CHEMISTRY

BOOKS - MODERN PUBLICATION

STRUCTURE OF ATOM

Example

1. Calculate the kinetic energy and potential energy of the electron in the first orbit of hydrogen atom.Given that $e = 1.6 \times 10^{-19}C$ and $r = 0.53 \times 10^{-10}m$.

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2. Answer the following question- Is artificial gold a mixture?

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3. Complete the following statement- Ammonal is composed of-

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4. State whether the statement is true or false- Dutch metal is a metal.

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5. In Geiger-Marsden experiment,a $5MeV\alpha$-particle is scattered through $180°$ from the gold foil.If the atomic number of gold is 79 ,find the distance of closet appraoch to the gold nucleus.

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6. Determine the speed of the electron in the n=3 orbit of hydrogen atom.

7. Fill in the blanks- _____ is the mixture of Aluminium powder and ammonium nitrate and is used as an explosive.

8. Complete the following statement- German silver is a mixture of-

9. Calculate the ratio of energies of photons produced due to transition of electron of hydrogen atom from its,

Second permitted energy level to the first level?

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10. Calculate the ratio of energies of photons produced due to transition of electron of hydrogen atom from its,

Second permitted energy level to the first level?

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11. Express 1066 in roman numbers.

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12. The energy of an electron in an excited hydrogen atom is $-3.4eV$. Calculate the angular momentum of the electron according to Bohr's theory.

(Given Rydberg's constant

$$R = 1.09737 \times 10^{-7} m^{-1}, h = 6.626176 \times 10^{-34} Js, c = 3 \times 10^{8} ms^{-1})$$

.

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13. State whether the statement is true ort false- Monel metal is a metal.

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14. The wavelength of first member of Balmer series in the hydrogen spectrum is $6563\overset{\circ}{A}$.

Calculate the wavelength of second member of Balmer series.

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15. Calculate the shortest wavelength of Balmer series in Hydrogen atom spectrum. Given $R = 10970000m^{-1}$

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

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17. Draw the lewis dot structure of Cl2

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18. A 12.5 eV electron beam is used to bombard gaseous hydrogen at room temperature. What series of wavelengths will be emitted?

19. The electron in a hydrogen atom make a transtion n_1 rarrn_2 where n_1 and n_2 are the priocipal quantum number of the two states . Assume the Bohr model to be valid . The time period of the electron in the initial state is eight time that in the final state . The possible values ofn_1 and n_2 are

20. The total energy of an electron in the first excited state of the hydrogen atom is about-3.4ev What is the potential energy of the electron in this state?

21. The wavelength of first member of Balmer series in the hydrogen spectrum is $6563 \overset{\circ}{A}$.

Calculate the wavelength of second member of Balmer series.

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22. How many and what type of bonds are present in (NH4)+

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23. What is the formal charge on carbon atom in the carbonate ion .

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24. A hydrogen atom in the ground state is excited by monochromatic radiation of wavelength $\lambda \overset{\circ}{A}$. The resulting spectrum consists of

maximum 15 different lines. What is the wavelength λ?

$$\left(R_H = 109737cm^{-1}\right)$$

25. Light from a dicharge tube containing hydrogen atoms falls on the surface of sodium.The kinetic energy of the fastest electrons emitted from sodium is 0.73 eV.The work function for sodium is 1.82 eV. Find the energy of the photons causing the photoelectric emission,

26. Light from a dicharge tube containing hydrogen atoms falls on the surface of sodium.The kinetic energy of the fastest electrons emitted from sodium is 0.73 eV.The work function for sodium is 1.82 eV.find the quantum numbers of the two levels involved in the emission of these photons,

27. Express 949 in roman numbers.

28. Light from a dicharge tube containing hydrogen atoms falls on the surface of sodium.The kinetic energy of the fastest electrons emitted from sodium is 0.73 eV.The work function for sodium is 1.82 eV.find the recoil speed of the emitting atom assuming it to be at rest before the transmition.(Ionisation energy of hydrogen is 13.6 eV).

29. Answer the following statement- Is coin metal is a mixture?

30. Answer the following question- Is gun metal a mixture?

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31. Complete the following statement- Monel metal is a mixture of-

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32. Which atomic part was discovered by Rutherford?

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33. Define impact parameter?

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34. What is impact parameters for scattering by $180°$?

35. What is the scatering angle for b=0?

36. What would happen, if the electrons in an atom were stationary?

37. Why are electrons revolving around the nucleus?

38. State Bohr's postulates for hydrogen atom.

39. State Bohr's postulate of quantisation of angular momentum of the orbiting electron in hydrogen atom?

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40. What is Bohr's quantum condition?

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41. Answer the following question- Is Dutch metal a mixture?

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42. What is Bohr's frequency condition?

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43. Write the expression for Bohr's radius in hydrogen atom?

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44. What is the diameter of hydrogen atom?

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45. What is the ratio of radii of the orbits corresponding to first excited state and ground state in a hydrogen atom?

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46. The radius of the innermost electron orbit of a hydrogen atom is $5.3 \times 10^{-11} m$. What are radii of the n=2 and n=3 orbits?

