

CHEMISTRY

BOOKS - KUMAR PRAKASHAN KENDRA CHEMISTRY (GUJRATI ENGLISH)

STRUCTURE OF ATOM

Section A Questions

1. Which were the major problems before the scientists

after the discovery of sub atomic particles ?

2. Explain Dalton s atomic theory

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3. Explain discovery of electron.
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4. What is cathode rays discharge tube ? Write down
its uses.

5. What is cathode rays ? Write down the characteristics .



6. Write down resutls of cathode ray discharge tubes.



7. Who discovered the ratio of charge to mass of

electon and how ? Expalin with diagram

8. According to Thomson the direction cathode particle in electric discharge tube by electrical and magnetic . Field depends which factors?

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9. Who discovered charge of electron ? State charge mass of electron.

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10. Give general information about the fundamental particles of atom.



14. Give names of atomic models and write about Thomson model.



15. Explain the production characteristic and uses of X-

rays.



16. Write about rays emit by radioactive elements





particle scattering experiment.



20. Explain Rutherford nuclear model of atom



21. In Rutherford experiment generally the thin foil of heavy atoms like gold platinum etc have been used to be bombarded by the α – particles If the thin foil of light atoms like aluminium etc is used what difference would be observed from the above results



22. In Rutherford experiment if light atoms used instead of heavy elements than what change is observed in results ?

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23. Which are the drawbacks of Rutherford atomic model

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24. Explain : Rutherford atomic model can not explain stability of an atom



and II proton present in hydrogen and sodium atom

respectively

27. How to mention the atom notation ? Give example

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28. Give defination and examples of isobars an isotopes.	nd
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29. Give isotopes of hydrogen carbon and chlorine and

write down number of electron neutron and protons.

30. Which development played a role in the formation

of Bohr.s model of atom ?



31. According to the electromagnetic theory of maxwell

what happen when charge particles accelerated ?



32. What is electromagnetic radiation ?

33. What is light ?



36. The characteristics electromagnetic radiation given

by which properties?



37. Arrange the following type of radiation in increasing order of frequency :

- (a radiation from microwave oven
- (b) amber light from traffic signal
- (c) radiation from FM radio
- (d) cosmic rays from outer space and
- (e) X- rays .



38. Which observatin are not explain by electron

magnetic theory of physics ?

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39. Explain phenomenon of black bod radiation .

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40. Write importance of Planck's quantum theory.

41. Explain photoelectric effect.

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42. Explain : Photoelectric effect.
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43. Explain : energy photon energy of electron and no
of photons in photoelectric effect.
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44. Write down Dual behaviour of electromagnetic radiation.



45. Explain emission and absorption spectrum



46. Explain line spectra and its uses.

47. What is hydrogen spectrum give its characteristic ?

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48. Explain Balmer series and gives its equation.
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49. Write down of hydrogen spectrum .
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50. Give Rydberg equation for all lines in hydrogen spectrum



51. What is the difference in line spectrum of different

atoms and hydrogen atom ?



52. Write postulates of Bohr.s model of hydrogen atom



53. Bohr.s atomic model.

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54. Write down Bbohr.s model of hydrogen atom.
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55. Explain according to Bohr.s model of hydrogen (1)
principal quantum number (ii) Reading of stationary
orbit (r) (iii) Energy of stationary state (iv) isoelecronic
ion of h (v) Velocity of electron

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56. Explain linear and angular momentum.

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57. Explain hydrogen spectrum by Bohr's model



58. Write down limitations of bohrs model

59. Which two development remove the drawbacks of

Bohr.s model ?



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62. Write down Helsenbergy uncertainty principle .

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63. Give reasons for the failure of the Bohr model
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64. Newton mechanics is applicable to which objects and not applicable to which objects ?

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65. What is quantum mechanics ?give its primary information .



66. Explain Schrodinger wave equation and also explain σ and σ^2 one electron system.



67. Explain Schrodinger wave equation and also explain

 σ and σ^2 one electron system.

68. Give difference between w and w^2

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69. What is quantum mechanical model of atom give

its important features.



70. Write down principal quantum number (n)



71. Write about subsidary quantum number (I)

72. Write about magnetic quantum number (m_1)
72. Write about magnetic quantum number (m_1)
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73. Write down about electron spin quantum number (s)

74. Given difference of 1s and 2s

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76. Write characteristic of s orbitals .



77. What is orbital ? Explain point and boundary surface diagram of orbitals

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78. Write about p- orbitals.

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79. Explain 2p orbitals

80. Explain d orbital .

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81. Write alown about energy of orbitals in hydrogen								
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82.	Give	the	order	of	energy	of	orbitals	in
mul	tielecti	ron at	om					
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83. Hydrogen atom has only one electron, so mutual repulsion between electrons is absent. However, in multielectron atoms mutual repulsion between the electrons is significant. How does this affect the energy of an electron in the orbitals of the same principal quantum number in multielectron atoms ?

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84. Explain the energy of orbital and extent of shielding in same shell depends on shape of orbitals.

85. Explain (n +1) rules for energy of orbital by example



energy on the basis of (n+1) rule .

88. Arrange the 1s, 2s, 4s, 3p, 4p and 3d orbitals

according to increasing order of energy.

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89. Explain Aufbau principle with example

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90. Explain Pauli exclusion principle by example .

91. Write down about the Hund .s rule .

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92. Explain Hund.s rule of maximum multiplicity .
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93. What is electron configuration of atom ? Explain its

method by example.

94. Give orbital picture of following elements Na Mg Al

,SiP,S,CI,Ar,K,Ca



95. What is core electrons and valence electron ?

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96. Write electron configuration of chromium and copper give reason of are (z=24) Cu (z=10 and Cr = $4s^1$

97. Explain by giving resons of stability of completely filled and half filled subshell

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98. The quantum number of six electrons are given below ,Arrange them in order of increasing energies . If any of these combination has have the same energy lists :

(1) n-4 ,l=2 ,
$$m_1=2m_1=rac{1}{2}$$

(2) n=3 , l = 2, $m_1=1, m_s=rac{1}{2}$
(3) $n=4, l=1, m_1==0m_s=rac{1}{2}$

$$egin{aligned} (4)n &= 3 \colon l = 2m_1 = -2m_s = -rac{1}{2} \ (5)n &= 3, l = 1, m_1 = -1m_s = rac{1}{2} \ (6)n &= 4, l = 1, m_1 = 0m_s = rac{1}{2} \end{aligned}$$

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99. The bromine atom possesses 35 electrons .it contains 6 electrons in 2p orbitals 6 elecrons in 3p orbital and 5 electron in 4p orbitals which of these electron experience the lowest effective nuclear charge


100. Give symbol of following species :

(I) Number of electron proton and neutron in 10 8 and 8 respectively .

(ii) ca (z= 20) and nucleon = 40

(iii) Species of mass number 25 proton 12 magnesium and electron 10

(iv) Species of Bromine f in which (z=35) electron 36

and neutron 45 .

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101. The unpaired electrons in AI and sI are present in3p orbital . Which electron will experience more





104. The number of electrons protons and neutrons in

a species are equal to 18,16 and 16 respectively. Assigh

the proper symbol to the species.



105. How many neutrons and protons are there in the

following nuclei.

 $.{}^{13}_6\,C,.{}^{16}_8\,O,.{}^{24}_{12}\,Mg,.{}^{88}_{38}\,Sr$

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106. Write the complete symbol for the atom with the

given atomic number (z) and atomic mass (A)

(i) Z= 17 ,A= 35 (ii) Z= 92 , A= 233

(iii) Z=4, A=9



107. Symbol $._{35}^{79} Br$ and $._{35}^{79} Br$ can be written whereas symbols $._{79}^{35} Br$ and are not acceptable Answer Briefly .



108. (i) Calculate the number of electrons which will together weigh one gram (ii) Calculate the mass and charge of one mole of electron .



109. (i) Calculate the total number of electron present in one mole of method

(ii) Find (a) the total number and (b) the total that mass of neutron = 1.675×10^{27} kg (iii) Find (a) the total number and (b) the total mass of protons in 34 of NH_3 at STP Will the answer change if the temperature and pressure are changed ?



110. if the diameter of atom is 0.15 nm calculate the number of carbon atom which can be placed side by side in a straight line across length of scale of length 20 cm long



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111. $2 imes 10^8$ atoms of carbon are arranged side by side caculate the radius of carbon atom if the length of this arrangement is 2.4 cm .



112. in milikan experiment static electric charge on the oil drops has been obtained by shining X-rays if the static electric charge on the oil drop is -1.282 $\times 10^{18}C$ calculate the number of electron presenct on it.



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113. A certain particle carreis $2.5 \times 10^{16}C$ of static electric charge .Caculate the number of electrons presenct in it.



114. The diameter of zinc atom is 2.6 A .Calcuate (a) radius of zinc atom in pma and (b) number of atoms present in a length of 1.6 cm if the zinc atoms are arranged side by side lengthwise.



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115. An elements with mass number 81 contains 31.7% more neutronsis compared to protons Assign the atomic symbol .



116. An elements with mass number 81 contains 31.7% more neutronsis compared to protons Assign the atomic symbol .

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117. An elements with mass number 81 contains 31.7% more neutronsis compared to protons Assign the atomic symbol .



118. The vividh Bharati station of All india Radio Delhi . Broadcasts on a frequency of 1.368 kHz (kilo hertz) Calculate the wavelength of the elctromagnetic radiation emitted by transmitter .Which part of the electromagnetic spectrum does it belong to ?

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119. The wavelength range of the visible spectrum extends from vloler (400nm) to red (750 nm) Express these wavelength in frequency (Hz)

120. Calculate (a) wavenumber and (b) frequecy of

yellow radiation having wavelength 5800 A



122. Calculate the wavelength frequency and wave number of a light wave whose period is 2.0 $imes 10^{10} s$



123. Calculate energy of one mole of photons of radiation whose frequency is $5 imes 10^{14} Hz$

(h = 6.626 $\, imes\,10^{34}j$)

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124. A 100 wart bulb emits monochromatic light of wavelength 400 bn, Calculate the number of photons emitted per second by the bulb.



125. Electromagnetic radiation of wavelength 242 nm is

just sufficient to ionise the sodium atom .Calculate the

ionisation energy of sodium in Kj mol^{-1}



126. The threshold frequency V_0 for a metal is $7.0 \times 10^{14} s^{-1}$ Calculation the kinetic energy of and electron emitted when radiation of frequency $v = 1.0 \times 10^{15} s^{-1}$ hits the metal .

127. Find energy of each of the photon which

(I) Correspond to light of frequency $3 imes 10^{15} Hz$

(ii) have wavelength of 0.50 A



128. What , is the number of photons of ligth with a

wavelength of 400 pm that provide 1 j of energy

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129. Photon of wavelength 4×10^7 strikes on metal surface the work function of the metal being 2.13 eV

Calculate (i) The energy of the photon ev (ii) The kinetic energy of the emission and (iii) the velocity of the photoelectron .

 $\left(1eV=1.6020 imes10^{19}J
ight)$

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130. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionise the sodium atom .Calculate the ionisation energy of sodium in Kj mol^{-1}



131. A 25 watt bulb emits monochromatic yellow light of wavelength of 0.57 μm .Calculate the rate of emission of quanta per second .



132. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800A. Calculate threshold frequency (V_0) and work function (W_0) of the metal.



133. Nitrogen laser produces a radiation at a wavelength of 337.1 nm if the number of photons emitted is $5.6 imes10^{24}$ calculate the power of this laser.

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134. Neon gas is generally used in the sign boards .if it emits strongly at 616 nm calculate (a) the frequency of emission (b) distance traveled by this radiation in 30 s (c) energy of quantum and (d) number of quanta present if it produces 2 J of energy .



135. A 100 wart bulb emits monochromatic light of wavelength 400 bn, Calculate the number of photons emitted per second by the bulb.

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136. Lifetimes of the molecules in the excited states are often measured by using pulsed radiation source of duration nearly in the nano second range . If the radiation source has the emitted during the pulse source is 2.5×10^{15} . Calculate the energy of the source .



