CHEMISTRY

BOOKS - OMEGA PUBLICATION

STRUCTURE OF ATOM

Questions

1. What is an electron ?

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2. Who discovered electron?

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3. What is the value of charge on electron? Is a charge less than this value possible?

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4. Who determined the charge on the electrons ?

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5. What is the charge to mass ratio of electron ?

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6. Give two conditions under which cathode rays are produced.

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7. Give the properties of cathode rays ?

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8. What is a proton ?

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9. Who discovered the proton ?

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10. What are canal rays?

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11. Which charge is present on canal ray particles ?

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12. A positively charged particle is released from rest in an uniform electric field . The

electric potential energy of the charge:

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13. What is a' neutron ?

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14. Who discovered neutron?

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15. Who discovered neutron?

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16. What is Rutherford's a-ray scattering experiment ? Give its observations. Howdoes Rutherford explain this observations ?

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17. What are observations of Rutherford's scattering experiment?

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18. What were the observations and conclusions drawn from a-scattering experiment ?

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19. Discuss in brief Rutherford's Model of atom.

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20. Give two drawbacks of Rutherford's atom model.

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21. Define the terms: Atomic number

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22. Define the terms : Mass number

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23. How will you represent chlorine atom having mass number 35 and atomic number 17 ?

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24. Write the complete symbol for the atom with given atomic number Z and atomic mass A

$Z = 92, A = 233$

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25. Write the complete symbol for the atom with given atomic number Z and atomic mass A

$Z = 4, A = 9$

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26. Explain with examples : Isobars.

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27. Explain with examples : Isotopes

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28. Calculate the number of electrons which will together weigh one gram.

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29. Calculate the mass and charge of 1 mole of electrons.

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30. A certain particle carries $2.5 \times 10^{-16} C$ of static electric charge. Calculate the number of electrons present in it.

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31. Calculate the total number of electrons present in 1 mole of methane.

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32. What is the structural formula of 2-Iodopropane?

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33. Find

the total mass of 'neutrons in 7 mg of ^{14}C.

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34. Find the total number of proper factors of

the number 35700.

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35. Find

the total mass of protons in 34 mg of NH_3 at

STP.

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36. How many neutrons and protons are there

in the following nuclei?

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37. How many neutrons and protons are there in the following nuclei?

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38. How many neutrons and protons are there in the following nuclei?

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39. How many neutron and proton are their in nuclei ?

$^{56}_{26}Fe$

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40. How many neutron and proton are their in nuclei ?

$^{88}_{38}Sr$

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41. What are electromagnetic waves?

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42. Discuss general characteristics of electromagnetic radiations.

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43. Define the term:

Wavelength

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44. Define the term:

Frequency

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45. Define the terms wave and wave motion.

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46. Calculate the wavelength and frequency of a light wave whose period is 2* 10(-10)

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47. Yellow light emitted from a sodium lamp has a wavelength (λ) of 580 mm. Calcualte the frequency (v) and wavenumber $\left(\overrightarrow{v}\right)$ of yellow light.

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48. The frequency of strong yellow light in the spectrum of sodium is $5.09 \times 10^{14} s^{-1}$. Calculate the wavelengh of the light.

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49. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionise the sodium atom, Calculate the ionisation energy of sodium is $KJmol^{-1}$.

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50. Calculate energy of one mole of photons of radiation whose frequency is 5 x 10^(14) hz

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51. Find the energy of each of photon which correspond to light of frequency 3*(10)-15.

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52. Find the energy of each of the photon which have wavelength of 0.50 A*

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53. A 25 What bulb emits monochromatic yellow light of wavelength of $0.75um$. Calculate the rate of emission of quanta per second.

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54. What is the number of photon of light with a wvelengthof 4000 pm that provide 1 J of energy ?

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55. Define work function of metal and photoelectric effect.

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56. Alkali metals show photoelectric effect. Why ?

