

C. $(ii), (iii), (iv)$

D. $(i), (ii), (iii), (iv)$

Answer: D

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71. Materials that have a color, such as dyed textiles and painted walls, appear colored because of the absorption of light. When white light falls on a substance that absorbs red light, the color components that are not absorbed are reflected. The substance thus appears.

A. orange-red

B. blue-green

C. violet

D. yellow

Answer: B

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72. The splitting of spectral lines in an external magnetic field is known as the

A. Stark effect

B. Zeeman effect

C. Bohr effect

D. Sommerfeld effect

Answer: B

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73. How many Bohr-Sommerfeld orbits are possible for $n = 4$?

A. Eight

B. Sixteen

C. Four

D. Six

Answer: C

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74. Which of the following is correct?

(i) A particle of light, a photon, has a definite enegry $E = hv$.

(ii) The photon has momentum, mc.

(iii) The momentum of photon is related to the wavelength of the light.

A. $(i), (ii)$

B. $(i), (ii), (iii)$

C. $(i), (iii)$

D. $(ii), (iii)$

Answer: B

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75. Which of the following is the limatation of de Broglie's analysis?

A. Waves associated with macroscopic particles cannot be detected.

B. Diffraction of electrons by a crystal.

C. States having zero orbital angular momenutm do exist.

D. Waves can behave like particles and particles can exhibit wave properties.

Answer: C

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76. Which of the following equations implies that a particle in motion can be treated as a wave and a wave can exhibit the properties of a particle?

A. $2\pi r = n\lambda$

B. $\lambda = \frac{h}{m}$

C. $2\pi r = nh$

D. $\lambda = \frac{h}{mv}$

Answer: D

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77. The standing waves are generated by plucking a guitar string. The length of the string (l)must be equal to a whole number times

A. λ

B. $\frac{\lambda}{2}$

C. $\frac{\lambda}{3}$

D. $\frac{\lambda}{4}$

Answer: B

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78. The kinetic enegry of a moving electron is $3.0 \times 10^{-25} J$. Calculate its wavelength.

A. $786nm$

B. $520nm$

C. $897nm$

D. $623nm$

Answer: C

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79. A particle of charge q and mas m si accelerated from set through a potential difference V. Its de Broglie wavelength is equal to

A. $\sqrt{\frac{h}{2mqV}}$

B. $\frac{hqV}{\sqrt{2m}}$

C. $\sqrt{\frac{hqV}{2m}}$

D. $\frac{h}{\sqrt{2mqV}}$

Answer: D

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80. Find out the number of waves made by a bohr electron in one complete revolution in its third orbit.

A. 9

B. 3

C. 6

D. 12

Answer: B

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81. The uncertainty principle is one of the basis principle of modern science. This principle rules out the existence of definite trajectroies but we continue to talk of paths of cars, balls, planets, etc., because

A. these objects are visible to us

B. the effect of the uncertainty principle is important for the motion of microscopic objects

C. the effect of the uncertainty principle is negligible for macroscopic objects

D. the value of Planck's constant is very small

Answer: C

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82. Heisenberg's uncertainty principle is the direct consequence of

(i) wave nature of radiation

(ii) wave-particle dualoty of radiation

(iii) particle nature of matter

(iv) wave-particle duality of matter

A. (i)

B. (iii)

C. (ii)

D. $(ii), (iv)$

Answer: D

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83. The solutions (there are many) to the Schrddot(o)dinger equation are called

(i) wave functions (ii) orbitals

(iii) orbits (iv) trajectories

A. $(i), (iii)$

B. $(i), (iv)$

C. $(i), (ii)$

D. $(ii), (iv)$

Answer: C

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84. The best way to think about a wave function is to regard it as an expression whose_____defines the probability of finding the electron within a given volume of space around the nucleus.

A. cube

B. square

C. square root

D. cube root

Answer: B

85. A1though quantum mechanics tells us that we cannot pinpoint an electorn in an atom, it does define the region where the electron might be at a given time. The concept of_____gives the

probability that an electron will be found in a particular region of an atom.

A. electron mass

B. electron charge

C. electron size

D. electron density

Answer: D

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86. The mathematical approach of quantum mechanics involves treating the electon in an atoms as a _____wave.

A. standing

B. matter

C. water

D. sound

Answer: A

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87. In 1926, Erwin Schrddot(o)dinger modified an existing equation that described a three-dimensional standing wave by imposing wavelength restrictions suggested by de Broglie's idea. It is a differential equation of the type

A.

$$\frac{h^2}{8\pi^2 m}\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2 \psi}{\partial y^2}+\frac{\partial^2 \psi}{\partial z^2}\right)+V\psi=E\psi$$

B.

$$-\frac{h^2}{8\pi^2 m}\left(\frac{\partial^2 \psi}{\partial x^2}+\frac{\partial^2 \psi}{\partial y^2}+\frac{\partial^2 \psi}{\partial z^2}\right)+V\psi=E\psi$$

C.

$$-\frac{h^2}{8\pi^2 m}\left(\frac{\partial^2 \psi}{\partial x^2}+\frac{\partial^2 \psi}{\partial y^2}+\frac{\partial^2 \psi}{\partial z^2}\right)-V\psi=E\psi$$

D.

$$\frac{h^2}{8\pi^2 m}\left(\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}\right)-V\psi=E\psi$$

Answer: B

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88. The Schrddot(o)dinger equation has been solved exactly only for

(i) H (ii) He^+

(iii) Li^{2+} (iv) b^{3+}

A. $(i), (ii), (iii), (iv)$

B. $(ii), (iii), (iv)$

C. $(i), (ii), (iii)$

D. $(i), (ii), (iv)$

Answer: C

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89. Quantum mechancial model of atom is the picture of the structure of the atom which emerges from the application of the Schrddot(o)dinger equation to atoms. Which of the following is the

incorrect feature of the euantum mechanical model of atom?

A. The energy of free electrons is quantized.

B. The existance of quantized enegry levels is the direct result of the wave-like properties of electron and are allowed solutions of the Schrddot(o)dinger wave equation.

C. We talk of only the proabability of finding the electron at different points in an atom as the path of an electron in an atom can never be determined or known accurately in

accordance with Heisenberg's uncertainty principle.