137. The longest wavelength double absorption transition is observed at 589 and 589 nm Calculate the frequency of each transition and energy difference between two excited states.



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138. Photon of wavelength 4×10^7 strikes on metal surface the work function of the metal being 2.13 eV Calculate (i) The energy of the photon ev (ii) The kinetic energy of the emission and (iii) the velocity of the photoelectron .

 $\left(1eV=1.6020 imes10^{19}J
ight)$





139. Following results are observed when sodium metal is irradiated with different wavelength Calculate

(a) threshold wavelength and (b) planks constant

λ (nm)	500	450	400
$v \times 10^{-5} (m s^{-1})$	2.55	4.35	5.35



140. The ejection of the photoelectron from the silver metal in the photoelectric effect experiment can be stopped by applying the voltage of 0.35 eV with the

radiation 256.7 nm is used .Calculated the work

function silver metal.



141. If the photon of the wavlength 150 pm strikes an atom and one of tis inner bound electron is ejectred out with a velocity of $1.5 \times 10^7 m s^{-7}$ calculate the energy with which it is bound to the nucleus .

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142. What are the frequency and wavelength of a photon emitted during a transition from n=5 state to



144. What are the frequency and wavelength of a photon emitted during a transition from n=5 state to the n=2 state in the hydrogen atom ?

145. Calculate the ionisation energy of hydrogen atom

as well as energy needed to promote its electron from

first energy level to third energy level



146. What is the maximum number of emission lines when the excited electron of a H atom in n=16 drops to

the ground state ?



147. (i) The energy associated with the first orbit in the hydrogen atom is $-2.18 \times 10^{18} Ja \rightarrow m^{-1}$ what is the energy associated with the fifth orbit ? (ii) Calculate the radius of Bohr. fifth orbit for hydrogen atom

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148. Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen

149. What is the energy in joules requried to shift the electron of the hydrogen atom from the first Bohr orbit to the fifth bohr orbit and what is the wavelength of the light emitted when the electron returns to the ground state ? The ground state electron energy is 2.18×10^1 ergs

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150. The electron energy in hydrogen atom is given by $E_n = (-2, 18 \times 10^{18}) / m^2 n^2 J$ Calculate the energy required to remove an electron completely from the n=2 orbit .What is the longest wavelength of ligth in cm that can be used to cause this transitiion ?



151. (i) The energy associated with the first orbit in the hydrogen atom is $-2.18 \times 10^{18} Ja \rightarrow m^{-1}$ what is the energy associated with the fifth orbit ? (ii) Calculate the radius of Bohr. fifth orbit for hydrogen atom

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152. Calculate the energy required for the process

$$He_g^+
ightarrow He_g^{2+} + e^-$$

the ionization energy for the H atom in the ground state is $2.18 imes10^{-18}Ja o m^{-1}$

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153. Emission transition in the paschen series end at orbit n=3 and start from orbit n and can be represented as v= 3.29 $\times 10^{15} (Hz) rac{1}{3^2 - rac{1}{n^2}}$

Calculate the vallue of n if the transition is observed at

1285 nm . find the region of the spectrum



154. Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen

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155. What will be the wavelength of a ball of mass 0.1

kg moving with a velocity of 10 ms^{-1}



156. The mass of an electron is $9.1 imes10^{31}kg$ if its K.E. Is $3.0 imes10^{25}J$ calculate its wavelength .





158. Dual behaviour of matter proposed by de Broglie led to the discovery of electron microscope often used for the highly magnified images of biological moleculas and other type of material .If the velocity of the electron in this microsocope is $1.6 \times 10^6 m s^{-1}$ Calculate de - Broglie wavelength associated with this

electron $\left(m_e=9.1 imes10^{31}kgh=6.626 imes10^{34}Js
ight)$



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159. Dual behaviour of matter proposed by de Broglie led to the discovery of electron microscope often used for the highly magnified images of biological moleculas and other type of material .If the velocity of the electron in this microsocope is $1.6 \times 10^6 m s^{-1}$ Calculate de - Broglie wavelength associated with this electron ($m_e = 9.1 \times 10^{31} kgh = 6.626 \times 10^{34} Js$)

160. Dual behaviour of matter proposed by de Broglie led to the discovery of electron microscope often used for the highly magnified images of biological moleculas and other type of material .If the velocity of the electron in this microsocope is $1.6 \times 10^6 m s^{-1}$ Calculate de - Broglie wavelength associated with this electron $(m_e = 9.1 \times 10^{31} kgh = 6.626 \times 10^{34} Js)$

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161. The velocity associated with a proton moving in a potential difference of 100 v is $4.37 \times 10^5 m s^{-1}$.if the hockey ball of mass 0.1 kg is moving with this velocity , calculate the wavelength associated with this velocity



162. Mass of elements $9.1 \times 10^{31} kg$ find total uncertainty $(\Delta V. \Delta x)$ discuss the result ? (n = 6.626 $\times 10^{34} Js$)

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163. Mass of elements $9.1 \times 10^{-31} kg$ find total uncertainty ($\Delta V. \Delta x$) (h = 6.626 $\times 10^{-34} Js$)

164. A microscope using suitable photons is employed to locate an electron in an atom within a distance of 0.1 A .what is the uncertainty involved in the measurement of its velocity .

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165. A golf gall has a mass of 40 g and a speed of 45 $m \, / \, s$ if the speed can be measured within accuracy of

 $2\,\%\,$ calculate the uncertainty in the position

166. If the position of the electron is measured within an accuracy of + 0.002 nm calculate the uncertainty in the momentum of the electron Suppose the momentum of the electron is $h/4\pi_m \times 0.05nm$ is there any problem in defining this value ?

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167. Calculate the wavelength of an electron moving

with a velocity of $2.05 imes 10^7 m s^{-1}$

168. The mass of an electron is $9.1 imes10^{31}kg$ if its K.E. Is

 $3.0 imes 10^{25} J$ calculate its wavelength .



169. Show that the circumference fo the Bohr orbit for the hydrogen atom is an integral multiple of the de-Broglie wavelength associated with the electron revolving around the orbit.



170. What is the total number of orbitals associated

with the principle quantum number n-3?



171. Using s,p,d f notations describe the orbital with

the following quantum number

$$(a)n=2, l=1(b)n=4, l=0$$

(c) n=5,l =3 (d) n=3, l= 2
172. (a) How many sub - shells are associated with m=4

(b) How many electron will be present in the sub - shells having m value of $\frac{1}{2}$ for n= 4 ?

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Section A Try Your Self 1

1. Find neutron electron and proton in the following

(i)	31P 15	(11)	²³ Na*	(111)	$^{32}_{16}S^{2}$
(iv)	²³⁵ X	(v)	⁴⁰ Ca ²⁺	(vi)	¹⁹ F-

- **2.** Give symbol of following species :
- (I) Number of electron proton and neutron in 108 and

8 respectively.

(ii) ca (z= 20) and nucleon = 40

(iii) Species of mass number 25 proton 12 magnesium

and electron 10

(iv) Species of Bromine f in which (z= 35) electron 36

and neutron 45.



3. Give relation between following pair of species

(i)
$$\frac{40}{20}$$
Ca and $\frac{40}{19}$ K (iii) $\frac{40}{18}$ Ar and $\frac{40}{20}$ Cu and $\frac{40}{19}$ K (ii) $\frac{35}{17}$ Cl and $\frac{37}{17}$ Cl (iv) $\frac{87}{38}$ Sr and $\frac{90}{38}$ Sr



1. Calculate the number of electron in one mole $N^{\,-3}$

ion.

2. Find total number of electron proton and neutron in

0.192 kg $.^{32}_{16} S$



5. Give symbol of atom name atomic number (Z) . Mass number (A) and their electron (e) proton (p) and neutron (n) of 1 to 20 atomic number containing elements .

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Section A Try Your Self 3

1. Calculate frequency and wave number of 3.6A wavelength of photon .

2. Calculate frequency and wave number of 3.6A wavelength of photon .



3. Calculate the wavelength of an electron moving with

a velocity of $2.05 imes10^7ms^{-1}$

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4. Find the wavelength of electromagnetic radiation

having frequency 1368 KHz.

5. Chlorophy in green plant absorb the light 4.620 $imes 10^{14} Hz$ then find the length of thed line and also state the region in spectra.



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6. Find the wavelength of electromagnetic radiation

having frequency 1368 KHz.



7. Find the wavelength of electromagnetic radiation

having frequency 1368 KHz.



1. 1 mole photon having frequency 4.0 $imes 10^{14} Hz$ find

energy

2. Find the ratio of energy for radiations heaving

6000a and 4000 A wavelength

$$(h=6.62 imes 10^{-34} Js, C=3 imes 10^8 m s^{-1})$$

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3. 1 mole photon having frequency 4.0 $\times 10^{14} Hz$ find energy



4. Find the ratio of energy for radiations heaving6000a and 4000 A wavelength



photon.

7.1 mole photon having frequency 4.0 $~ imes ~10^{14} Hz$ find

energy



8. Find the frequency and wavelength of light require

ionization of solution .

(ionization energy of solution $= 8.2 imes 10^{-19} J$)

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Section A Try Your Self 5

1. In this spectrum of Li^{2+} the difference of two energy level is 2 and sum is 4. Find the wavelength of photon for difference of these two energy state. (note $n_1 + n_2 = 4$ and $n_2 = 2$ **so take** $n_1 = 1$ **and** $n_2 = 3$

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2. In electron From infinite state to ground state in

H atom . Find the emitted wavelength .



3. In this spectrum of Li^{2+} the difference of two energy level is 2 and sum is 4. Find the wavelength of photon for difference of these two energy state. (note $n_1 + n_2 = 4$ and $n_2 = 2$ so take $n_1 = 1$ and

 $n_2=3$

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4. find the wave number of shortest wavelength In

Balmer series (Note $n_1 := 2n_2 = \infty$)

5. In this spectrum of Li^{2+} the difference of two energy level is 2 and sum is 4. Find the wavelength of photon for difference of these two energy state. (note $n_1 + n_2 = 4$ and $n_2 = 2$ so take $n_1 = 1$ and $n_2 = 3$

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6. In this spectrum of Li^{2+} the difference of two energy level is 2 and sum is 4. Find the wavelength of photon for difference of these two energy state.

(note $n_1+n_2=4$ and $n_2=2$ so take $n_1=1$ and

$$n_2 = 3$$





7. Calculate the energy required for the process

 $He_g^e
ightarrow He_g^{2\,+} + e^{\,-}$

the ionization energy for the H atom in the ground

state is $2.18 imes 10^{18} Ja o m^{-1}$

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8. Find the radius of first second third orbit of hydrogen



9. Calculate the ionization energy of $H_i H e^+$ and $L i^{2+}$

in $kJmol^{-1}$

Note n=1,Z=1,2,3 respectively $E_n=rac{2.18 imes10^{-18}Z^2}{n^2}$



10. The energy difference of two stable orbit of hydrogen is 214 .68 $kJmol^{-1}$ if the transition of electron take place than find the emitted frequency (Note: v = $\Delta E/h$)



11. (i) The energy associated with the first orbit in the hydrogen atom is $-2.18 \times 10^{18} Ja \rightarrow m^{-1}$ what is the energy associated with the fifth orbit ? (ii) Calculate the radius of Bohr. fifth orbit for hydrogen atom

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12. Calculate the ratio of radius of 2n and 3rd orbit of

hydrogen atom (Note $r_n \propto n^2$)

13. (i) What is the energy of electron for hydrogen in J

/ atom and 1/ mole?

(ii) Calculate the energy of this electron per mole for

first transition.



14. Calculate wavelength of emitted radiation when

electron transition from n=3 to n=2?

This radiation belong to which region.

15. The wavelength of first line of Balmer series is 656 nm . Calculate the wave length of second line of this series. (Note : first line means n_3 to n_2 and second line

means
$$n_4 o n_2$$

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16. The energy of n^{th} orbit of hydrogen is $E_n = \frac{(1.31 \times 10^6)}{n} Jmol^{-1}$ is electron transist from n = 3 to n=2 than find frequency of emitted radiation (Note : h= $6.6 \times 10^{-34} jsN_A = 6.02 \times 10^{23} mol^{-1}$)



3. Nomination of electron is 5200 A .At which velocity

of electron its wavelength is equal to photon.