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57. A photon of wavelength $4 \times 10^{-7} m$ strickes on metal surface, the work function of the metal being 2.13 eV. Calculate

energy of the photon (eV)

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58. A photon of wavelength $4 \times 10^{-7} m$ strickes on metal surface, the work function of the metal being 2.13 eV. Calculate

the kinetic energy of the emission

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59. A photon of wavelength $4 \times 10^{-7} m$ strickes on metal surface, the work function of the metal being 2.13 eV. Calculate

the velocity of the photoelectron $\left(1eV = 1.6020 \times 10^{-19} J\right)$

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60. Electrons ar emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength $6800A^{\circ}$. Calculate threshold frequency (v_0) and work function (w) of the metal.

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61. What is an atomic spectra ?

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62. Explain the origin of spectral lines of hydrogen using Bohr's theory?

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63. What is the maximum number of emission lines when the excited electron of H atom in n = 6 drops to the ground state ?

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64. What transition in the hydrogen spectrum would have the same wavelength as Balmer transitio, $n = 4$ to $n = 2$ in the He^+ spectrum?

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65. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes trnsition from an energy level with n = 4 to an energy level with n = 2 ?

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66. Calculate the energy required for the process $He^+(g) \rightarrow He^{2+}(g) + e^-$ The ionisation energy for the H-atom in the ground state is $2.18 \times 10^{-18} J \text{atom}^{-1}$.

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67. Calculate the wavenumber for radiation of longest wavelength in Balmer series of atomic hydrogen.

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68. Calculate the wavelength for the higest transition in the Balmer series of atomic hydrogen.

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69. What is the maximum number of emission lines when the excited electron of H atom in n = 6 drops to the ground state ?

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70. Give the main points of Bohr's model of atom.

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71. How will you calculate the energy and radius of H-atom in stationary state by Bohr's theory?

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

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73. 2×10^8 atoms of carbon are arranged side by side. Calculate the radius of carbon atom if the length of this arrangement is 2.4 cm.

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74. Give drawbacks of bohr's model of an atom.

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75. Give drawbacks of bohr's model of an atom.

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76. Who proposed the dual behaviour of matter?

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77. Explain the dual behaviour of matter.

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78. Derive de Broglie's equation.

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79. What will be the wavelength of a ball of mass 0.1 kg moving with a velocity of $10ms^{-1}$.

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80. If the velocity of the electron in Bohr's first orbit is $2.19 \times 10^{5}ms^{-1}$. Calculate the de-Broglie wavelength associated with it .

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81. Calculate the wavelength of an electron moving with a velocity of 2.05×10 7 ms −1

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82. The mass of an electron is $9.1 \times 10^{-31} kg$. If its K. E. is $3.0 \times 10^{-25} J$, calculate its wavelength.

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83. The velocity associated with a proton in potential difference of 1000 V is $4.37 \times 10^5 ms^{-1}$. If the hockey ball ofmass 0.1 kg is moving with this velocity, calculatethe walvelength associated with this velocity.

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84. State Heisenberg's uncertainty principle.

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85. What is the significance of uncertainty principle ?

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86. Calculate the uncertainty in the position of a dust particle with mass equal to 1 mg if uncertainty in its velocity is $5.5 \times 10^{-20} ms^{-1}$.

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87. Calculate the uncertainty in the momentum of an electron if it is confined to a linear region of length 1×10^{-10} metre.

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88. Write the schrodinger wave equation.

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89. What is ψ (Psi) ? What is its significance?

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90. What is the physical significance of wave function?

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91. Define an orbital.

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92. Distinguish between orbit and orbital.

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93. Define quantum numbers.

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94. Explain the quantum number n.

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95. Explain various quantum numbers.

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96. Explain the quantum number m.

Watch Video Solution

97. Explain the quantum number s.

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98. What is the maximum number of electrons in a subshell that can have the quantum numbers n = 3 and l = 2 ?