D. To distinguish the quantum mechanical description form Bohr's model, we speak of an atomic orbital or just orbital, rather than an orbit. An orbital can be though of as the wave function (ψ) of an electron in an atom.

Answer: A

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90. Which of the following is not ture for the quantum mechanical model of the atom?

A. Even though there is one electron in an H atom, there are many atomic orbitals in the atom as many wave functions are possible as the solution of the wave equation.

B. All the information about the electron in an atom is stored in its orbital wave function ψ and quantum mechanics makes it possible to extract this information out of ψ.

C. The probability of finding an electron at a point within an atom is proportional to the square of the orbital wave function, i.e., $|\psi|^2$ at that point.

D. $|\psi|^2$ is known as the probability density and can never be positive.

Answer: D

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91. According to quantum mechanics, each electron in an atom is described by__different quantum numbers.

A. four

B. three

C. five

D. two

Answer: A

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92. A wave function for an electron in an atom is called

A. an orbit

B. ordinate

C. an orbital

D. origin

Answer: C

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93. The enegry of an electron in an atom//ion depends principally on

A. m_s

B. l

C. m_l

D. n

Answer: D

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94. Orbitals of the same quantum state___are said to belong to the same shell.

A. n

B. l

C. m_l

D. m_s

Answer: A

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95. Which of the following quantum numbers relates to the average distance of an electron from the nucleus in a particular orbital?

A. Electron spin quantum number

B. Magnetic quantum number

C. Angular momentum quantum number

D. Principal quantum number

Answer: D

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96. Maximum number of orbitals is given shell identified by the principal quantum number n is equak to

A. n

B. n^2

C. $2n^2$

D. $2n$

Answer: B

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97. Which of the following quantum numbers distinguishes the orbitals of given n having different shapes?

A. Principal quantum number

B. Magnetic quantum number

C. Angular momentum quantum number

D. Spin quantum number

Answer: C

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98. Within the M shell, there are_____kinds of orbitals, each having a different shape for the region where the electron is most likely to be found.

A. nine

B. six

C. four

D. three

Answer: D

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99. A1though the energy of an orbital is principally determined by the n quantum number, the energy also depends some what on the l quantum number except for_____atom//ion.

(i) H (ii) Li^+

(iii) He^+ (iv) Be^{2+}

A. $(i), (ii), (iii)$

B. $(i), (iii), (iv)$

C. $(i), (ii)$

D. $(i), (ii), (iii), (iv)$

Answer: C

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100. Orbitals of the same_____but different_____are said to belong to different subshells of a given shell.

A. n, l

B. l, n

C. l, m_l

D. m_l, l

Answer: A

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101. The angular momentum quantum number (l) does not tell us the_____of the orbitals.

(i) size (ii) shape

(iii) orientation (iv) sublevel

A. $(i), (ii), (iv)$

B. $(i), (iii)$

C. $(ii), (iv)$

D. $(i), (iii), (iv)$

Answer: B

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102. The possible values of l depend on the value of the principal quantum number n. For a given value of n, l has possible intergal values from

A. $0 \text{to } n$

B. $1 \text{to} n-1$

C. $1 \text{to} n$

D. $0 \text{to } n-1$

Answer: D

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103. The value of $l$is generally designated by the eletters $s, p, d \ldots$. Thus, if $l = 4$, we have a//an_____orbital.

A. f

B. g

C. d

D. p

Answer: B

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104. magnetic quantum number, m_l, distingushes the orbitals of given n and l, that is, of given enegry and shape but having a different_____in space.

A. orientation

B. mamentum

C. oscillation

D. order

Answer: A

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105. The allowed values of magnetic quantum nunber (m_l) are the integers from

A. . $\prec o + (l - 1)$

B. $-(l - 1)$to +l`

C. $-l$ to +l`

D. s

Answer: C

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106. There are_____orbitals in each subshell o fthe quantum number l.

A. $2l$

B. $(2l+1)$

C. $2l-1$

D. l^2

Answer: B

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107. How many orbitals are possible for $n = 2$ and $l = 1$?

A. Five

B. Just one

C. Three

D. Seven

Answer: C

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108. Which of the following is incorrect?

A. Magnetic quantum number (m_l) designates the specifi orbital within a shell.

B. Orbitals within a given subshell differe in their orientations in space, but not in their enegries.

C. The maximum value of m_l depends on the value of l.

D. Within each subshell, m_l may take any intergal values form $-l$ through zero up to

and including $+l$.

Answer: A

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109. Spin quantum number (m_s) refers to the_____pssible orientations of the spin axis of an electron.

A. infinite

B. six

C. four

D. two

Answer: D

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110. Experiements on the emission spectra of_____atoms gave rise to a fourth quantum number describing an electron in an atom.

(i) H (ii) Na

(iii) Ag (iv) I

A. $(i), (iv)$

B. $(ii), (iii)$

C. $(i), (ii), (iii), (iv)$

D. $(ii), (iii), (iv)$

Answer: C

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111. Conclusive proof of electron spin was provided by O. Strem and W. Gerlach. Which of the following is incorrect regarding the experiment?

A. A beam of atoms is generated in a hot furnace.

B. A beam of atomic is directed through a non-homogeneous magnetic filed.

C. The interaction between an electron and the magnetic field causes the atom to be eflected form its stright lone path.

D. Two spots of unequal intensity are observed on the detecting screen.

Answer: D

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112. Which of the following is incorrect?

A. Property of the electrons called its spin is best visualized as a manifestation of the particle aspect of the electron.

B. There is a definite relatiship between the spin quantum number and the values of n, l and m_l.

C. We cannot associate a particular value of m_s with a particular direction of spin, as m_s

describes relative, not absolute, direction of spin.

D. The spin is specified by the spin quantum number m_s.

Answer: B

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113. Which of the following sate of quantum numbers is not permissible for an electron in an atom?

(i) $n = 1, l = 1, m_l 0, m_s = +1/2$

(ii) $n = 3, l = 1, m_1 = -2, m_s = -1/2$

(iii) $n = 1, l = 1, m_l = 0, m_s = +1/2$

(iv) $n = 2, l = 0, m_l = 0, m_s = 1$

A. $(i), (ii), (iii), (iv)$

B. $(ii), (iii), (iv)$

C. $(i), (ii), (iv)$

D. $(i), (iii), (iv)$

Answer: C

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114. Which of the following combinations of quantum numbers is possible for a $4p$ orbital?