4. the kinetic energy of proton wave is 500 eV .Calculate debroglie wave length (mass of proton $=1.67 imes10^{-27}kg$

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5. The velocity of electron is 1% of velocity of light . Calculate debrobile wavelength of electron.



6. The kinetic energy of electron is $4.55 \times 10^{-25} J$ and mas is $9.1 \times 10^{-31} kg$ then calculate velocity , momentum and wave length of electron.

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7. If electron is accelerated by $1.0 imes 10^4$ volt than

calculate kinetic energy frequency and wavelength



8. The electron energy in hydrogen atom is given by $E_n = (-2, 18 \times 10^{18}) / m^2 n^2 J$ Calculate the energy required to remove an electron completely from the n=2 orbit .What is the longest wavelength of ligth in cm that can be used to cause this transitiion ?



9. (i) What is the energy of electron for hydrogen in J /

atom and 1/mole ?

(ii) Calculate the energy of this electron per mole for

first transition.

10. Calculate the nomination of particle which has 1A

wave

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11. Find the mass of photon of sodium lamp. How much

times this mass than electron mass ?

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12. If the wavelength and distance travel by electron in

1 sec . Is same than calculate the its velocity .



13. The mass of an electron is $9.1 imes 10^{31} kg$ if its K.E. Is

 $3.0 imes 10^{25} J$ calculate its wavelength .



14. An electron and a proton are detected in a cosmic ray experiment , the first with kinetic energy 10 keV and the second with 100 keV.Which is faster , the electron or the proton ? Obtain the ratio of their speeds . (electron mass = 9.11×10^{-31} kg , proton mass = $1.67 \times 10^{-27} kg$, $1eV = 1.60 \times 10^{-19}$ J)

15. The uncertainty in position is $10^{-10}m$ and in velocity is $5.27 \times 10^{-24}ms^{-1}$ calculate mass of particle .

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16. The moving bullet of gun has 10 gm mass and $10^{\,-5}$

m uncertainty in position . Find uncertainty in velocity



17. Nomination of electron is 5200 A .At which velocity

of electron its wavelength is equal to photon.



18. A golf gall has a mass of 40 g and a speed of 45

m/s if the speed can be measured within accuracy of

 $2\,\%\,$ calculate the uncertainty in the position



Section B Objective Question

1. How the atom word is derived ?



4. What is the charge mass its ratio electron ?



8. State the characteristic and uses of X-rays



11. Studied the radioactivity and developed it

 $.^{14}_6 C.^{13}_6 C.^{14}_7 N.^{12}_6 C$



12. Give the amount of protium and deuterium in

hydrogen atom with symbol.



13. Static isotopes of Hydrogen and write the no of

proton Electron Neutron in them .

14. What is the atomic number of carbone ? Give the

symbol of its isotops

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15. What are $.^{35}_{17}$ Cl and $.^{37}_{17}$ Cl ? Why

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16. Deuterium Tritium are the Isotopes of -



electromagetic radiation it can be explain ?



19. Which properties can be explained by wave nature

and particle nature of light.

20. In visible spectrum which colour has maximum

energy ? Static its wavelength and frequency.



21. In visible spectrum which colour has minimum

energy ?State ite wavelength and frequency.



22. Give formula for coloumbic attraction force and

graviation force?

23. State Maxwell's electromagnetic principal.



25. The characteristics electromagnetic radiation given

by which properties?

26. What is speed of electromagnetic radiation in vacuum ? What is it called ?

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27. Give equation of wave number and periodic time



28. Is there nutron in nucleus of hydrogen ?
29. What is the change observe in iron on heating with

different temperature ?



31. Calculate the ratio of diameter of atom and nucleus



32. in chlorine $.^{35}$ CI and $.^{37}$ CI is in 3:1 ratio calculate

charge atomic mass.



33. Which of the following is dimensional formula of

intensity of radiation ?

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34. Explain visible spectrum and continuous spectrum.



35. Give example of continuous spectrum

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36. Give the reason for the formation of spectrum .
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37. Which colour from violet and Red is more refracted
? Why

38. What is emission spectrum?



spectrum to which each belongs.

14.4 keV [energy of a particular transition in ^{57}Fe



42. If electron transits from n=5 to n=2 it belong which

series.?

43. Emission spectrum of gaseous atom is linear but

not cureve Why?



44. In emission spectra $n_2
ightarrow , n_3
ightarrow n_1 n_4
ightarrow n_1, n_5
ightarrow n_1$ tansition are respectively for energy E_1, E_2, E_3, E_4 So what is the order of energy ?



45. In emission spectra $n_2 o n_1, n_3 o n_2, n_4 o n_3, n_5 o n_4$ transition are respectively for energy of E_1, E_2, E_3, E_4 so what is the order of energy.



46. State the angular momentum when electron revent

orbits ?



47. How much radius are there in stationary orbitals ?



51. Give the equation to calculate energy of one electron.



52. The velocity of electron in orbit depends on which

factors ?

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53. How the energy of an electron change in orbit?

54. The intensity of lines in spectrum depends on which factor? Watch Video Solution 55. What is Zeman effect and stark effect? Watch Video Solution

56. State Debroglie principle

57. State Heisenberg principle



59. What is the characterstrics of electron microscopy

? It depends on which principle ?

60. All maters has nature ? Why



?

63. Which type of dimension require for position of

electron ?



66. What is the uncertainty $\Delta v. \ \Delta x$ for 1 mg object ?

What in indicate ?



67. What is the value of $\Delta v. \ \Delta x$ (uncertaintly) for

electron ?What it indicate ?

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68. Which elements does not posses neutron?

69. when electron strike with ZnS it shhows fluorescent

what is indirector ?



71. Which type of metal used in photoelectric cell give

example.

72. What is quantum mechanics ?



73. Who developed quantum mechanics ?



74. Who developed fundamental equation of quantum

mechanics?

75. Give the equation for system such as quantum or a

molecule whose energy does not change with time.



78. The energy of hydrogen and species like it depends

on which factor ? And not depends on which factor ?



79. The energy of hydrogen and species like it depends

on which factor ? And not depends on which factor ?



80. How is the solution of Schrodinger equation for

multielectron atom ?

81. What is atomic orbital?

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82. How the atomic orbitals are distingulshed from

each other ?

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83. What is indicated by n, l and m_l ?



87. what is the difference between 2p and 2s?



91. State the number of radial nodes in 2p , 3p ,4p ,5p

orbitals



94. The number of orbitals depends on which quantum

number and not depends on which quantum number ?

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95. Where is the nodal plane in P_x, P_y and P_z orbital ?
Vatch Video Solution
96. how many angular node in d_x orbital which ?
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97. How is the angular node in s,p,d,f



99. Give the energy order of 2s orbitals of H, Li ,Na ,K.

100. Give the relation between energy of orbital and

atomic number is same energy level ?



101. Which one has higher energy 4s and 3d ? why ?



102. For both 2p and 3s orbital value of (n+l) is same ie

3. than which one has less energy from both ? Why ?

103. Which orbitals are then in hydrogen atom?

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104. What is the difference in ground state and
exicited state of hydrogen ?
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105. State the name of orbitals as per quantum number, magnetic quantum number and no of oribitals .

$$(i)n=3, l=2(ii)n=4, l=3$$

$$(iii)n=2, l=0(iv)n=5, l=1$$



106. From the following in which pair of orbitlas have

more attraction with nucleus

(i) 4f and 5d (ii) 4d and 5 s (iii) 7s and 5 f,

(ii) 7p and 5p (v) 3d and 3f





110. State the electron configuration of atom having (z=16) Mention that how many p electron are there in and give the number of half filled and full filled orbitals

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111. Ion having -2 charge posses electron configuration

 $1s^22s^22p^6$ state the ion ?

112. One atom has (z=25) state s electron

Watch Video Solution]
113 if n =3 than state in number of orbitals an	4
electron ?	J

114. State the element in which valence electron are $2p^4,\,3s^2,\,3p^3$

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115. Arrange in increasing order of energy

(I) n=2, l =0,
$$m_1 = 0m_s = \frac{1}{2}$$

(ii) $n = 2, l = 1, m_1 = +1, m_s = \frac{1}{2}$
(ii) $n = 3, lm_1 = +1, m_s = \frac{1}{2}$
(iv) $n = 3, l = m_l = -1m_s = +\frac{1}{2}$

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116. How many nods are there in 4s and 3s?



117. Which one is more closer to nucleus from 2p and



119. What is the relation in shape of $3d_{xy}$ and $3dx_2$?



120. State the number of Radial node and angular nod

of 5F?



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123. How many maximum electron can be filled in d and

f orbitals ?



127. State minimum value of n and l for f orbital



129. Write the electronic configuration of the following

ions :

$$(a)H^{\,-}\,(b)Na^{\,+}\,(c)O^{2\,-}\,(d)F^{\,-}$$



130. What are the atomic numbers of elements whose

outermost electron are represented by

 $(a)3s^1(b)2p^3$ and $(c)3p^5$?

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131. Which atom are indicated by the following configuration ?


132. What is the lowest value of n that allows g orbitals

to exist ?



133. An electron is in one of the 3d orbitals .Give the

possible values of n , I and m_l for this electron.



134. An atom of an element contains 29 electron and 35 neutrons .Deduce (i) The number of protons and (ii) the electronic configuration of the element .



137. list the quantum number $(m_l \text{ and } l)$ of electrons for 3d orbital Watch Video Solution

138. Which of the following orbitals are possible

1p , 2s, 2p , 3f



139. using s,p,d notations describle the orbital with the

following quantum numbers .

(a) n= 1, l =0 (b) n = 3, l = 1 (c) n= 4,l =2

(d) n=4, l =3



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140. Explain giving reasons which of the following sets of quantum number are not possible (a) n=0, l =0 $m_l = 0, m_s = +\frac{1}{2}$ (b) n=1, l = 0 $m_l = 0, m_s = -\frac{1}{2}$ (c) $n = 1, l = 1, m_l = 0, m_s = +\frac{1}{2}$ (d) $n = 2, l = 1, m_l = 0, m_s = \frac{1}{2}$

(e) n=3, l = 3,
$$m_l=3, m_s=\,+\,rac{1}{2}$$

(f) n=3, l = 1, $m_l=0, m_s l=\,+\,rac{1}{2}$

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141. How many electron in an atom may have the following quantum number ?

(a) n=4,
$$m_s=~-~rac{1}{2}(b)n=3, l=0$$

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Section C Multiple Choice Question Mcqs

1. Which of the following statement is incorrect regarding cathode rays ?

A. a) Characteristics cathode rays do not depends

upon the material of electrode.

B. b) Characteristics cathode rays do not depends

upon the nature of the gas.

C. c) Cathode rays have no mass and charge

D. d) Cathode rays orginate from the cathode.

Answer: C

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2. Proton is

A. an ionisded hydrogen atom

B. an ionised hydrogen molecule

C. an α particle

D. a negatively charged particle

Answer: A

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3. Which of the following properties is associated with

whole number for an atom ?

A. Atomic radius

B. Atomic mass

C. Atomic

D. Atomic number



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5. State the species in which electron proton and neutron are 10 ,8 , 8 respectively ?

A.
$$\cdot_{8}^{12} O^{2-}$$

B. $\cdot_{8}^{16} O$
C. $\cdot_{8}^{16} O^{2-}$

D.
$$.^{16}_8 \, O^{\,-}$$

Answer: C

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6. The number of proton neutron and electron respectively And? .