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99. Calculate n, l, m and s for 4f and 3d electrons.

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100. Whichof the following orbitals are possible ?

IP, 2s, 2p and 3 f

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101. Describe the orbital with the quantum number : n = 1 l = 0

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102. Using s, p, d notations, describe the orbital with the quantum number.

$n = 4, l = 2$

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103. Using s, p, d notations, describe the orbital with the quantum number.

$n = 3, l = 1$

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104. Using s, p, d notations, describe the orbital with the quantum number.

$n = 4, l = 3$

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105. Explain giving reaons, which of the sets of quantum number are not possible ?

$n = 0 \quad l = 0 \quad m_l = 0 \quad m_s = +1/2$

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106. Explain giving reaons, which of the sets of quantum number are not possible ?

$n = 1 \quad l = 0 \quad m_l = 0 \quad m_s = -1/2$

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107. Explain giving reasons, which of the sets of quantum number are not possible ?

$n = 1 \quad l = 1 \quad m_l = +0 \quad m_s = 1/2$

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108. Explain giving reaons, which of the sets of quantum number are not possible ?

$n = 2 \quad l = 1 \quad m_l = 0 \quad m_s = +1/2$

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109. Explain giving reaons, which of the sets of quantum number are not possible ?

$n = 3 \quad l = 3 \quad m_l = 0 \quad m_s = +1/2$

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110. Explain giving reasons, which of the sets of quantum number are not possible ?

$n = 3 \quad l = 0 \quad m_l = 0 \quad m_s = +1/2$

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111. How many sub-shells are associated with n = 4 ?

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112. How many electrons will be present in the subshells having m_s value of $-1/2$ for n = 4 ?

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113. Give the number of orbitals in :

p-subshell

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114. Give the number of orbitals in :

d-subshell

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115. An electron is in 4f orbital. What possible values for quantum number n, l and m_l can it have,

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116. List all values of l and m_l for n =2 .

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117. Give all possible values of l, m_l and m_s for electrons when n =3.

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118. What is node or nodal surface ?

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119. How can we determine the number of nodes for a given orbital ?

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120. What are boundary surface diagrams ?

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121. Give the boundary surface diagrams of p-orbitals.

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122. Give the boundary surface diagrams of the five 3d-orbitals.

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123. Draw the shapes of all d-orbitals.

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124. What are degenerate orbitals ?

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125. What do you understand 'by shielding effect ?

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126. What is effective nuclear charge ?

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127. The unpaired electrons in Al and Si are present in 3p orbital. Which electron will experience more effective nuclear charge from the nucleus?

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128. Among the pairs of orbital which orbital will experience more effective nuclear charge ?

3d and 3p

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129. Among the pair of orbital which orbital will experience more effective nuclear charge ?

4d and 4f

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130. Among the pair of orbital which orbital will experience more effective nuclear charge ?

4d and 4f

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131. Discuss Bohr's Bury's rules.

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132. The quantum numbers of six electrons are given below . Arrange them in order of increasing energies. If any of these combinations has /have the same energy lists:

a)	$n = 4$	$\ell = 2$	$m_\ell = -2$	$m_s = -\frac{1}{2}$
b)	$n = 3$	$\ell = 2$	$m_\ell = 1$	$m_s = +\frac{1}{2}$
c)	$n = 4$	$\ell = 1$	$m_\ell = 0$	$m_s = +\frac{1}{2}$
d)	$n = 3$	$\ell = 2$	$m_\ell = -2$	$m_s = -\frac{1}{2}$
e)	$n = 3$	$\ell = 1$	$m_\ell = -1$	$m_s = +\frac{1}{2}$
f)	$n = 4$	$\ell = 1$	$m_\ell = 0$	$m_s = +\frac{1}{2}$

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133. How many electrons in sulphur $(Z = 16)$ can have n + l = 3 ?`

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134. Why in building of the atoms the filling of 4s orbital takes place before 3d orbital ?