A. $n = 4, l = 1, m_l = 0, \pm 1$

B. $m = 4, l = 1, m_l = -1$

C. $n = 4, l = 1, m_l = 0$

D. $n = 4, l = 1, m_l = +1$

Answer: A

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115. Strictly specking, an orbital does not have a well-defined shape because

A. it is three-dimensional

B. it is hypotentical

C. the wave function characterizing the orbital extends from the nucleus to infinity

D. it is a mathmatical concept

Answer: C

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116. For which of the following orbitals is the radial probaility density R^2 the maximum at the nucleus and descrease sharply as the distance form the nucleus increases?

A. $1s$

B. $2s$

C. $3s$

D. All the s orbitals

Answer: A

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117. ns orbital has_____radial nodes.

A. n

B. $n-3$

C. $n-2$

D. $n-1$

Answer: D

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118. How many peacks are present in the radial distribution function for the $3d$ orbital?

A. Zero

B. One

C. Two

D. Three

Answer: B

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119. The radius of maximum probability for $1s$ orbital of H atom is

A. $52.4nm$

B. $52.9\mu m$

C. 52.9Å

D. $52.9 \pm$

Answer: D

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120. All s orbitals are spherically symmetrical, meating that the probability of finding an s electron depends

A. only on the distance form the nucleus, not on direction

B. only on the direction from the nucleus, not on distance

C. on the distance as well as direction form the nucleus

D. neither on the distance nor on the direction from the nucleus

Answer: A

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121. How many nodal planes pass through the nucleus for a g orbital?

A. Infinite

B. Six

C. Four

D. Five

Answer: C

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122. In case of p_z orbital, the_____is a nodal plane.

A. xz – plane

B. xy-plane

C. yz-plane

D. z-plane

Answer: B

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123. Which of the following d orbitals has diagonal nodal planes?

A. $d_{x^2-y^2}$

B. d_{xz}

C. d_{xy}

D. d_{yz}

Answer: A

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124. Which of the following orbitals is called the ground state of an H atom?

A. $2s$

B. $2p$

C. $1s$

D. $3s$

Answer: C

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125. Which of the following orbitals has maximum enegry?

A. $2s$ orbitals of Li

B. $2s$orbital of H

C. $2s$ orbital of Na

D. All have the same enegry

Answer: B

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126. Which of the following electrons extres the maximum shileding effect in a multi-electron atom?

A. $4f$

B. $4d$

C. $4p$

D. $4s$

Answer: D

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127. Which of the following electrons possesses the minimu penetrating power?

A. $4s$

B. $4f$

C. $4d$

D. $4p$

Answer: B

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128. The electrons identified by the following quantum numbers n and l: $(i) n = 4, l = 1$, $(ii) n = 4, l = 0$, $(iii) n = 3, l = 2$, and (iv) $n = 3, l = 1$ can be placed in the order of increasing enegry from the lowest to the highest as

A. $(iii) < (i) < (iv) < (ii)$

B. $(i) < (iii) < (ii) < (iv)$

C. $(ii) < (iv) < (i) < (iii)$

D. $(iv) < (ii) < (iii) < (i)$

Answer: D

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129. What is the maximum number of electrons that can be placed in $4f_{xyz}$ orbitals?

A. 14

B. 7

C. 2

D. 5

Answer: C

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130. What is the maximum number of electrons that can be placed in each shell?

A. $2n^2$

B. n^2

C. $(2n)^2$

D. $2n$

Answer: A

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131. What is the maximum number of electrons that can be placed in each subshell?

A. $2l^2$

B. $2(l+1)$

C. $2(2l+2)$

D. $2(2l+1)$

Answer: D

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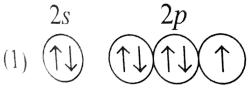
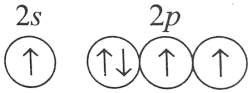
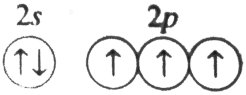
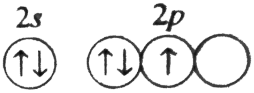
132. The orbital diagram in which the Aufbau principle is violated is

A. 

B. 

C. 

D. 

Answer: B

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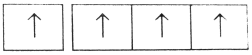
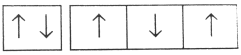
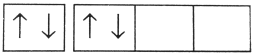
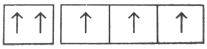
133. Which of the following is a violation of the Pauli exclusion principle?

A. 

B. 

C. 

D. 

Answer: D

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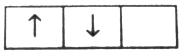
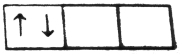
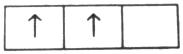
134. Which of the following is a violation of the Hund's rule?

A. 

B. 

C. (3) 

D. Both (1) and (2)

Answer: D

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135. Which of the following is the right electronic confiuration of the element palladium $(Z = 46)$?

A. $[Kr]4d^{10}$

B. $[Kr]4d^{9}5s^{1}$

C. $[kr]4d^{8}5s^{2}$

D. $[Kr]4d^{7}5s^{3}$

Answer: A

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136. How many unpaired electrons are present in the atomic mercury $(Z = 80)$?

A. one

B. zero

C. two

D. three

Answer: B

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137. An oxygen atom has a total of eight electrons. The correct set of four quantum numbers for the eighth electron of oxygen is

A. $(2, 1, -1, -1/2)$

B. $(2, 1, 0, -1/2)$

C. $2, 1, 1, -1/2)$

D. $(2, 1, o, \text{ or } \pm 1, -1/2)$

Answer: D

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138. The extra stability of half-filled and completely-filled subshell is due to

A. relatively small shielding

B. smaller coulombic repulsion enegry

C. larger exchange enegry

D. all of these

Answer: D

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139. Which of the following metaks has the highest value of exchnage enegry?