A. 1,3,1

B. 1,2,1

C. 1,0,1

D. 2,1,0

Answer: B



7. What is not same in $.^{35}_{17} CI$ and $.^{37}_{17} CI$?

A. Electron

B. Proton

C. Neutron

D. Nucleon

Answer: C



8. What is same in isotone?

A. Electron

B. Proton

C. Neutron

D. Nucleon

Answer: C



9. What is used in Rutherford experiment?

A. Cathode rays

B. He^{2+} rays

C. X-rays

D. γ rays

Answer: B



10. The spectral line obtained when electron jumps from $n_1=6$ to $n_2=2$ state in hydrogen atom

belongs to the

A. Pfund series

B. Pachen series

C. Lyman series

D. Balmer series

Answer: D



11. The splitting of the spectral lines under the influence of magnetic field is called

A. Photoelectric effect

B. Zeeman effect

C. diffraction

D. Interference

Answer: B



12. The spliting of spectral line in magnetic and electrical field is known as .

A. Photoelectron and stark effect

B. Zeman and stark effect

C. Stark and zeman effect

D. Photoelectron and zeman effect

Answer: B



13. State True (T) or False (F) for following statements

A. As the frequency is more wavelength is less

B. As the frequency is more energy is less

C. As the frequency is more energy is more

D. As the frequency is more wavelength is more

Answer: A

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14. Which of the following sentences is not true ?

A. Light is a beam of photon

B. Light has wave nature so it diffracted.

C. Light has particle nature so balck body radiation

observe.

D. Light require air as medium

Answer: D



15. From the following which equation is not the form

of de - broglis equation ?

A. Kinetic energy
$$rac{2hv}{\lambda}$$

B.
$$\lambda m = rac{h}{v}$$

C. $\lambda p = h$

D. Kinetic energy $=rac{hv}{2\lambda}$

Answer: A







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18. How many maximum number of electrons in 3p orbital have spin quantum number $s=~+~rac{1}{2}$?

A. 0

B.6

C. 3

D. 2

Answer: C



19. Which is the correct set of all four quantum number for valance electron of Na ?

A. 1,
$$-0, 0, +\frac{1}{2}$$

B. 2, 1, $1 + \frac{1}{2}$
C. 3, 0, $0 + \frac{1}{2}$
D. 3, 1, 0, $+\frac{1}{2}$

Answer: C



20. Which quantum number indicates the orientation

of oribitals space under magnetic field ?

A. n

B.s

C. I

D. m

Answer: D



21. Which pair is true from the following ? a-aufbau principle-1 mvr b-angular momentum-2-orientation of electron in orbital c-hunds rule-3 order of orbital energy

A. b>1

B. a>1

C. c>1

D. b>3

Answer: A

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22. Which one is the most stable electron

configuration ?



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23. How many orbitals upton n=4?

A. 8

B. 30

C. 16

D.4

Answer: B



24. Which will be the oribital when n= + 12?

A. s

B.p

C. d

D. f



C. I

D. m

Answer: C



2. Give number of unpaired electron in Ni^{2+}

- **A.** 0
- **B.** 1
- **C.** 3
- D. 2

Answer: D



3. The electron configuration $1s^22s^22p^63s^23p^2$ is for Element

B. p

C. si

D. s

Answer: C



4. It n =6 l =1 p orbital m= 0 .Then the max electron in p

orbital are

A. 6

B. 2

C.4

D. 10

Answer: B



5. When electron transist from higher energy level to

lower energy level then

A. energy absorb

B. energy emits

C. atomic number increase

D. atomic number decreases

Answer: B



6. Which ion does not posses electron cofiguration like

Ne?

A. Na⁺ **B.** F⁻

C. $Mg^{2\,+}$

D. $CI^{\,-1}$

Answer: D



7. From the following orbitals of which electron

configuration violates Aufbau principle?



8. the electron configuration of nitrogen is

 $1s^22s^22p_x^12p_y^12p_z^1$ instead of

 $1s^22s^22p_x^22py^1$ is decided by .

A. Paulis principle

B. Aufbau principle

C. Hund.s rule

D. Ritz rule

Answer: C



9. The spectra of He^+ is similar as

A. Li^+

B. Na

C. He

D. H

Answer: D



10. Which type of spectra obtained if electron transists

from M - orbit to L- orbit ?

A. absorption

B. emission

C. continuous

D. spectra will not obtain



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12. How many unpaired electrons are present in p -

orbital of oxygen ?

A. 0

B.1

C. 2

D. 3

Answer: C


13. Which series of lines obtained in ultraviolet region

in hydrogen spectra?

A. Paschen

B. Balmer

C. Lyman

D. Pfund

Answer: C



14. In hydrogen atom for which change higher energy

required ?

A. n= 3 to n= 5

B. n=1 to n=2

C. n=2 to n=3

D. n=2 to n=1

Answer: B



15. give electron configuration of Fe^{+3} in its ground state .

- A. $[Ar]3d^34s^2$
- $\textbf{B.} [Ar] 3d^5 4s^2$
- $\mathbf{C.}\,[Ar]3d^6$
- $\mathbf{D}_{\boldsymbol{\cdot}}[Ar]3d^5$

Answer: D



16. Which are isoelectronic from the following

A.
$$Cr^{+3}, Ar$$

B. Si^{+4}, P^{+3}

C. $Mg^{2\,+},\,Na$

 $\mathbf{D.} Ar, CI$

Answer: D



17. If atomic number is (z=26) then given number of 3d

electrons .

A. 6

B.8

C.4

D. 5

Answer: A



18. the four quantum number of the outermost electron of k (z=19) are

A. n=4 ,l = 0, m=0, s=
$$+\frac{1}{2}$$

B. n=4,l=0, m=1, s = $+\frac{1}{2}$
C. n=3 ,l=0, m=0, s $+\frac{1}{2}$
D. n=3, l=2, m=-1, s = $+\frac{1}{2}$



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20. When α -particles are made incident on a thin metal foil most of them pass straight through the foil because .

A. most part of the atom is empty

B. α - particles are positively charged

C. $\alpha\text{-}\operatorname{particle}$ move with high velocity

D. α particle are positively charged

Answer: A

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21. In hydrogen atom electron jumps from 3^{rh} to 2^{nd} energy level the energy released is

A.
$$3.03 imes 10^{12} Ja
ightarrow m^{-1}$$

B. $1.03 imes 10^{19} Ja o m^{-1}$

C. $6.06 imes 10^{19} Ja o m^{-1}$

D.
$$3.03 imes 10^{19} Ja
ightarrow m^{-1}$$

Answer: C



22. Wavelength associated with electron motion

A. increase with increase in speed of electron.

B. remains same irrespective of speed of electron

C. decreases with increases in speed of electron

D. is zero

Answer: C

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23. What is the ratio of mass of proton and electron ?

A. $1.836 imes 10^3$

B. 1.836

C. 1.836×10^2

D. $1.836 imes 10^4$

Answer: A

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24. According to Bohr's theory of hydrogen atom which of the following is quantised for and electron ?

A. Angular momentum

B. Angular acceleration

C. Accelaration

D. Velocity

Answer: A



25. The electrons identified by 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 order of increasing energy from the lowest to highest as

$$\begin{array}{l} \textbf{A.}\,(iv) < (iii) < (iii) < (i) \\ \textbf{B.}\,(ii) < (iv) < (i) < (iii) \\ \textbf{C.}\,(i) < (iii) < (ii) < (iv) \\ \textbf{D.}\,(iii) < (i) < (iv) < (ii) \end{array}$$

Answer: A



26. Assertion (A): The 19^{th} electron in potassium atom eneters into 4s- orbital and not the 3d- orbital Reason (R : (n + l) rule is followed for determining the orbital of the lowest energy state. The correct choice is

A. Both (A) and (R) are true and (R) is the correct

explanation of (A)

B. both (A) and (R) are true but (R) is not the correct explanation of (A)

C. (A) is true but (R) is not true

D. (A) is not true but (R) is true

Answer: A

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27. Assertion (A) : The orbital cannot have more than two electrons > Reason (R) Two electrons in an orbital create opposite magnetic field. The correct choice is

A. both (A) and (R) are true (R) is the correct

explantion of (A)

B. both (A) and (R) are true but (R) is not the

correct explanation of (A)

C. (A) is true but (R) is not true

D. (A) is not true but (R) is true

Answer: B

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28. the electron configuration of an element is $1s^22s^22p^63p^63d^54s^1$ this represents

A. excited state

B. ground state

C. cationic

D. anionic state

Answer:

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29. Which one is least stable in from following

A. Li^{-}

 $\mathbf{B.}\,B^{-}$

C. Be^{-}

D. $C^{\,-}$

Answer: C



30. The correct set of quantum number for 4d electron

A. 4,
$$3 - 1 + \frac{1}{2}$$

B. 4, 2, 1, $-\frac{1}{2}$
C. 4, 3, $2 + \frac{1}{2}$
D. 4, 2, 1, 0

Answer: B

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31. Iso - electronic species are

A.
$$F^{-}, O^{-2}$$

B. $F^{-}O$
C. F^{-}, O^{+}
D. F^{-}, O^{+2}

Answer: A



32. the charge of an electron is $-1.6 imes 10^{19} C$. the value of free charge on Li^+ ion will be

A. $3.6 imes 10^{19}C$

 $\textbf{B.}1\times 10^{19}C$

C. $1.6 imes 10^{19}C$

D. $2.6 imes 10^{19}C$

Answer: C



33. The frequency of yellow light having wavelength 600 nm is

A. $5.0 imes10^{14}Hz$

 ${f B.}\,2.5 imes10^7 Hz$

C. $5.0 imes 10^7 Hz$

D. $2.5 imes 10^{14} Hz$

Answer: A

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34. Give number of unpaired electron in Ni^{2+}

A. 0

B.1

C. 3

D. 2



total number of electrons present in all the p -orbitals

of the ground state atom of that element

A. 6

B. 11

C. 17

D. 23

Answer: C



36. If electron is removed from an atom then is energy

A. decreases

B. increases

C. remain same

D. none

Answer: B

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37. What is the mass of photon having wavelength 3.6

$$ig(h=6.6 imes 10^{34} kgm^2 s^{-1}, c=3 imes 10^8 ms^{-1}ig)$$

A. $8.212 imes10^{31}kg$

B. $5.687 imes 10^{34} kg$

 ${f C.6.135 imes10^{33}kg}$

D. $7.256 imes 10^{32} kg$

Answer: C

Α

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38. the nucleus of an element contain 9 protons

its valency would be

A. -1

B. 3

C. 2

D. 5

Answer: A



39. Which of the following ion has the highest number

of the upaired electrons ?

A. Fe^{3+}

- **B.** Fe^{2+}
- C. Ni^{2+}
- **D.** CO^{2+}

Answer: A



40. What is the mass of photon having wavelength 3.6

$$(h=6.6 imes 10^{34} kgm^2 s^{-1}, c=3 imes 10^8 ms^{-1})$$

A. $6.135 imes 10^{29}kg$

B. $3.6 imes 10^{29}kg$

C. $6.135 imes 10^{33} kg$

D. $3.6 imes 10^{17} kg$

Answer: A

Α

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41. The nature of anode rays depends upon

A. Nature of electrone

B. Nature of residual gas

C. Nature of discharge tube

D. all the above

Answer: B

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42. If magnetic quantum number is -3 then the principle quantum number can be

A. 1

B. 2

C. 3

D.4

Answer: D



43. Which one is not correct?

A.
$$n=4, l=2, m=0$$

B.
$$n = 4, l = 1, m = 0$$

C. n = 4, l = 4, m = 1

D.
$$n = 4, l = 0, m = 0$$

Answer: C



44. Which of the following has maximum number of unpaired electrons ?

A.
$$Fe^{3+}$$

B. Fe^{2+}

C. Co^{2+}

D. Co^{3+}



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46. Magnitude of K.E. in an orbit is equal to

A. Half of the potential energy

B. Twice of the potential energy

C. One fourth the potential energy

D. None of these

Answer: A

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47. For one atom the energy difference between excited state ground state is $4.4 imes 10^{-4} J$ Then what

will be wavelength of photon ?