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135. Explain Aufbau principle .

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136. Explain Pauli’s exclusion principle.

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137. State and explain Hund's rule of maximum multiplicity by taking an example of nitrogen.

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138. What is electronic configuration of atoms ?

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139. Write the electronic configuration of the ion:

H^-

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140. Write the electronic configuration of the ion:

Na^+

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141. Write the electronic configuration of the ion:

O^{2-}

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142. Write the electronic configuration of the ion:

F^{-}

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143. What is the atomic number of elements whose outermost electrons are represented by

$3s^1$

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144. What is the atomic number of elements whose outermost electrons are represented

by

$2p^3$

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145. What is the atomic number of elements whose outermost electrons are represented by

$3p^5$

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146. Which of the following are isoelectronic species i.e., having the same number of electrons ?

$Na^+, K^+, Mg^{2+}, Ca^{2+}, S^{2-} Ar,$

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147. Which atoms ar indicated by the configuration

$[He]2s^1$

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148. Which atoms ar indicated by the configuration

$[Ne]3s^2 3p^3$

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149. Which atoms ar indicated by the configuration

$[Ar]4s^2 3d^1$

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150. Write the electronic configuration of $Cr(Z = 24)$.

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151. Give the electronic configuration of copper (Z = 29).

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152. Why Cr and Cu have exceptional electronic configurations ?

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153. What is the lowest value of n that allows g-orbital to exist ?

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154. An atom of an element contains 29 electrons and 35 neutrons. Deduce

(i) the number of protons

(ii) the electronic configuration of the element.

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155. Give the number of electrons in species H_2^+, $H_2O_2^+$

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156. Indicate the number of unpaaired electron

in

P

Watch Video Solution

157. Indicate the number of unpaired electron

in

Si

Watch Video Solution

158. Indicate the number of unpaired electron

in

Cr

Watch Video Solution

159. Indicate the number of unpaired electron

in

Fe

Watch Video Solution

160. Indicate the number of unpaired electron

in

kr

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161. How many electrons are present in the

O^{2-} ion ?

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162. An electron is present in '3p' subshell. Write the possible values for quantum numbers l and m.

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163. Half filled and completely filled orbitals have extra stability. Why?

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Multiple Choice Questions Mcq S

1. Emission of β -particle is equivatent to:

A. meson

B. neutron

C. proton

D. electron

Answer:

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2. The mass of the neutron is of the order of

A. $10^{-23}kg$

B. $10^{-24}kg$

C. $10^{-26}kg$

D. $10^{-27}kg$

Answer:

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3. The number of electrons and neutrons of an element is 18 and 20 respectively. Its mass number is

A. 2

B. 17

C. 37

D. 38

Answer:

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4. Which of the following has longest wavelength ?

A. Blue colour

B. Violet colour

C. Red colour

D. Yellow colour

Answer:

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5. The value of Planck's constant is

A. 6.626×10^{-27} ergs

B. 66.26×10^{-27} ergs

C. 6.02×10^{-15} ergs

D. 301×10^{-23} ergs

Answer:

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6. Which of the following expresson gives the de-Broglie relationship ?

A. $\frac{h}{mv} = P$

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

C. $\lambda = \frac{h}{mp}$

D. $\lambda m = \frac{v}{p}$

Answer:

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7. The total number of orbitals possible for the quantum number n is

A. n

B. n^2

C. $2n$

D. $2n^2$

Answer:

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8. The four quantum numbers of the valence electron of potassium are

A. $4, 1, 1, 1/2$

B. $4, 0, 0, 1/2$

C. $4, 1, 0, 1/2$

D. $4, 4, 0, 1/2$

Answer:

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9. An electron has principal quantum number 3. The number of its (i) shells and (ii) orbitals would be respectively

A. 3 and 5

B. 3 and 7

C. 3 and 6

D. 2 and 5

Answer:

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10. The correct set of quantum numbers for a 4d electron is