A. Zn

B. Cr

C. Cu

D. Mn

Answer: C

Watch Video Solution

Follow Up Test 2

1. Which of the following is incorrect for X rays (Roentgen rays)?

A. They are produced when a stream of electrons strikes a heavy metal traget forming part of a massive anode.

B. They are deflected by the electric and megnetic fields.

C. They are of very short wavelengths $(\sim 0.1nm)$ and posses electromagnetic character.

D. The absorption of the rays by matter depends upon the density and the relative atomic mass (r.a.m.) of the material. The lower the r.a.m. and density, the more transparent is the material to X rays.

Answer: B

Watch Video Solution

Follow Up Test 3

1. According to $J.J.$ Thomson, an atom could be through of as

A. a uniform, negative sphere of matter in which protons are embedded

B. a unifrom sphere of matter in which both electrons and protons are uniformly distributed

C. a unifrom, positive sphere of matter in which electrons are embedded

D. the planet Saturn with a large, positively charged centre sphere surrounded by "hard" of electrons.

Answer: C

Watch Video Solution

Follow Up Test 4

1. Which of the following have been discovered by αparticle scattering experiment?

(i) Electron (ii) Proton

(iii) Nucleus (iv) Neutron

A. (iii)

B. $(iii), (iv)$

C. $(ii), (iii), (iv)$

D. $(i), (ii), (iii), (iv)$

Answer: B

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Follow Up Test 5

1. $A1$through they appear quite different to our senses, visible light, infared radiation, microwaves, radiowaves, X rays, and other forms of radiant enegry are all different kinds of

A. electrical radiation

B. magnetic radiation

C. electromagnetic radiation

D. electrostatic radiation

Answer: C

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Follow Up Test 6

1. A quantum of visible light is called

A. phonon

B. photon

C. phon

D. phot

Answer: B

Watch Video Solution

Follow Up Test 7

1. Which of the following relates to photon both as wave motion and as a stream of particles ?

A. Diffraction

B. $E = hv$

C. $E = mc^2$

D. Interference

Answer: B

Watch Video Solution

Follow Up Test 8

1. Which of the following substance give off visible light when excited in an electric discharge tube?

(i) Helium (ii) Neon

(iii) Sodium (iv) Mercury

A. $(i), (ii), (iii), (iv)$

B. $(iii), (iv)$

C. $(ii), (iii)$

D. $(ii), (iii), (iv)$

Answer: A

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Follow Up Test 9

1. How many spectral series appear in the emission spectrum of atomic hydrogen?

A. six

B. four

C. five

D. seven

Answer: A

Watch Video Solution

Follow Up Test 10

1. The angular momentum of the electron moving around the nucleus in a circular orbit of radius r is given by

A. $m_e vr$

B. $m_e v / r$

C. $m_e v r^2$

D. $m_e v / r^2$

Answer: A

Watch Video Solution

Follow Up Test 11

1. Calculate the ionzation enthalpy of Li atom using Bohr's theory?

A. $122.4eV$

B. $40.8eV$

C. $81.6eV$

D. Cannot be calculated

Answer: D

Watch Video Solution

Follow Up Test 12

1. The wavelength associated with a golf ball weighing $200g$ and moving at a speed of $5mh^{-1}$ is of the order

A. $10^{-30}m$

B. $10^{-20}m$

C. $10^{-40}m$

D. $10^{-10}m$

Answer: A

Watch Video Solution

Follow Up Test 13

1. In mathematical terms, Heisenberg's principle states that the uncertainty in the electron's position, Δx, times the uncertainty in its momentum, Δpx, is____the quantity $h/4\pi$.

(i) equal to (ii) less than

(iii) greater than

A. (i) or (ii)

B. (i) or (iii)

C. (i)

D. (iii)

Answer: B

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Follow Up Test 14

1. Quantum mechancial model of atomic structure is framed in the of a___, a mathematical equation similar in from to that used to describe the motion of ordinary waves in fluids.

A. wave equation

B. wave packet

C. wave crest

D. wave trough

Answer: A

Watch Video Solution

Follow Up Test 15

1. The principle quantum number, n, describes the____an electron occupies.

A. subenergy level

B. main energy level

C. secondary enegry level

D. tertiary enegry level

Answer: B

Watch Video Solution

Follow Up Test 16

1. Radial wave function depends on the quantum numbers

(i) n (ii) l(iii) m_(l)$(iv) m_s$

A. $(ii), (iii)$

B. $(i), (ii)$

C. $(i), (ii), (iii)$

D. $(i), (ii), (iii), (iv)$

Answer: B

Watch Video Solution

Follow Up Test 17

1. For Be^{3+} ion, the degeneracy of the $3rd$ enegry level is equal to

A. nine

B. six

C. three

D. seven

Answer: A

Watch Video Solution

Watch Video Solution

Follow Up Test 18

1. In how many different ways can the four quantum numbners designate a $3p$ electron?

A. Three

B. Six

C. Five

D. Just one

Answer: B

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Question Bank

1. Canal rays are

A. a strem of positrons

B. a stream of protons

C. a stream of positively charged ions

D. electromagentic waves

Answer: C

Watch Video Solution

Level I

1. When the azimuthal quantum number has the value 2, the number of orbitals possible is

A. 5

B. 7

C. 0

D. 3

Answer: A

Watch Video Solution

2. According to Boohr's theory the angular momentum of an electron in 5th orbit is :

A. $25h/\pi$

B. $2.5\frac{h}{\pi}$

C. $1.0h/\pi$

D. $10h/\pi$

Answer: B

Watch Video Solution

3. The number of $2p$ electrons having spin quantum number $s = -1/2$ are

A. 6

B. 0

C. 2

D. 3

Answer: D

Watch Video Solution

4. Nitrogen has the electronic configuration $1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$ and not $1s^2 2s^2 2p_x^2 2p_y^1 2p_z$ as it violates.