A.
$$2.26 imes 10^{12}m$$

- B. $1.13 imes 10^{12} m$
- C. $4.25 imes 10^{12}m$
- D. $4.52 imes 10^{12} m$

Answer: D

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48. Nuclear theory for atom was given by

A. Rutherford

B. Einstein

C. Neil bohr

D. J.J. Thomson

Answer: A



49. How many electrons in 2p orbital have spin quantum number $s=rac{1}{2}$?

A. 6

B. O

C. 2

D. 3

Answer: D



50. Which orbital is non directional?

A. 4p

B. 4d

C. 4f

D. 3s

Answer: D





51. Rutherford experiment prove

A. Electron

B. Proton

C. Atom

D. Nucleon

Answer: D



52. Give no. of energy state, orbital and electrons in N

orbital .

A. 4,12,32

B. 4,16 ,30

C. 4,16 ,32

D. 4,32,64

Answer: D



53. Calculate the energy of 1 mole of photon whose

frequency is $5 imes 10^{14} Hz$

A. 19.951 * Kj

B. 199.51 kJ

C. 39.90 kj

D. 399.0 kj

Answer: C


54. Three unpaired electron of nitrogen atom can be examplained by ...

A. Paulis rule

B. Aufbau principle

C. Uncertainity principle

D. Hund.s rule

Answer: B



55. the energy of electron in first energy level is $-21.79 \times 10^{12} erg/$ atom. What will be energy in second energy level ?

A. $-54.47 imes 10^2 erg \, / \, a
ightarrow m$

B. $-5.447 imes 10^{12} erg/a
ightarrow m$

 ${
m C.}-5.5447 imes 10^{12} erg/a
ightarrow m$

D. $0.05447 imes 10^{12} erg/a
ightarrow m$

Answer: B

56. An electron from one Bohr stationary orbit can go to next higher orbit

A. by emission of electromagnetic radiation

B. by absorption of electromagnetic radiation

C. by absorption of electromagnetic radiation of

particular frequency.

D. without emission or absorption of electron

magnetic radiation .

Answer: C



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

A. 0

B. 52.9

C. 26.5

D. 105.8

Answer: C



58. IN which one of the following the number of protons greater than neutrons but number of protons is less than the number of electrons

A. $D_{3}O^{+}$

B. SO_2

 $\mathbf{C}.H_2O$

D. OH^{-3}

Answer: D

59. Which set of quantum number is not possible

-	n	1	m	8	-	n	1	m	8
(A)	3	2	-2	$+\frac{1}{2}$	(B)	4	0	0	$+\frac{1}{2}$
(C)	5	3	0-	$\frac{1}{2}$	(D)	3	2	-3	$+\frac{1}{2}$



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60. Assertion (A) : The probability of finding an electron in a small volume around a point (x,y,z) at a diatance r from the nucleus is proportional to square of orbital wave function.

reason (R) : subatomic particle have both wave and particle nature. The correct choice is

A. Both (A) and (R) are true and (R) is the correct

explanation of (A)

B. Both (A) and (R) are true but (R) is not the

correct explanation of (A)

C. is true but (R) is not true

D. (A) is not true but (R) is true

Answer: B

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61. A body of mass xkg is moving with velocity of $100ms^{-1}$ its de - broglie wavelength is

 $6.62 imes 10^{-34} m^{-1}$ Hence x is ...

`(h= 6.62 x 10^(-34) J s)

A. 0.25kg

B. 0.15kg

 $\mathbf{C.} 0.2kg$

 $\mathbf{D.}\,0.1kg$

Answer: D



62. Which of the following wave equation is trure?

(A)
$$\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2} + \frac{8\pi^2 m^2}{h^2} (E - V)\psi = 0$$

(B)
$$\frac{\partial \psi^2}{\partial x^2} + \frac{\partial \psi^2}{\partial y^2} + \frac{\partial \psi^2}{\partial z^2} + \frac{8\pi^2 m^2}{h^2} (E - V)\psi = 0$$

(C)
$$\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2} + \frac{8\pi^2 m}{h^2} (E - V)\psi = 0$$

(D) $\frac{\partial^2 \psi}{\partial^2 x} + \frac{\partial^2 \psi}{\partial^2 y} + \frac{\partial^2 \psi}{\partial^2 z} + \frac{8\pi^2 m}{h^2} (E - V)\psi = 0$

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63. What does the electron configuration $1s^22s^22p^53s^1$

indicate ?

A. ground state of fluorine

- B. excited state of fluorine
- C. excited state of neon
- D. excited state of the O_2^{-1} ion

Answer: C



64. Which of the following is true for number of electrons orbitals and type , orbitals present in N-orbit respectively?

A. $4,\,4$ and 8

B. 4,8 and 16

C. 32,16 and 4

D. 4,16 and 32

Answer: C

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65. A metallic ion m^{2+} has na electronic configuration of 2,8,14 and the ionic weight is 56 amu. The number of neutron in its nucleus is

A. 30

B. 32

C. 34

D. 42

Answer: A



66. Calculate the wavelength of the light required to break the bond between two chlorine atoms in a chlorine molecule . The Cl-Cl and bond energy is 243 kj mol^{-1}

$$egin{array}{lll} (n=6.6 imes10^{34}JsC=3 imes10^8ms^{-1} & { t Avogadrons} \ { t number}\ = 6.02 imes10^{23}mol^{-1}$$
)

A. $8.18 imes 10^{31}m$

 ${f B.6.26 imes10^{21}m}$

C. $4.91 imes 10^{-7} m$

D. $4.14 imes 10^6 m$

Answer: C



67. A 600 W mercury lamp emits monochromatic radiation of wavelength 313 .3 nm . How many phtons are emitted from lamp per second ? $(h = 6.626 \times 10^{34} Js$ velocity of light $3 \times 10^8 ms^{-1})$

A. $1 imes 10^{19}$

 $\textbf{B.}1\times10^{20}$

 $\textbf{C.}1\times10^{21}$

 $\textbf{D.}1\times10^{22}$

Answer: C



68. The shortest wavelength in hydrogen spectrum of

layman series when R_H = 109678 `cm^(-1)' is

A. 1002.7A

B. 1215.67 A

C. 1234.7A

D. 911.7 A

Answer: D



69. In which one of the following pairs the two species are both isoelectronic and isotopic (atomic number Ca = 2 , Ar = 18 , K = 19 mg = 12 ,fe = 26 , Na=11)

A. . 40 Ca^{2+} and . 40 Ar

B. . 39 K^+ and . 40 K^+

C. ${}^{.56}Fe^{3+}$ and ${}^{.57}Fe^{2+}$

D. . 23 Na and . 24 Na^+



D. f

Answer: B



2. How many electrons are present in n= 3 orbit ?

A. 2

B. 18

C. 8

D. 32

Answer: B

3. If angular momentum quantum number I=3 then give possible values of magnetic quantum number m.

A. 0,1,2

B.0, ± 1 , $\pm 2 \pm 3$

C. 0, 1, 2, 3

D. $\pm 1, \pm 2, \pm 3$

Answer: B

4. An atom has the electronic configuration of $1s^2$, $2s^22p^6$, $3s^23d^{10}$, $4s^24p^5$.Its atomic weight is 80. Its atomic number and the number of neutrons in its nucleus shall be

A. 35 and 45

B. 45 and 35

C. 40 and 40

D. 30 and 50

Answer: A

5. The maximum electron occupy in f orbital are

A. 10

B. 18

C. 8

D. 14

Answer: D



6. Three unpaired electron of nitrogen atom can be examplained by ...

A. Aufbau principle

B. Hund.s rule

C. Pauli.s exclusion principle

D. Heisenberg uncertainty

Answer: B

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7. Which ion has 18 electron in its outermost orbit ?

A. Cu^+

 $\mathbf{B.}\,K^+$

C. Cs^+

D. CI^{-1}

Answer: B



8. Atomic radius of hydrogen atom H in Bohr.s model is

A. $0.529 imes 10^7 cm$

 ${f B.0.529 imes10^9cm}$

 ${f C.0.529 imes 10^8 cm}$

D. $0.529 imes 10^{10} cm$



D. Cu^{+2}

Answer: C



10. The spectrum of he is expected to be similar to that of

A. H

B. Na

C. He^+

D. Li^+

Answer: D

11. Which one is correct for hydrogen

A. The energy of 3d orbital is less than 3p

B. The energy of 3p orbital is less than 3d

C. The energy of 3s & 3p is less than 3d

D. 3s, 3p & 3d all orbitals have same energy

Answer: D

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12. The correct increasing order of energy is

A. ns, np ,(n-1) d, (n-1) f

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

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

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

Answer: C



13. Which one is correct for electron in 4f orbital

	n	ı	m	8		n	1	m	8
(A)	4	3	+4	$+\frac{1}{2}$	(B)	4	4	-4	$-\frac{1}{2}$
(C)	4	3	+1	$+\frac{1}{2}$	(D)	3	2	-2	$+\frac{1}{2}$

14. What will be the number of electron in ground state of Cr having subsidiary quantum number I=1 and I=2 respectively ?

A. 12 and 4

B. 12 and 5

C. 16 and 4

D. 16 and 5

Answer: B



15. What is the angular momentum of electron in 5^{th}

orbit of Bohr.s model

A.
$$1.0\frac{h}{\pi}$$

B. $10.\frac{h}{\pi}$
C. $2.5.\frac{h}{\pi}$
D. $25.\frac{h}{\pi}$

Answer: C



16. From the following which sets of ions is isoelectronic?

A.
$$K^+, CI^-, Ca^2, Sc^3$$

B.
$$Ba^{+2}, Sr^2, K^+s^{-2}$$

C.
$$N^{-3}O^{-2}F^{-}S^{-2}$$

D.
$$Li^+, Na^+, Mg^{-2}, Ca^{+2}$$

Answer: A



17. For an electron v= 300 ms^{-1} and certainty in velocity is 0.001 % what is the uncertainty in position

A. $5.76 imes10^2m$

B. $1.92 imes 10^2 m$

C. $3.84 imes 1^2 m$

D. $19.2 imes 10^{-2} m$

Answer: B



18. Who proposed that electron has wave nature?

A. Schrodinger

- **B. De- Broglie**
- C. Heiseneberg
- D. None

Answer: B



19. Which nuclear reaction produce isotope

A. emission of neutron

B. emission of positron

C. emission of α particle

D. emission of β particle

Answer: A

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20. Which of the following sets of quantum numbers represents the highest energy of an atom ?

A. n=3 ,l= 0 m=0 ,s=
$$\frac{1}{2}$$

B. n=3,l=1 m=1,s= $\frac{1}{2}$
C. n=3,l=2 m=1 s= $\frac{1}{2}$
D. n=4,l=0 m=0 ,s= $\frac{1}{2}$



21. What is the orbital angular momentum for electron in 2s orbital ?

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

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

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

Answer: B



22. The ionization energy hydrogen atom is 13.6 ev .The

ionization energy of He

A. 13.6 eV

B. 54.4eV

C. 122.4eV

D. zero

Answer: B

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23. Which of the following sets of quantum number is

not possible ?

	n	1	m	5
(1)	3	0	0	$+\frac{1}{2}$
(2)	2	2	1	$+\frac{1}{2}$
(3)	4	3	-2	$\frac{1}{2}$
(4)	1	0	-1	$-\frac{1}{2}$
(5)	3	2	3	$+\frac{1}{2}$

A. 1 and 3

B. 2,3 and 4

C. 1,2,3 and 4

D. 2,4 and 5

Answer: D



24. The ionization energy of hydrogen atom is $1.312 \times 10^6 Jmol^{-1}$ calculate the energy require for jump of electron from n=1 to n=2

A. $9.56 imes10^5 j/mol$

B. $7.56 imes 10^5 j/mol$

C. $9.84 imes 10^5 j/mol$

D. $8.51 imes 10^5 j/mol$

Answer: C


25. Which sets of ions is isoelectronic?

- **A.** NO^+ , $C_2^{-2}CN^-N_2$
- $\mathbf{B.}\,CN^{\,-1}N_2O_2^{\,-2}C_2^{\,-2}$
- C. $N_2, O_2^{-1}NO^+CO$
- ${\sf D.}\, C_2^{\,-2} O_2^{\,-1} CO, No$

Answer: A

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26. the density of a nucleus of an atom is

A.
$$2.4 imes 10^{15} kgm^{-3}$$

B. $2.4 imes 10^{19} kgm^{-3}$
C. $2.4 imes 10^{17} kgm^{-3}$
D. $2.4 imes 10^{14} kgm^{-3}$

Answer: C



27. if uncertainty in position and momentum are equal

then uncertainty in velocity is

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

B. $\frac{1}{m}\sqrt{\frac{h}{2\pi}}$
C. $squr\left(\frac{h}{\pi}\right)$
D. $squr\left(\frac{h}{\pi}\right)$

Answer: A



28. Applying bohr.s model when electron of H atom comes from n=4 to n=2 calculate its wavelength

A. 4866 A

B. 5272 A

C. 4634 A

D. 5084A

Answer: A

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

A. 0.40 nm

B. 14. nm

C. 2.5 nm

D. 0.32 nm

Answer: A

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30. The maximum number of electron in subshell is given by expression .