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47. An electron revolvles in a circular orbit around a nucleus of charge Ze. How is the electron velocity related to the radius of its orbit?

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48. What is the order of speed of electrons in a hydrogen atom in ground state?

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49. What is the value of Rydberg constant?

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50. What is the significance of the negative energy of the electron in the orbit ?

51. Write the empirical relation for Pashen series line of hydrogen spectrum.

52. Name the series of hydrogen spectrum which has least wavelength.

53. Name the series of hydrogen spectrum lying in ultra-violet region.

54. Name the series of hydrogen spectrum lying in ultra-violet region.

55. A compound with empirical formula AB2 has the vapour density equal to its empirical formula weight. Find the molecular formula.

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56. Namethe series of hydrogen spectrum lying in visible region.

▶ Watch Video Solution

57. Name the series of hydrogen spectrum which fall in infra-red region.

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58. What is the Ionisation potential of hydrogen atom?

59. What is energy possessed by an electron for $n = \infty$?

60. Energy of an electron in the nth orbit hydrogen atom is given by

$$E_n = -\frac{13.6}{n^2}eV$$

How much energy is required to take an electron from the ground state to the first excited state?

61. Calculate the energy required to excite an electron from first orbit of the hydrogen atom to the third orbit?

62. The total energy of an electron in the first excited state of the hydrogen atom is about-3.4ev What is the potential energy of the electron in this state?

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63. The total energy of an electron in the first excited state of the hydrogen atom is about-3.4ev What is the kinetic energy of the electron in this state?

▶ Watch Video Solution

64. The ground state energy of hydrogen atom is -13.6eV. what is the potential energy of the electron in this state?

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65. Explain,why the spectrum of hydrogen atom has many lines.although a hydrogen atom contains only one electron.

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66. Out of cathode rays and X-rays,which has a greater veloctiy?

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67. A compound with empirical formula AB2 has the vapour density three times its empirical formula weight. Find the molecular formula.

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68. An organic compound contains 4.07% hydrogen , 71.65% chlorine and remaining carbon. its molar mass is 98.96. Find its empirical formula.

69. For a given impact parameterb,does the angle of deflection increase or decrease with the increase in energy?

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70. Why is that the mass of the nucleus does not enter the formula for impact parameter ,but its charge does?

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71. Draw a labelled schematic arrangement showing Rughterford's α-particle scattering experiment.

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72. What conclusions are drawn from Rutherford's experiment on the scattering of a-particles from a thin gold foil ?

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73. Rutherford model could not explain the stability of the atom and line spectrum of hydrogen atom. (true/false)

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74. Explain, how Rutherford's experiment on scattering of a-particles led to the estimation of the size of the nucleus ?

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75. What is distacne of the closet approach? Derive an expression for it.

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76. What is energy of the electron when it is at a very large distance from the nucleus?

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77. for a given energy of the projectile,does the scattering angle increase or decrease wtih the increase in impact parameter?

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78. Write the main postulates of Rutherford's atomic model and the cause of failure of this model.

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79. What are drawbacks of Rutherford's atomic model ? How did Bohr remove these ?

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

▶ Watch Video Solution

**81.** State Bohr's postulates for hydrogen atom.

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82. Using bohr's second postaulate of quantisation of orbital angular momentum,show that the circumfernece of the electron in the nth orbital srtate in hydrogen atom is n times the de-Broglie wavelength associated with it.

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83. Calculate the radius of third orbit of hydrogen atom. Compare it with the same radius of second Bohr orbit of singly ionised helium atom.

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84. In the given figure for the stationary orbits of the hydrogen atom, mark the transitions representing the Balmer and Lyman series.

Fig. SAQ 22 (a)
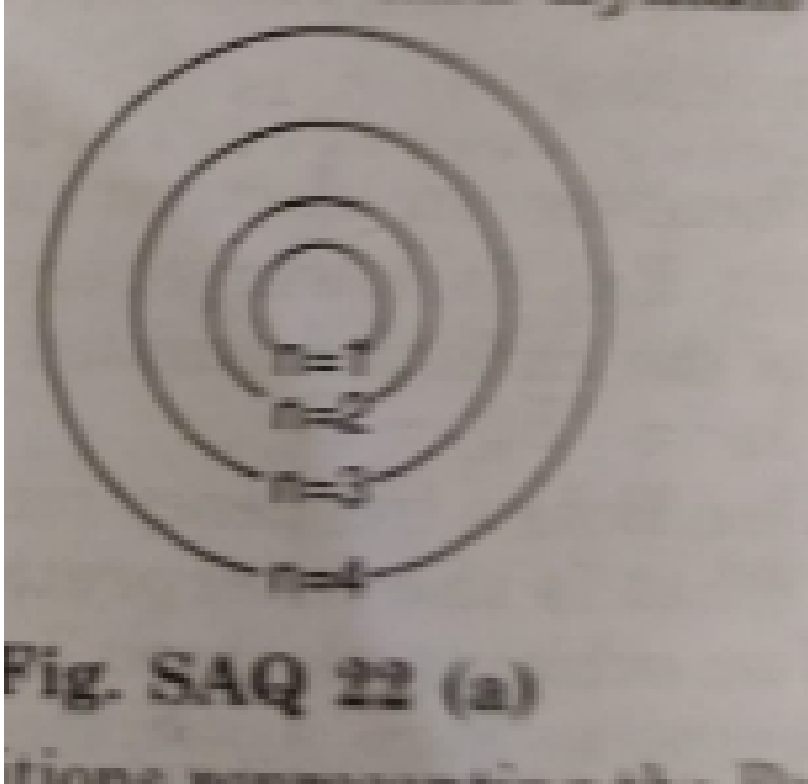
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85. Express 923 in roman numbers.