A. Hund's rule

B. Pauli's exculsion principle

C. Aufban principle

D. $(n + l)$ rule

Answer: A

Watch Video Solution

5. Two electrons occupying the same orbital are distinguished by :

A. Principal quantum number

B. azimuthal quantum number

C. magnetic qauntum number

D. spin quantum number

Answer: D

 Watch Video Solution

6. The enegry of the following is not ture regarding cathode rays?

A. zero

B. $-54.4eV$

C. $-13.6eV$

D. $-26.5eV$

Answer: B

Watch Video Solution

7. Which of the following os not true regarding cathode rays?

A. A strem of nagatively charged particles

B. Deflected by electric field

C. Deflected by magnetic field

D. Move with the speed of light

Answer: D

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Level Ii

1. $1mol$ of photons each of frequency $250s^{-1}$ would have approximately a total enegry of

A. $1MeV$

B. $1erg$

C. $1J$

D. $1eV$

Answer: B

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2. Calculate the wavelength (in nanometer) associated with a proton moving at $1.0 \times 10^3 ms^{-1}$(Mass proton $= 1.67 \times 10^{-27} kg$ and $h = 6.63 \times 10^{-34} Js$):-

A. $2.5nm$

B. $1.4nm$

C. $0.032nm$

D. $0.40nm$

Answer: D

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3. In an atom, an electron is moving with a speed of $600m/s$ with an accuracy of $0.005\,\%$. Certainty with which the position of the electron can be localized is :

$\left(h = 6.6 \times 10^{-34} kgm^2 s^{-1}\right.$,

mass of electron $\left.(e_m) = 9.1 \times 10^{-31} kg\right)$.

A. $1.92 \times 10^{-3} m$

B. $3.84 \times 10^{-3} m$

C. $5.10 \times 10^{-3} m$

D. $1.52 \times 10^{-4} m$

Answer: A

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4. The ionization enthalpy of hydrogen atom is $1.312 \times 10^6 Jmol^{-1}$. The energy required to excite the electron in the atom from $n = 1$ to $n = 2$ is :

A. $6.56 \times 10^5 J\text{atom}^{-1}$

B. $8.51 \times 10^5 Jmol^{-1}$

C. $7.56 \times 10^5 J\text{atom}^{-1}$

D. $9.84 \times 10^5 Jmol^{-1}$

Answer: D

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Watch Video Solution

5. The radius of the forst Bohr orbit of hydrogen atom is 0.59Å. The radius of the third orbit of He^+ will be

A. 2.66Å

B. 1.41Å

C. 1.59Å

D. 0.705Å

Answer: A

Watch Video Solution

6. Which of the following set of quantum numbers represents the highest energy of an atom ?

A. $n = 4, l = 0, m_l = 0, s = +1/2$

B. $n = 3, l = 1, m_l = 1, s = +1/2$

C. $n = 3, l = 0, m_l = 0, s = +1/2$

D. $n = 3, l = 2, m_l = 1, s = +1/2$

Answer: D

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7. A body of mass $10mg$ is moving with a velocity of $100ms^{-1}$. The wavelength of the de Broglie wave associated with it would be

A. $6.63 \times 10^{-31}m$

B. $6.63 \times 10^{-35}m$

C. $6.63 \times 10^{-34}m$

D. $6.63 \times 10^{-7}m$

Answer: A

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8. Which of the following set of quantum numbers is not possible for an electron in the ground state of an atom with atomic number 19?

A. $n = 3, l = 1, m_l = -1$

B. $n = 2, l = 1, m_l = 0$

C. $n = 3, l = 2, m_l = -2$

D. $n = 2, l = 0, m_l = 0$

Answer: C

Watch Video Solution

9. The atomic numbers of Ni and Cu are 28 and 29 respectively. The electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$ represent

A. Cu^+

B. Ni

C. Ni^{2+}

D. Cu^{3+}

Answer: A

Watch Video Solution

10. Electrons will first enterinto the orbital with the set of quantum numbers

A. $n = 5, l = 0$

B. $n = 4, l = 1$

C. $n = 3, l = 2$

D. any of these

Answer: C

Watch Video Solution

11. The H-spectrum confirms

A. the diffraction of electrons

B. Heisenberg's uncertainty principle

C. the polarization of radiation

D. the presence of qunatized enegry states

Answer: D

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12. If $n = 3, l = 0,$ and $m = 0,$ then the atomic number is

A. $12, 13$

B. $13, 14$

C. $10, 11$

D. $11, 12$

Answer: D

Watch Video Solution

13. The ionization energy for the hydrogen atom is $13.6eV$ then calculate the required energy in eV to excite it from the ground state to 1^{st} excited state.

A. $3.4eV$

B. $10.2eV$

C. $12.1eV$

D. $1.5eV$

Answer: B

Watch Video Solution

14. One electron species having ionization enegry of $54.4eV$ is

A. H

B. Li^{2+}

C. He^{+}

D. Be^{2+}

Answer: C

Watch Video Solution

15. The wavelength of the radiations emitted when in a hydrogen atom electron falls from infinity to stationary state is : $\left(R_H = 1.097 \times 10^7 m^{-1}\right)$.

A. $91nm$

B. $192nm$

C. $406nm$

D. $9.1 \times 10^{-8}nm$

Answer: A

Watch Video Solution

16. Consider the ground state Cr atom $(Z = 24)$. The number of electron with the azimuthal number $l = 1$ and 2 ,respectively are

A. $12$and 4

B. $12$and 5

C. 16and 4

D. 16 and 5

Answer: B

 Watch Video Solution

17. The number of d-electron retained in $Fe^2(\text{At no. of} Fe = 26)$ ion is.

A. 6

B. 5

C. 4

D. 3

Answer: A

Watch Video Solution

18. In a hydrogen atom, if energy atom, if energy of an electron in group state is $-13.6eV$, then that in the 2^{nd} excited state is :

A. $6.04eV$

B. $3.4eV$

C. $1.51eV$

D. $13.6eV$

Answer: C

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19. Which of the following ions has the maximum magnetic moment in aqueous solution ?

A. Fe^{2+}

B. Ti^{2+}

C. Mn^{2+}

D. Cr^{2+}

Answer: C

Watch Video Solution

Level Iii

1. The electronic conguration $1s^2 2s^2 2p^6 3s^2 3d^9$ represnts a

A. metal atom

B. nonemtallic atom

C. metallic cation

D. nonmetallic anion

Answer: C

Watch Video Solution

2. Gaseous metal ion M^{2+} has 5 unpaired electron.

What is the atomic number?