A. 41 -2

B. 4l+2

C. 2l+1

D. $2n^2$

Answer: B



31. Which of the following is not permissible arrangement of electron in an atom ?

A.
$$n = 5, l = 3m = 0, s = +\frac{1}{2}$$

B. n=3 ,l =2 m=-3 ,s= $\frac{1}{2}$
C. $n = 3, l = 2m = 2, s = \frac{1}{2}$
D. $n = 4, l = 0nm = 0s = \frac{1}{2}$

Answer: B

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32. ionisation energy of He is $19.6 imes 10^{-18} ja o m^{-1}$

The energy of the first stationary state (n=1) of Li^+ is

A. $4.14 imes 10^{16}a
ightarrow m^{-1}$

B. $4.14 imes 10^{-17} J$ atom

C. $2.2 imes 10^{15} J$ atom

D. $8.82 imes 10^{17} J$ atom

Answer: B

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33. if a species has 16 proton 18 electron and 16 neutron find the species and its charge

A. s^{-1} **B.** Si^{2+} **C.** p^{3-}

D. s^{2-}

Answer: D



34. A gas absorbs photon of 355 nm and emits two wavelength if one of the emission is at 680 nm the other is at .

A. 1035 nm

B. 325 nm

C. 743 nm

D. 518 nm

Answer: C



35. An ion has a charge of -1 . It has eighteen electrons

and twenty neutron mass number is

A. 17

B. 37

C. 18

D. 38

Answer: B



36. maximum number electrons in a subshell with I =3

and n=4 is

A. 10

B. 12

C. 14

D. 16

Answer: C



37. the correct set of the four quantum number for the

valence electron or Rubidum atom (z=37) is

A. 5, 0, 0,
$$+\frac{1}{2}$$

B. 5, 1, 9, $+\frac{1}{2}$
C. 5, 1, 1, $+\frac{1}{2}$
D. 6, 0, 0, $+\frac{1}{2}$

Answer: A



38. The orbital angular momentum of a p- electron is

given as

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

B. $\sqrt{3}$. $\frac{h}{2\pi}$
C. $\sqrt{\frac{3}{2}}$. $\frac{h}{\pi}$
D. $\sqrt{6}$. $\frac{h}{2\pi}$

Answer: A



39. The electron identified by quantum number n and l

A. n=4 ,l=1

B.
$$n = 4, l = 0$$

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

D.
$$n = 3, l = 1$$

Answer: B



40. The value of plank constant is 6.63 $\times 10^{10^{34}kg}$ the speeds light is $3 \times 10^{17} nms^{-1}$ which value is clossed to the wavelength in nanometer of a quantum of light with frequency of $6 \times 10^{15}s^{-1}$?

A. 25

B. 50

C.75

D. 10

Answer: B



41. What is the maximum number of electrons that can be associated with the following set of quantum numbers ?

n = 3, I = 1 and m = -1

A. 6

B.4

C. 2

D. 10

Answer: B



42. Energy of an electron is given by E=-2.718*10-18 J Wavelength of light required to excite an electron in a hydrogen atom from level n = 1 to n = 2 will be...

A. $1.214 \times 10^{-7}~\text{m}$

 $\textbf{B.}\,2.186\times10^{-7}~\textbf{m}$

 ${
m C.}\,6.500 imes10^{-7}~{
m m}$

 ${\sf D.8.500 imes10^{-7}}~{\sf m}$

Answer: A



43. the correct set of the four quantum number for the

valence electron or Rubidum atom (z=37) is

A. 5, 1,
$$+\frac{1}{2}$$

B. 5, 1, $1 + \frac{1}{2}$
C. 5, 0, $1 + \frac{1}{2}$

D. 5, 0,
$$0 + \frac{1}{2}$$

Answer: D



44. What is the maximum number of orbitals that can be identified with the following quantum number n =3, I = 1, m = 0.

A. 1

B. 2

C. 3

D.4



45. Calculate the energy in corresponding to light of wavelength 45 nm. (Planck's constant h = 6.63×10^{-34} JS, Speed of light C = $3 \times 10^8 m s^{-1}$)

A. $6.67 imes 10^{15}$

 ${f B.6.7 imes10^{11}}$

C. $4.42 imes 10^{-15}$

D. $4.42 imes 10^{-18}$

Answer: D



47. Based on equation $E = -2.178 \times 10^{-15} J \frac{z^2}{n^2}$ certain conclusion are written. Which of them is not correct ? n = 3, I = 1 and m = 0

A. Larger the value of n, the larger is the orbit radius

- B. Equation can be used to calculate the change in energy when the electron changes orbit.
- C. For n = 1, the electron has a more negative

energy than it does for n = 6 which means that

the electron is more loosely bound in the smallest allowed orbit.

D. The negative sign in equation simply means that

the energy of electron bound to the nucleus is

lower than it would be if the electrons were at

the infinite distance from the nucleus.

Answer: C

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48. The angular m om entum of electron in 'd ' orbital

is equal to

A. Oh

B. $\sqrt{6}$ h

 ${\rm C.}\,\sqrt{2}\,{\rm h}$

D. $2\sqrt{2}$ h

Answer: B

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49. Which of the following is the energy of a possible excited state of hydrogen ?

A. +13.6eV

B.-6.8eV

C. - 3.4 eV

 $\mathbf{D.}+6.8eV$

Answer: C



50. A stream of electrons from a heated filament was passed between two charged plates kept at a potential difference V esu. If e and m are charge and mass of an electron, respectively, then the value of h/λ (where λ is wavelength associated with electron wave) is given by

A. $\sqrt{2meV}$

B. meV

C. 2meV

D. \sqrt{meV}

Answer: A

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51. Two electrons occupying the same orbital are distinguished by

A. Spin quantum number

B. Principle quantum number

C. Magnetic quantum numbe

D. Azimuthal quantum number



Answer: A



53. Which of the following pairs of d-orbitals will have electron density along the axes ?

- A. d_z^2, d_{xy}
- B. d_{xy}^2, d_{yz}
- C. $d_z^2, d_{x^2-y^2}$

D.
$$d_{xy}^2, d_{x^2-y^2}$$

Answer: C

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54. The energies E_1 and E_2 respectively. The relation between their wavelengths, i.e. λ_1 and λ_2 will be

A.
$$\lambda_1=rac{1}{2}\lambda_2$$

B. $\lambda_1=\lambda_2$
C. $\lambda_1=2\lambda_2$
D. $\lambda_1=4\lambda_2$

Answer: C



55. The frequency transition n = 4 to n = 2 of He+ is equal to the transition in H atom corresponding to which of the following.

A. n=3 to n=1

B. n=2 to n=1

C. n=32 to n=1

D. n=4 to n=3

Answer: B



56. $\frac{e}{m}$ ratio was determined by

A. j.j thomson

B. dalton

C. chadwick

D. goldstein

Answer: A

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57. The group having isoelectronic species i s

A. O^{2-}, f^-, Na^+ . Mg^{2+}

$${\tt B.}\,O^-,F^-,Na,Mg^+$$

C.
$$O^2, F^-, Na, Mg^{2+}$$

D.
$$O^-, F^-, Na^+, Mg^{2+}$$

Answer: A



58. The total num ber of orbitals present for principle

quantum number n = 4 i s

A. 12

B.15

C. 16

D. 30

Answer: C

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Section C Mcq Asked In Board Exam

1. The hydrogen electron de-exites from its 3rd excited state. W hich are tru e and false statem ents for it. Assign T for true and F for the false. (i) It emits the radiation giving the lines in the Lyman Balmer and Paschen series. (ii) It emits radiation of only UV and visible regions and not infrared region. (iii) It em its the ra d ia tio n of sm allest wavelength giving the line in Lyman series. (iv) It will emit the radiation of the highest frequency giving line in Pfund series

A. TFTF

B. FTFT

C. TTFF

D. FFTT

Answer: A



2. How many elements are there having electrons in dorbital among the elements with atomic number 1 to 100 ?

- **A.** 30
- **B. 60**
- **C. 80**
- **D.** 20

Answer: C



3. X and Y both are m oving particles. The uncertainty in measure of momentum of Y is half than that of X. If uncertainity of position of X is \pm 0.05A than that of Y is

A. $2.5 imes 10^{-10}$ cm

 $\textbf{B.1}\times 10^{-10}~\textbf{cm}$

C.
$$5 imes 10^{-10}$$
 cm

D.
$$1 imes 10^{-9}$$
 cm

Answer: D

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4. The relative is proportion of the atoms of

tritium and protium.

A. $10:10^{17}$

B. 1 : 10¹⁷

C. $10: 10^7$

 ${f D}.\,1 imes 10^7$

Answer: B



5. A species 'X' contains 20 protons and 18 electrons.(A) species 'Y' contains 18 protons and 18 electrons.
What are 'X' and 'Y' respectively ?

A. Ca and Ar

- B. Ca^{2+} and S^{2-}
- C. Ca^{2+} and CI^{-}
- D. Ca^{2+} and Ar

Answer: D



6. Which element has ns^2np^5 type electronic configuration in its outermost shell

A. carbon

B. chlorine

C. Neon

D. Aluminium

Answer: B



7. The introduction of neutron in nucleus of an atom

would lead to the change i n

A. atomic weight

B. Atomic number

C. Number of electrons around a nucleus

D. Chemical nature of the atom

Answer: A

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8. Match the species of Column - X with the electron configuration of the elements in the Column - Y and select correct answer

Column - X	- X Column - Y		
(i) _{an} Ti ²⁺	(P) (n-1) d ⁴ ns ²		
(ii) ₂₀ Zn	$(Q) (n + 1) d^{10} ns^{1}$		
(iii) ₃₄ Cr	(R) $(n - 1) d^2 ns^0$		
(iv) mCu	(S) $(n - 1) d^5 ns^1$		
29	(M) $(n - 1) d^{10} ns^2$		
	$(N) \ (n=1) \ d^{10} \ ns^2$		

$$egin{aligned} \mathbf{A}.\,(i) &
ightarrow M,\,(ii)
ightarrow N,\,(iii)
ightarrow P,\,(iv)
ightarrow Q \ \mathbf{B}.\,(i) &
ightarrow R,\,(ii)
ightarrow N,\,(iii)
ightarrow P,\,(iv)
ightarrow S \ \mathbf{C}.\,(i)
ightarrow M,\,(ii)
ightarrow Q,\,(iii)
ightarrow S,\,(iv)
ightarrow R \ \mathbf{D}.\,(i)
ightarrow R,\,(ii)
ightarrow N,\,(iii)
ightarrow S,\,(iv)
ightarrow Q \end{aligned}$$

Answer: D



9. For the third electron of Lithium atom moving in its premissible orbit, the values of angular momentum and energy are...... Respectively

A. Angular momentum
$$rac{h}{2\pi}$$
 energy $=rac{-9\pi^2 e^4 m}{2h^2}$



10. In long form of periodic table, an elem ent has electronic configuration $Is^2 2s^{22}p^6 3s^2 3p^3$ Thus what will be the atomic no. of elem ent ? Which is just below this elem ent in its group ? **B.** 16

C. 47

D. 33

Answer: D



11. The decrease in number of neutrons when $a^x_a U$ changes the $b^y_b Pb$ is represented as :

A. (x-a)+(y+b)

B. (x-a)-(y+b)

C. (x+a)-(y-b)

D. (x-a)-(y-b)

Answer: D



12. The correct relationship betw een quantum numbers n, I and m is :

A.
$$n < l < m$$

- $\textbf{B.} n < l \leq m$
- C. $n>l\geq$, m

D. $n \geq l > m$



13. If there are 13 electrons in M shell and 1 electron in N shell th en the num ber of unpaired electrons in such atom will be.....