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

B. $4, 2, 1, 0$

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

D. $4, 2, 1, -\frac{1}{2}$

Answer:

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11. No two electrons in an atom will have all the four quantum numbers same. This statement is known as

A. Exclusion principle

B. Uncertainty principle

C. Hund's rule

D. Aufbau principle

Answer:

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12. The correct order of increasing energy of atomic orbitals is

A. $5p < 4f < 6s < 5d$

B. $5p < 6s < 4f < 5d$

C. $4f < 5p < 5d < 6s$

D. $5p < 5d < 4f < 6s$

Answer:

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13. The energy of an electron in nth orbit of hydrogen atom is

A. $\frac{13.6}{n^4}eV$

B. $\frac{13.\ 6}{n^3}eV$

C. $-\frac{13.\ 6}{n^2}eV$

D. $\frac{13.\ 6}{n}eV$

Answer:

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14. The triad of nuclei that is isotonic is

A. ${}_6C^{14}, {}_7N^{14}, {}_9F^{19}$

B. ${}_6C^{12}, {}_7N^{14}, {}_9F^{19}$

C. ${}_6C^{14}, {}_7N^{15}, {}_9F^{17}$

D. ${}_6C^{14}, {}_7N^{14}, {}_9F^{17}$

Answer:

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15. Bohr's model can explain

A. the spectrum of hydrogen atom only

B. spectrum of atom or ion containing one electron only

C. the spectrum of hydrogen molecule

D. the solar spectrum

Answer:

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16. If the value of l = 2, what will be the value of principal quantum number?

A. 3

B. 0

C. 2

D. 1

Answer:

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17. Rutherford's experiment on scattering of alpha particles showed for the first time that atom has :

A. nucleus

B. electrons

C. protons

D. neutrons

Answer:

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18. 3d-orbitals have

A. $n = 2, l = 3$

B. $n = 3, l = 0$

C. $n = 3, l = 1$

D. $n = 3, l = 2$

Answer:

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19. Number of unpaired electrons in the electronic configuration $1s^2, 2s. 2a^4$ is

A. 2

B. 3

C. 4

D. 6

Answer:

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20. The two electrons in an orbital have different

A. principal quantum number

B. azimuthal quantum number

C. magnetic quantum number

D. spin quantum number

Answer:

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21. The principal which gives a way to fill the electrons in the available energy level is

A. Hund's rule

B. Pauli's exclusion principle

C. Aufbau principle

D. none of these

Answer:

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22. Number of unpaired electrons in Nat is

A. 2

B. 0

C. 1

D. 3

Answer:

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23. f -sub-shell is characterised by:

A. $l = 0$

B. $l = 1$

C. $l = 2$

D. $l = 3$

Answer:

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24. When the 3d orbital is complete, the new electron will enter the

A. 4 p orbital

B. 4 f orbital

C. 4s orbital

D. 4 d orbital

Answer:

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25. Energy of atomic orbitals in a particular shell is in the order

A. $s < p < d < f$

B. $s > p > d > f$

C. $p < d < f < s$

D. $f > d > s > p$

Answer:

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26. The set of quantum numbers not applicable for an electron in an atom is

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

B. $n = 1, l = 0, m = 0, s = +1/2$

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

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

Answer:

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27. Indicate the number of unpaired electron in

Cr

A. 6

B. 3

C. 4

D. 5

Answer:

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28. The limiting line in Paschen series corresponds to

A. $n_1 = 3, n_2 = 4$

B. $n_1 = 3, n_2 = 3$

C. $n_1 = 3, n_2 = 10$

D. $n_1 = 3, n_2 = \infty$

Answer:

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29. The configuration of Fe^{3+} ion in the ground state

A. $[Ar]^{18}3d^3 4s^2$

B. $[Ar]^{18}3d^6 4s^2$

C. $[Ar]^{18}3d^5$

D. $[Ar]^{18}3d^6$

Answer:

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