A. 26

B. 25

C. 27

D. 24

Answer: B

Watch Video Solution

3. On an X-ray diffraction photograph, the intensity of the spots depends on the

A. proton density of the atoms

B. proton denisty of the ions

C. electron density of the atoms/ions

D. neturon density of the atoms/ions

Answer: C

Watch Video Solution

4. The following quantum numbers are possible for how many orbitals $(s)n = 3, l = 2, m = +2$?

A. 3

B. 4

C. 2

D. 1

Answer: D

Watch Video Solution

5. What is the angular momentum of an electron in $3P$ orbital.

A. $3\frac{h}{2\pi}$

B. $\frac{h}{\sqrt{2}\pi}$

C. $\frac{1}{2}\frac{h}{2\pi}$

D. $\frac{\sqrt{2}h}{\pi}$

Answer: B

Watch Video Solution

6. In a malti-electrons atom which of the following orbitals deseribed by the three quantum number will have the same energy in the absence of megnetic and electric field ?

I.$n = 1, l = 0, m = 0$

II. $n = 2, l = 0, m = 0$

III.$n = 2, l = 1, m = 1$

IVgt$n = 3, l = 2, m = 1$

V$n = 3, l = 2, m = 0$

A. $(i)$and(ii)

B. $(ii)$and(iii)

C. $(iii)$and(iv)

D. $(iv)$and (v)

Answer: D

Watch Video Solution

7. The number of radial nodes in $3s$ and $2p$, respectively, are

A. 0and2

B. 1and2

C. 2and0

D. 2and1

Answer: C

Watch Video Solution

8. Which hydrogen -like species will have the same r adius as that of Bohr orbit of hydrogen atom ?

A. $Li^{2+}(n=2)$

B. $He^{+}(n=2)$

C. $Be^{3+}(n=2)$

D. $Li^{2+}(n=3)$

Answer: C

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9. In Bohr series of lines of hydrogen spectrum, third line from the red end corresponds to which one of the following inner orbit jumps of electron for Bohr orbit in atom in hydrogen :

A. $3 \rightarrow 2$

B. $4 \rightarrow 1$

C. $2 \rightarrow 5$

D. $5 \rightarrow 2$

Answer: D

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10. If nitrogen atoms had el,ectonic configuration is ? It would have energy lower than that of the nornal ground state configuration $1s^2 2s^2 2p^3$ because the electrons would be clear to the nucleus yet $1s^2$ is not oberved because it violates ?

A. Bohr's postualate of stationary states

B. Hund's rule

C. Pauli's exculsion principle

D. Heisenberg's uncertainty principle

Answer: C

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11. The least stable in amongst the following is :

A. C^-

B. B^-

C. Be^-

D. Li^-

Answer: C

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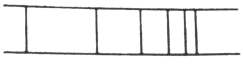
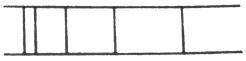
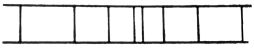
Level Iv

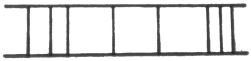
1. Which diagram best represnts the apperance of the line spectrum of atomic hydorgen in the visible region?

$\xrightarrow{Increasing\ \lambda}$

A. 

B. 

C. 

D. 

Answer: B

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2. The correct enegry value order is

A. $ns, np, nd, (n-1)f$

B. $ns, np, (n-1)d, (n-2)f$

C. $ns, np, (n-1)d, (n-1)f$

D. $ns, (n-1)d, np(n-1)f$

Answer: D

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3. The ionization potential for hydrogen atom is $13.6eV$, the ionization potential for He^+ is

A. $24.5V$

B. $6.8V$

C. $54.4V$

D. $13.6V$

Answer: C

Watch Video Solution

4. The quantum number $+1/2$ and $-1/2$ for the electron spin represent

A. $(i), (ii)$

B. (i)

C. $(iii), (iv)$

D. (ii)

Answer: A

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Archives

1. The value of Planck's constant is $6.63 \times 10^{-34} Js$. The speed of light is $3 \times 10^{17} nms^{-1}$. Which value is the closed to the wavelength in nanometers of a quantum of light with frequency $6 \times 10^{10} s^{-1}$?

A. 25

B. 50

C. 75

D. 10

Answer: B

Watch Video Solution

2. What is the maximum number of electrons that can be associated with a following set of quantum numbers ? $(n = 3, l = 1 \text{ and } m = -1)$.

A. 6

B. 4

C. 2

D. 10

Answer: C

Watch Video Solution

3. Which of the following lanthanoid ions is diamagnetic? (Atomic number of $Ce = 58, Sm = 62, Eu = 63, Yb = 70$]

A. Sm^{2+}

B. Eu^{2+}

C. Yb^{2+}

D. Ce^{2+}

Answer: C

Watch Video Solution

4. Based on equation $E = -2.178 \times 10^{-18} J\left(\frac{Z^2}{n^2}\right)$, certain conclusions are written. Which of them is not correct ?

A. The large the value of n, the large is the orbit radius.

B. The eqaution can be used to calculate the change in enegry when the electrons change orbit.

C. For $n = 1$, the electron has more negative energy tham it does for $n = 6$ which means

that the electron is more lossely bound in the smallest allowed orbit.

D. The negative sign in equation means that the enegry of the electron bound to the nucleus is lower than it would be if the electrons were at infinite distance form the nucleus.

Answer: C

Watch Video Solution

5. Which of the following is not permissible arrangement of electrons in an atom ?

A. $n = 5, l = 3, m = 0, s = +1/2$

B. $n = 3, l = 2, m = -3, = +1/2$

C. $n = 3, l = 2, m = -2, s = -1/2$

D. $n = 4, l = 0, m = 0, s = -1/2$

Answer: B

Watch Video Solution

6. The energy absorbed by each molecule (A_2) of a substance is $4.4 \times 10^{-19} J$ and bond energy per molecule is $4.0 \times 10^{-19} J$. The kinetic energy of the molecule per atom will be.