A. 5

B.4

C. 3

D.6

Answer: D



15. The num ber of protons in nucleus of an elem ent having maximum unpaired electrons in 2p sub-shell are A. 7 **B.** 5 C. 14 D. 6 **Answer: A** Watch Video Solution

16. How m any orbitals are a sso cia ted w ith n = 4?

A. 16

B.15

C. 8

D. 18

Answer: A



17. What is wavelength of wave associated with electron whose velocity (v) is $10^8 cm \sec^{-1}$?

A. 7.27 nm

B. $7.27 imes 10^{-8}$ m

C. $7.27 imes 10^{-10}$ m

D. $7.27 imes 10^{-10}$ A

Answer: C

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18. The product of frequencyof light and wavelength is

equal to

- A. Redberg's constant
- B. Planks constant
- C. Energy of photon
- D. Velocity of light



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20. Spin m ultiplicity value of oxygen element is

A. 2

B. 1.5

C. 1

D.4



21. How m any number of proton, electron and neutron

n in . 55 Mn^{+2} respectively ?

A. 25,27,30

B. 25,25,30

C. 25,23,30

D. 25,27,26



22. Which of the following is the correct form ula for

one m ole of p h o to n energy?

A.
$$\frac{Nh}{\lambda c}$$

B. $\frac{hc}{\lambda}$
C. $\frac{Nhc}{\lambda}$
D. $\frac{Nc}{\lambda}$



23. The correct electronic configuration of
$$_{.29}$$
 $Cu^{2\,+}\,$ is

- A. $[Ar]4s^13d^{10}$
- $\mathbf{B.}\,[Ar]4s^23d^8$
- C. $[Ar]4s^23d^9$
- D. $[Ar]4s^03d^9$

Answer: D



24. From the following w hich pair is isotone and isobar respectively.

A. iii and I

B. I and ii

C. I and iii

D. iii and iv

Answer: A

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25. Which of the following represents the correct set of four quantum number of 3d orbital electron ?

-1

A.
$$n=3, l=3, m=2, s=+rac{1}{2}$$

B.
$$n=3, l=2, m=2, s=0$$

C.
$$n=3, l=2, m=1, s=\,+\,rac{1}{2}$$

D. n=4, l=2, m=2, s=0

Answer: C				
Watch Video Solution				
26. What are the possible values of I w hen n = 4				
A. 0,1,2,3				
B. 1,2,3,4				
C. 0,1,2,3				
D. 4,0,2,3				
Answer: A				
Watch Video Solution				

27. Give num ber of protons, electrons and neutrons

respectively in $.^{32}_{16} S^{2-}$

A. 16,16,16

B. 16,14,16

C. 16,16,14

D. 16,16,18

Answer: D



28. According to De-Brogli's principal, what is the relation between momentum and w avelength of m ovable particals

A. inverse proportion

B. underroot proportion

C. same proporotion

D. none of these

Answer: A



29. Electron configuration of M olybdenum (Z = 42) is

A.
$$[Kr]4d^45s^2$$

....

B.
$$[Kr]5s^24p^4$$

C. $[Kr]4d^55s^1$

D.
$$[Kr]4d^35s^2sp^{-1}$$



30. Give actual proportion energy having wavelength

of 3000A and 6000A respectively.

A. 2 : 1

B. 1:3

C. 3 : 1

D. 1:2

Answer: A



31. Identify the possible set of quantum numbers for outer shell electron in element K.

$$f A.\,n=4,\,l=0,\,m=0,\,s=\pmrac{1}{2}$$
 $f B.\,n=4,\,l=1,\,m=1,\,s=\pmrac{1}{2}$
 $f C.\,n=3,\,l=2,\,m=-1,\,s=\pmrac{1}{2}$
 $f D.\,n=3,\,l=0,\,m=0,\,s=\pmrac{1}{2}$

Answer: A



32. In Schrodinger's wave equation V indicates

A. wave function

B. total enthalpy of electron and proton

C. velocity of electrone

D. potential energy

Answer: D

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33. How many 'nodes' are there in 3s orbital ?

A. 3

B. 2

C. 1

D. zero

Answer: B

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34. Two electrons of K-shell can be distinguished by

A. spin quantum number.

B. azimuthal quantum number.

C. principal quantum number

D. magnetic quantum number

Answer: A



35. In an atom an electron is moving with a speed of 600 ms^{-1} with an accuracy of 0.005 % certain ty w ith w hich the p osition of the electron can be located is....

A.
$$5.10 imes10^{-3}$$
 m

B. $3.84x10^{-3}$ m

 ${
m C.}\,1.92 imes10^{-3}~{
m m}$

D. $1.52 imes 10^{-4}$ m



36. The splitting of the spectral lines under the influence of magnetic field is called....

A. photoelectric effect

B. Zeeman effec

C. diffraction

D. interference

Answer: B



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37. Bohr's atomic model could explain the spectrum o f

A. Atoms or ions which have two electrons.

- B. Only dihydrogen molecule.
- C. He^- atom only.
- D. Atoms or ions which contain only one electron

Answer: D

......



38. How many electrons in an atom with atomic number 50 can have (n + I) = 5?

A. 10

B. 12

C. 18

D. 25

Answer: C

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39. Which of the following set of quantum numbers of

an electron will have the highest energy

[n	1	m	s
(A)	4	2	- 1	$-\frac{1}{2}$
(B)	3	2	I.	$-\frac{1}{2}$
(C)	5	0	0	$-\frac{1}{2}$
(D)	4	1	0	$-\frac{1}{2}$



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40. The associate wavelength of a particle with mass 1

gram and velocity 100 m/s is

A.
$$6.63 imes10^{-35}$$
 m

 $\textbf{B.}\,6.63\times10^{-36}~\textbf{m}$

 $\textbf{C.}\,6.626\times10^{-\,33}~\textbf{m}$

D. $6.626 imes 10^{-34}$ m

Answer: C



41. When electron enters into the orbital of equal energy subshells, they are arranged in such a way that the direction of their spins remain parallel or the value of spin quantum number remains maximum. This statement is known as...

A. Hund's rule

B. Heisenberg's principle

C. Pauli's Exclusion principle

D. Auf-bau rule

Answer: A

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42. Assertion : The relative proportion of atoms of THtium and Protium is $1:10^{17}$ Reason : The property responsible for the low proportion of Tritium is its non-radioactivity.

A. Assertion is false but reason is true

B. Assertion is true but reason is false

- C. Both assertion and reason are true
- D. Both assertion and reason are true and reason is

the correct explanation of the assertion.

Answer: B



43. If kinetic energy of an electron is increased by nine times, the wavelength associated with it would become

A.
$$\frac{1}{3}$$
 times
B. $\frac{1}{9}$ times

C.9 times

D. 3 times

Answer: A

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44. The correct set of four quantum number for the unpaired electron of the element Z = 21 is

$$\begin{array}{l} \textbf{A}.\,n=3,\,l=2m=1s=\,+\,\frac{1}{2}\\\\ \textbf{B}.\,n=3,\,l=1m=0s=\,+\,\frac{1}{2}\\\\ \textbf{C}.\,n=3,\,l=3m=2s=\,+\,\frac{1}{2}\\\\ \textbf{D}.\,n=4,\,l=0m=0s=\,+\,\frac{1}{2}\end{array}$$



45. What is frequency of first line of Balmer series for H-atom ?

A. $3.29 imes10^{15}s^{-1}$

- B. $8.05 imes10^{13}s^{-1}$
- C. $8.22 imes 10^{15} s^{-1}$
- D. $4.57 imes10^{14}s^{-1}$

Answer: D


46. Number of unpaired electron(s) present in an element having atom ic num ber Z = 24 is

A. 6 B. 4 C. 0

D. 5

Answer: A

47. Number of total electrons in an orbit of - angular M

omentum Quantum Number (I) is

A. l^2

B. 4l+2

C. 2l+1

D. 2l+2

Answer: B



48. Number of electrons present in P^{-3} ion having 15

protons a r e

A. 15

B.16

C. 18

D. 12

Answer: C



49. Which of the following electronic configuration is

not possible

A. $4d^8$

 $\mathbf{B.}\,3f^{14}$

C. $3s^{1}$

D. $2p^6$

Answer: B



50. What is shape of theorbital having I = I and m = 0?

A. Triangular plana

B. Dumbbel

C. Square plana

D. Spherical

Answer: B



51. Electronic configuration of an elem ent of the m odern periodic table i s $Is^22s^22p^63s^23p^4$ What will be atomic number of the element immediately below it, in the same group ? A. 18

B. 34

C. 48

D. 24

Answer: B

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52. Which of the following series of lines in atomic spectrum of hydrogen appear in visible region ?

A. paschen

B. balmer

C. brackett

D. lyman

Answer: B

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53. The energy of one mole of photon having frequency $4 imes 10^{14}$ Hz is

A. $129kjmol^{-1}$

B. $159kjmol^{-1}$

C. $145 k jmol^{-1}$

D. $212kjmol^{-1}$



Section D Multiple Choice Questions

1. Which of the following conclusions could not be derived from Rutherford's a-particle scattering experiement ?

A. Most of the space in the atom is empty.

B. The radius of the atom is about 10^{-10} m while

that of nucleus is 10^{-15} m.

C. Electrons move in a circular path of fixed energy

called orbits.

D. Electrons and the nucleus are held together by

electrostatic forces of attraction.

Answer:

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2. Which of the following options does not represent ground state electronic configuration of an atom ?

A.
$$Is^22s^22p^63s^23p^63d^84s^2$$

B.
$$Is^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$$

C. $Is^2 2s^2 2p^6 3s^2 3P^6 3d^{10} 4s^1$

D. $Is^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

Answer:

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3. The probability density plots of Is and 2s orbitals are

given in



1s orbital



2s - orbital

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. Is and 2s orbitals are spherical in shape.

B. Is and 2s orbitals are spherical in shape.

C. The probability of finding the electron at a given

distance is equal in all directions

D. The probability density of electrons for 2s orbital

decreases uniformly as distance from the nucleus increases.

Answer:



4. Which of the following statement is not correct about the characteristics of cathode rays

A. They start from the cathode and move towards the anode.

B. They travel in straight line in the absence of an

external electrical or magnetic field.

C. Characteristics of cathode rays do not depend

upon the material of electrodes in cathode ray

tub

D. Characteristics of cathode rays depend upon the

nature of gas present in the cathode ray tube.

Answer:

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5. Which of the following statements about the electron is incorrect ?

A. It is a negatively charged particle.

B. The mass of electron is equal to the mass of

neutron

C. It is a basic constituent of all atoms

D. It is a constituent of cathode rays.

Answer:



6. Which of the following properties of atom could be

explained correctly by Thomson Model of atom

A. Overall neutrality of atom.

B. Spectra of hydrogen atom.

C. Position of electrons, protons and neutrons in

atom.

D. Stability of atom.



different number of electrons.

D. sum of the number of protons and neutrons is

same but the number of protons is different

Answer:

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8. The number of radial nodes for 3p orbital is...

A. 3

B.4

C. 2

D. 1

Answer:
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9. Number of angular nodes for 4d orbital is
A. 4
B. 3
C. 2
D. 1
Answer:
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10. Which of the following 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

Answer:

11. Total number of orbitals associated with third shell

will b e

A. 2

B.4

C. 9

D. 3

Answer:



12. Orbital angular momentum depends on

A. I

B. n and l

C. n and m

D. m and s

Answer:



13. Chlorine exists in two isotopic forms, Cl-37 and Cl-35 but its atomic mass is 35.5. This indicates the ratio of Cl-37 and Cl-35 is approximately **B.** 1:1

C. 1 : 3

D. 3:1

Answer:



14. The pair of ions configuration is

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

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

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

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

Answer:



15. For the electrons of oxygen atom, which of the following statements is correct ?

A. Z_{eff} for an electron in a 2s orbital is the same as

 Z_{eff} for an electron in a 2p orbital.