A. $2.2 \times 10^{-19} J$

B. $2.0 \times 10^{-19} J$

C. $4.0 \times 10^{-20} J$

D. $2.0 \times 10^{-20} J$

Answer: D

Watch Video Solution

7. Maximum number of electrons in a sub-shell of an atom is determined by the following.

A. $2l + 1$

B. $4l + 2$

C. $2n^2$

D. $2l + 2$

Answer: B

Watch Video Solution

8. The measurement of the electron position is associated with an uncertainty in momentum, which is equal to $1 \times 10^{-18} gcms^{-1}$. The uncertainty in electron velocity is (mass of an electron is $9 \times 10^{-28} g$)

A. $10^{9} cms^{-1}$

B. $10^{6} cms^{-1}$

C. $10^{5} cms^{-1}$

D. $10^{11} cms^{-1}$

Answer: A

Watch Video Solution

9. If uncertainty in position and momentum are equal then uncertainty in velocity is.

A. $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

B. $\sqrt{\frac{h}{2\pi}}$

C. $\frac{1}{m}\sqrt{\frac{h}{\pi}}$

D. $\sqrt{\frac{h}{\pi}}$

Answer: A

Watch Video Solution

10. What is the maximum number of electron in an atom that can have the quantum numbers $n = 4, m_l = +1$?

A. 4

B. 15

C. 3

D. 6

Answer:

Watch Video Solution

11. Consider the following sets of quantum numbers.

(i)

n	l	m	s
3	0	0	$+1/2$

(ii)

n	l	m	s
2	2	1	$+1/2$

(iii)

n	l	m	s
4	3	-2	$-1/2$

(iv)

n	l	m	s
1	0	-1	$-1/2$

(v)

n	l	m	s
3	2	3	$+1/2$

Which of the following sets of quantum number is not possible ?

A. $(i)$and(iii)

B. (ii), (iii), and (iv)`

C. $(i), (ii), (iii)$,and(iv)

D. $(ii), (iv)$,and(v)

Answer: D

Watch Video Solution

12. Which of the folowing statements is incorrect about an atomic orbital?

A. It is a single electron wave function.

B. It describes the trajectroy of electron in an atom.

C. It define the distribution of electron density in space.

D. It can be represented by boundary surface diargams.

Answer: B

Watch Video Solution

13. The angular momentum of an electron is zero. In which orbital may it be present?

A. $2s$

B. $2p$

C. $4f$

D. $5f$

Answer: A

Watch Video Solution

14. The de Broglie wavelength associated with a ball of mass $1kg$ having kinetic enegry $0.5J$ is

A. $6.626 \times 10^{-34}m$

B. $13.20 \times 10^{-34}m$

C. $10.38 \times 10^{-21} m$

D. $6.626 \times 10^{-34} m$

Answer: A

Watch Video Solution

15. The orientation of an atomic orbital is governed by :

A. magnetic quantum number

B. principle quantum number

C. azimuthal quantum number

D. spin quantum number

Answer: A

Watch Video Solution

16. Given $m_e = 9.11 \times 10^{-31} kg$ and $h = 6.626 \times 10^{-34} Js$, the uncertainty involved in the measuremenetof velocity within a distance of $0.1Å$ is

A. $5.79 \times 10^8 ms^{-1}$

B. $5.79 \times 10^5 ms^{-1}$

C. $5.76 \times 10^6 ms^{-1}$

D. $5.76 \times 10^7 ms^{-1}$

Answer: C

Watch Video Solution

17. In which of the following transition, the wavelength will be minimum :

A. $n_4 \rightarrow n_1$

B. $n_2 \rightarrow n_1$

C. $n_4 \rightarrow n_2$

D. $n_3 \rightarrow n_1$

Answer: A

Watch Video Solution

18. A metal surface is exposed to solar radiations. Which of the following is true?

A. The emitted electrons have enegry less than a maximum value of enegry depending upon the frequency of the incident radiation.

B. The emitted electrons have energy less than a maximum value of enegry depending upon the intensity of the incident radiation.

C. The emitted electrons have zero enegry.

D. The emitted electrons have enegry equal to the enegry of photons of the incident light.

Answer: A

 Watch Video Solution

19. The most probable radius (in pm) for finding the electron in He^+ is.

A. 0.0

B. 52.9

C. 26.5

D. 105.8

Answer: C

Watch Video Solution

20. The energy of second Bohr orbit of the hydrogen atom is $-328kJmol^{-1}$, hence the energy of fourth Bohr orbit would be.

A. $-1312kJmol^{-1}$

B. $-82kJmol^{-1}$

C. $-41kJmol^{-1}$

D. $-164kJmol^{-1}$

Answer: B

Watch Video Solution

21. Calculate the magnetic moment of a divalent ion in aqueous solution if its atomic number is 25.

A. $3.0BM$

B. $4.9BM$

C. $5.9BM$

D. $6.9BM$

Answer: C

 Watch Video Solution

22. The correct order of the number of unpaired electrons in the ions Cu^{2+}, Ni^{2+}, Fe^{3+}, and Cr^{3+} is

A. $Cu^{2+} > Ni^{2+} > Cr^{3+} > Fe^{3+}$

B. $Cr^{3+} > Fe^{2+} > Ni^{2+} > Cu^{2+}$

C. $Fe^{3+} > Cr^{3+} > Cu^{2+} > Ni^{2+}$

D. $Fe^{3+} > Cr^{3+} > Ni^{2+} > Cu^{2+}$

Answer: D

Watch Video Solution

23. An electron is moving in Bohr's fourth orbit. Its de Broglie wavelength is λ. What is the circumference of the fourth orbit?

A. $2/\lambda$

B. 2λ

C. 4λ

D. $3/\lambda$

Answer: C

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24. The atomic numbers of elements X, Y,and Z are $19, 21,$ and $23,$ respectively. The number of eletron present in the M shells of these elements follows the order

A. $Z > X > Y$

B. $X > Y > Z$

C. $Z > Y > X$

D. $Y > Z > X$

Answer: C

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25. What is the packet of enegry called?

A. Electron

B. Photon

C. Positron

D. Proton

Answer: B

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26. The number of d electrons in Ni (at.no $= 28$) is equal to that of the

A. s and p electrons in F^-

B. p electrons in Ar(at.no $= 18$)

C. d electrons in Ni^{2+}

D. total electrons in N

Answer: C

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27. Time taken by an electrons to complete one revolution in the Bohr orbit of the H atom is

A. $\frac{4\pi^2 mr^2}{hm}$

B. $\frac{nh}{4\pi^2 mr}$

C. $\frac{2\pi mr}{n^2 h^2}$

D. $\frac{h}{2\pi mr}$

Answer: A

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28. The atomic number of an element is derived from the

A. number of electron

B. number of protons

C. number of neutrons

D. number of isotopes

Answer: B

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29. Which of the following electronic configuration is not possible according to Hund's rule?