B. An electron in the 2s orbital has the same energy

as an electron in the 2p orbital

C. Z_{eff} for an electron in Is orbital is the same as

 Z_{eff} for an electron in a 2s orbital.

D. The two electrons present in the 2s orbital have

spin quantum numbers m_s but of opposite sign.

Answer:

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16. If travelling at same speeds, which of the following

matter waves have the shortest wavelength?

A. Electron

B. Alpha particle $\left(He^{2\,+}
ight)$

C. Neutron

D. Proton

Answer:



17. Identify the pairs which are not of isotopes

A.
$$._{6}^{12} X$$
, $._{6}^{13} X$
B. $._{17}^{35} X$, $._{17}^{37} X$
C. $._{6}^{14} X$, $._{7}^{14} X$
D. $._{4}^{8} X$, $._{5}^{8} X$

Answer:



18. Out of the following pairs of electrons, identify the pairs of electrons present in degenerate orbitals :

$$\begin{array}{l} \textbf{A}_{\cdot}(i)n=3,I=2,m_{l}=-2,m_{s}=-\frac{1}{2}\\ (ii)n=3,1=2m_{l}=-1,m_{s}=-\frac{1}{2}\\ \textbf{B}_{\cdot}(i)n=3,I=2,m_{l}=1,m_{s}=+\frac{1}{2}\\ \textbf{(ii)}n=3,1=2m_{l}=1,m_{s}=+\frac{1}{2}\\ \textbf{C}_{\cdot}(i)n=4,I=2,m_{l}=1,m_{s}=+\frac{1}{2}\\ \textbf{(ii)}n=3,1=2m_{l}=1,m_{s}=+\frac{1}{2} \end{array}$$

D.
$$(i)n=3, I=3, m_l=+2, m_s=+rac{1}{2}$$
 (ii) $n=3, 1=2m_l=+2, m_s=+rac{1}{2}$

Answer:



19. Which of the following sets of quantum numbers are correct ?

A.11+2

B. 21+1

C. 3 2 -2

D. 3 4 -2

Answer: Watch Video Solution

20. In which of the following pairs, the ions are iso electro n ic ?

- A. Na^+, Mg^{2+}
- B. Al^{3+}, O^{-}
- C. Na^+, O^{2-}
- D. N^{3-}, Cl^-

Answer:

21. Which of the following statements concerning the quantum numbers are correct ?

A. Angular quantum num ber determ ines the three

dim ensional shape of th e orbital.

B. The principal quantum num ber determ ines the

orientation and energy of the orbital.

C. M agnetic quantum num ber determ ines the

size of th e orbital

D. Spin q u a n tu m n u m b e r of an e lectro n

determ ines the orientation of the spin of

electron relative to th e chosen axis.

Answer:



22. Arrange s, p an d subshells of a shell in the increasing order of effective nuclear charge $(Z_{\rm eff})$ experienced by the electron present in them .

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23. Show the distribution of electrons in oxygen atom

(atom ic num ber 8) using orbital diagram.



24. Nickel atom can lose two electrons to form Ni^{2+}

ion. The atomic number of nickel is 28. From w hich orb

ital will nickel lose two electrons.

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25. Which of the following orbitals are degenerate ?

 $3d_{xy}, 4d_{xy}, 3d_{z^2}, 3d_{yz}, 4d_{yz}, 4d_{z^2}$

26. Calculate the total number of angular nodes and

radial nodes present in 3p orbital.



27. The arrangement of orbitals on the basis of energy is based upon th eir (n + l) value. Lower the value of (n + l), low er is th e energy. For o rb itals h aving sam e values of (n + l), th e o rb ital w ith low er value of n will have lower energy. (I) Based upon the above inform ation, arrange th e fo llo w in g o r b itals in th e in c re a s in g order of energy. (a) Is, 2s, 3s, 2p (b) 4s, 3s, 3p, 4d (c) 5p, 4d, 5d, 4f, 6s (d) 5f, 6d, 7s, 7p (II) Based u p o n th e above inform ation, solve the questions given below : (a) W hich of th e following orbitals has the lowest energy ? 4d, 4f, 5s, 5p (b) W hich of the following orbitals has the highest energy ? 5p, 5d, 5f, 6s, 6p



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28. Which of the following will not show deflection

from the path on passing through an electric field ?

Proton, C athode rays, E lectron, N eutron

29. An atom having atom ic m ass num ber 13 has 7

neutrons. W hat is the atom ic n u m b er of the atom?



30. Wavelengths of different rad iatio n s are given below :

 $\lambda(A) - 300 nm\lambda(B) = 300 \mu m\lambda(C) = 3nm\lambda(D) = 30A$

Arrange the seradiations in th eincreasing order of their energies.

31. Show the distribution of electrons in oxygen atom

(atom ic num ber 8) using orbital diagram.



32. The Balm er series in the hydrogen sp ectru m corresponds to the transition from $n_1 = 2$ to $n_2 = 3$, 4,.....This series lies in the visible region. Calculate the wave num ber of line associated with the tran sitio n in Balm er series w hen the electron m oves to n = 4 orbit. $(R_H = 109677 cm^{-1})$

33. According to de Broglie, matter should exhibit dual behaviour, that is both particle and wave like properties. However, a cricket ball of mass 100 g does not move like a wave when it is thrown by a bowler at a speed of 100 km/h. Calculate the w avelength of the ball and explain why it does not show wave nature.

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34. What is the experimental evidence in support of the idea that electronic energies in an atom are quantized ?

35. Out of electron and proton which one will have, a higher velocity to produce m atter waves of the same wavelength ? Explain it.



36. A hypothetical electromagnetic wave is shown in

Figure. Find out the wavelength of the radiation.


37. Chlorophyll present in green leaves of plants absorbs light at 4.620×10^{14} Hz. Calculate the wavelength of radiation in nanometer. Which part of the electromagnetic spectrum does it belong to ?



38. What is the difference between the terms orbit and

orbital ?



39. Table-tennis ball has a mass 10 g and a speed of 90 m/s. If speed can be measured within an accuracy of 4% what will be the uncertainty in speed and position

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40. The effect of uncertainty principle is significant only for motion of microscopic particles and is negligible for the macroscopic particles. Justify the statement with the help of a suitable example.



41. Hydrogen atom has only one electron, so mutual repulsion between electrons is absent. However, in multielectron atoms mutual repulsion between the electrons is significant. How does this affect the energy of an electron in the orbitals of the same principal quantum number in multielectron atoms ?

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42. Match the following species with their corresponding ground state electronic configuration.

Atom / Ion	Electronic configuration
(i) Cu	(a) 1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰
(ii) Cu ²⁺	(b) 1s ² 2s ² 2p ⁶ 3s ² 3d ¹⁰ 4s ²
(iii) Zn ²⁺	(c) 1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ¹⁰ 4s ¹
(iv) Cr ³⁺	(d) 1s ² 2s ² 2P ⁶ 3s ² 3P ⁶ 3d ⁹
	(e) 1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 3d ³

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43. Match the quantum numbers with the information

provided by these

Quantum number	Information provided
(i) Principal quantum number	(a) orientation of the orbital
(ii) Azimuthal quantum number	(b) energy and size of orbital
(iii) Magnetic quantum number	(c) spin of electron
(iv) Spin quantum number	(d) shape of the orbital



44. Match the following rules with their statements

Rules in the octation	Statements
(i) Hund's Rule	(a) No two electrons in an atom can have the same set of four quantum numbers.
(ii) Aufbau Principle	(b) Half-filled and completely filled orbitals have extra stablity.
(iii) Pauli Exclusion Principle	(c) Pairing of electrons in the orbitals belonging to the same subshell does not take place until each orbital is singly occupied.
(iv) Heisenberg's Uncertainty Principle	(d) It is impossible to determine the exact position and exact momentum of a subatomic particle simultaneously.
	(e) In the ground state of atoms, orbitals are filled in the order of their increasing energies.



45. Match the following

(i) X-rays	(a) $v = 10^{\circ} - 10^{4} \text{ Hz}$
(ii) UV	(b) $v = 10^{10}$ Hz
(iii) Long radio waves	(c) $\nu = 10^{16}$ Hz
(iv) Microwave	(d) $v = 10^{18}$ Hz

46. Match the following

(i)	Photon	(a) Value is 4 for N shell
(ii)	Electron	(b) Probability density
(111)	¥2	(c) Always positive value
(iv)	Principal quantum number n	(d) Exhibits both momentum and wavelength



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47. Match species given in Column-I with the electronic

configuration given in Column-II

Column-1	Column-II
(i) Cr	(a) [Ar]3d ⁸ 4s ⁰
(ii) Fe ²⁺	(b) [Ar]3d ¹⁰ 4s ¹
(iii) Ni ²⁺	(c) [Ar]3d ⁶ 4s ⁰
(iv) Cu	(d) [Ar]3d ⁵ 4s ¹
04007-94.	(e) [Ar]3d ⁶ 4s ²

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is not the correct

explanation of A.

C. A is true but R is false.

D. Both A and R are false.

Answer:



48. Assertion (A) : All isotopes of a given element show the same type of chemical behaviour. Reason (R) : The chemical properties of an atom are controlled by the number of electrons in the atom.

A. Both A and R are true and R is the correct

explanation of A.

B. Both A and R are true but R is not the

explanation of A.

C. A is true and R is false

D. Both A and R are false

Answer:



49. Assertion (A) : Black body is an ideal body that emits and absorbs radiations of all frequencies. Reason (R) : The frequency of radiation emitted by a body goes from a lower frequency to higher frequency with an increase in temperature.

- A. Both A and R are true and R is the correct explanation of A.
- B. Both A and R are true and R is not the correct

explanation of A.

C. A is true and R is false.

D. Both A and R are false.

Answer:

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50. Assertion (A) : It is impossible to determine the exact position and exact momentum of an electron simultaneously. Reason (R) : The path of an electron in an atom is clearly defined

51. What is photoelectric effect ? State the result of photoelectric effect experiment that could not be explained on the basis of laws of classical physics. Explain this effect on the basis of quantum theory of electromagnetic radiations.



52. Threshold frequency, v_0 is the minimum frequency which a photon must possess to eject an electron from a metal. It is different for different metals. When a photon of frequency $1.0 \times 10^{15} s^{-1}$ was allowed to hit a metal surface, an electron having $1.988 \times 10^{-19} J$ of kinetic energy was emitted. Calculate the threshold frequency of this metal. Show that an electron will not be emitted if a photon with a wavelength equal to 600 nm hits the metal surface.

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53. When an electric discharge is passed through hydrogen gas, the hydrogen m olecu les dissociate to produce excited hydrogen atoms. These excited atom s em it electrom agnetic radiation of discrete frequencies which can be given by the general formula What points of Bohr's model of an atom can be used to arrive at this formula ? Based on these p o in ts derive the above form ula giving description of each

step and each term.



replaced by, the concept of probability of finding

electron in an orbital ? What is the name given to the

changed model of atom ?



Questins Paper From Module Section A

1. One bivalent ion has electron configuration 2, 8, 8, 6, its atomic mass is 56. Calculate the number of neutron in it.

2. Which electromagnetic radiation has highest wave

length ?



3. What is indicated by magnetic Quantum number?



4. The metal with atomic number 20, 23, 37, 55 given.

Which show photoelectric effect most easily

5. State spin multiplicity of valence electron of Nitrogen atom.



6. State all four quantum number for 37th electron of

Cs.

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Questins Paper From Module Section B



1. Calculate frequency and wave length of photon during the transition of electron in hydrogen from n = 6 to n = 2 orbit.

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2. Give observation and conclusion of Rutherford's

scattering experiment.



Questins Paper From Module Section D

1. Explain Heisenberg's uncertainty principle.



2. Explain different types of Quantum Numbers.