A. $1s^2 2s^2$

B. $1s^2 2s^1$

C. $1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$

D. $1s^2 2s^2 2p_x^2$

Answer: D

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30. For d electron, the orbital angular momentum is

A. $\sqrt{6}\left(\frac{h}{2\pi}\right)$

B. $\sqrt{2}\left(\frac{h}{2\pi}\right)$

C. $\left(\frac{h}{2\pi}\right)$

D. $2\left(\frac{h}{2\pi}\right)$

Answer: A

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31. The frequency of radiations emitted when electron falls from $n = 4$ to $n = 1$ in $H - \text{atom}$ would be (Given E_1 for $H = 2.18 \times 10^{-18} J\text{atom}^{-1}$ and $h = 6.625 \times 10^{-34} Js$.)

A. $1.54 \times 10^{15} s^{-1}$

B. $1.03 \times 10^{15} s^{-1}$

C. $3.08 \times 10^{15} s^{-1}$

D. $2.0 \times 10^{15} s^{-1}$

Answer: C

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32. Among the following series of transition metal ions, the one where all metal ion have the sae $3d$ electronic configuration is

A. $Ti^{2+}, V^{3+}, Cr^{4+}, Mn^{5+}$

B. $Ti^{3+}, V^{2+}, Cr^{3+}, Mn^{4+}$

C. $Ti^{+}, V^{4+}, Cr^{6+}, Mn^{7+}$

D. $Ti^{4+}, V^{3+}, Cr^{2+}, Mn^{3+}$

Answer: A

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33. For principle quantum number $n = 4$, the total number of orbitals having $l = 3$ is

A. 3

B. 5

C. 7

D. 9

Answer: C

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34. The ratio of area covered by second orbital to the first orbital is.

A. $1:1$

B. $1:16$

C. $8:1$

D. $16:1$

Answer: D

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35. A proton is about 1840 times heavier than an electron. When it is accelerated by a potential difference difference of $1kV$, its kinetic enegry will be

A. $1840keV$

B. $1/1840keV$

C. $1keV$

D. $920keV$

Answer: C

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36. The atomic number of an element is 35. What is the total number of eletrons present in all the p orbitals of the ground state of that element?

A. 6

B. 11

C. 17

D. 23

Answer: C

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37. The total number of electrons present in all s orbitals, all the p orbitals, and all the d orbitals of cesium ion are, respectively,

A. $8, 26, 10$

B. $10, 24, 20$

C. $8, 22, 24$

D. $12, 20, 22$

Answer: B

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38. Rutherford's model suggests the existence of

A. atoms

B. nucleus

C. $a$particles

D. mesons

Answer: B

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39. The orbit in Rutherfprd's model is

A. spiral

B. circular

C. both (1) and (2)

D. none

Answer: B

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40. The number of orbitals present in the $3rd$ shell is

A. 3

B. 1

C. 9

D. 18

Answer: C

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41. Configuration of $5p^1$ is

A. $n = 5, l = 1$

B. $n = 4, l = 1$

C. $n = 4, l = 0$

D. $n = 5, l = 0$

Answer: A

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42. The value of Planck's constant is $6.63 \times 10^{-34} Js$. The velocity of light is $3.0 \times 10^{8} ms^{-1}$. Which value is closest to the wavelength in nanometers of a quantum of light with frequency $8 \times 10^{15} s^{-1}$?

A. 2×10^{-15}

B. 5×10^{-18}

C. 4×10^{1}

D. 3×10^{7}

Answer: C

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43. Which of the following expression respresents the electron probability function (D)?

A. $4\pi r dr \psi^{2}$

B. $4\pi r^{2} dr \psi$

C. $4\pi r^{2} dr \psi^{2}$

D. $4\pi r dr\psi$

Answer: C

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44. Outer electronic configuration of K, Cu, and Cr are, respectively,

A. $4s^1, 3d^{10}, 3d^5$

B. $4s^1, 3d^{10}, 3d^4$

C. $4s^1, 3d^9, 3d^4$

D. $4s^1, 3d^9, 3d^4$

Answer: A

45. The ratio between kinetic enegry and total enegry of the electrons of hydrogen atom according to Bohr's model is

A. $2:1$

B. $1:1$

C. $1:-1$

D. $1:2$

Answer: C

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46. The configuration $1s^2 2s^2 2p^5 3s^1$ shown

A. excited state of O_2

B. excited state of neon

C. excited state of fluorine

D. ground state of fluorine atom

Answer: B

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47. In a hydorgen atom, enegry of the first excited state is $-3.4eV$. Find out the kinetic enegry of the same orbit of H atom.

A. $+3.4eV$

B. $+6.8eV$

C. $-13.6eV$

D. $+13.6eV$

Answer: A

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48. As the nuclear charge increases form neon to calcium, the orbital energies

A. increase

B. increase rapidly

C. increase very slowly

D. fall

Answer: D

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49. The spectrum of He is expected to be similar to that of

A. H

B. Li^+

C. Na

D. He^+

Answer: B

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50. Which of the following element's outermost orbit's last electron has magnetic quantum number $m = 0$?

A. Na

B. O

C. $C1$

D. N

Answer: A

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51. Rutherford's αparticle dispersion experiment concludes that

A. all psoitive ions are deposited in a small part

B. all negative ions are deposwited in small part

C. protons moves around the nucleus

D. neutrons are charged particles

Answer: A

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52. An element M has an atomic mass 19 and atomic number 9. Its ion is represented by

A. M^+

B. M^{2+}

C. M^-

D. M^{2+}

Answer: C

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

A. Cr^{3+}, Fe^{3+}

B. Fe^{3+}, Mn^{2+}

C. Fe^{3+}, Co^{3+}

D. Sc^{3+}, Cr^{3+}

Answer: B

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54. In the ground state, an element has 13 electrons in its M shell. The element is

A. cobalt

B. chromium

C. nickel

D. iron

Answer: B

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55. For how many orbitals are the quantum numbers $n = 3, l = 2, m = +2$ possible?

A. 1

B. 2

C. 3

D. 4

Answer: A

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