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86. Calculate the ratio of energies of photons produced due to transition of electron of hydrogen atom from its,

Second permitted energy level to the first level?

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87. Calculate the ratio of energies of photons produced due to transition of electron of hydrogen atom from its,

Second permitted energy level to the first level?

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88. What is the maximum number of emission lines when the excited electron of H atom in n = 6 drops to the ground state ?
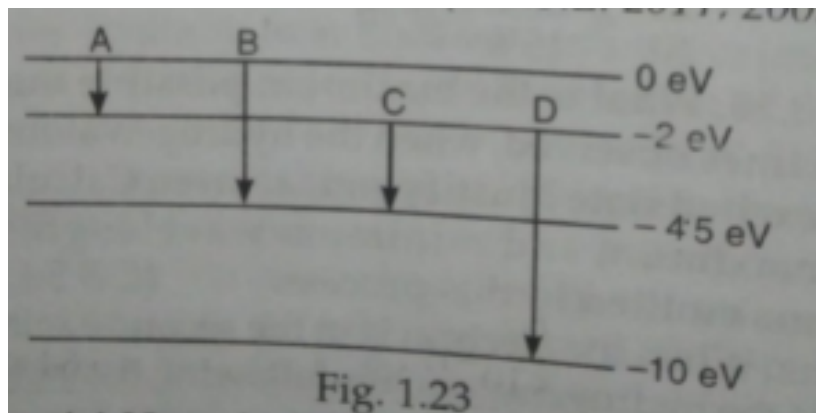
▶ **Watch Video Solution**

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

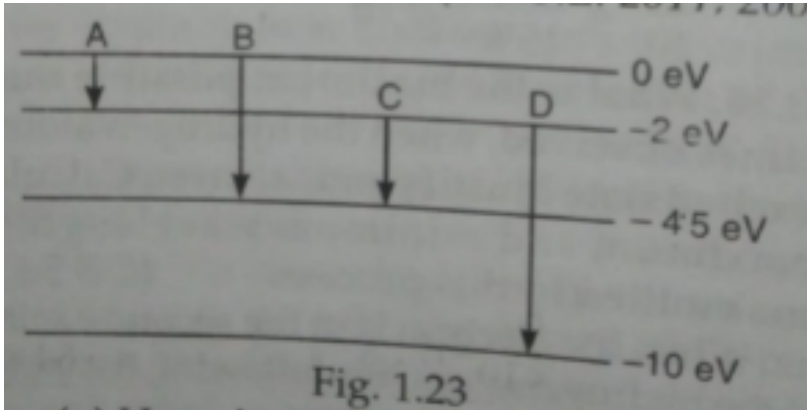**90.** The energy levels of an atom are as shown in Fig.1.23

Which one of these transitions will results in the emission of a photon of wavelength 275 nm?

Fig. 1.23

91. The energy levels of an atom are as shown in Fig.1.23

Which transition corresponds to emission of radiation of maximum wavelength?

Fig. 1.23

92. Answer the following question in one word- Name one alloy which is used to make equipments of machines?

93. Express 924 in roman numbers.

94. Explain energy level diagram for the Hydrogen atom and show different series in hydrogen spectrum.

95. What is meant by ionisation potential?

96. What is the ionisation energy of hydrogen in eV?

97. State the drawback of Bohr's atomic theory?

98. What are X-rays?How do they differ from electrons?

99. Answer the following questions which help you to understand the difference between Thomson's model and Rutherford's model better.

Is the probability of backward scattering (i.e.,scattering of α-particles at angle greater than $90°$) predicted by Thomson's model much less, about the same, or much greater than that predicted by Rutherford's model?

100. Define electric potential at a point. Derive an expression for the potential at a point due to a point charge.

101. Express 925 in roman numbers.

102. Express 1067 in roman numbers.

103. Express 926 in roman numbers.

104. An αparticle $\left(_2He^4 \right)$ is moving directly towards a stationary gold nucleus $\left(_{(79)}Au^{197} \right)$.The α-particle and the gold nucleus may be considered to be solid spheres with the charge and mass

concentrated at the centre of each sphere.When the two spheres are just toching,the sepaation of their centres is $9.6 \times 10^{-15}m$.

the α particle and the gold nucleus may be assumed to be an isolatedd system.Calculate for the α particle just in contact with the gold nucleus,

its electric potential energy.

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105. Express 930 in roman numbers.

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106. Express 931 in roman numbers.

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107. Classically, an electron can be in any orbit around the nucleus of an atom. Then what determines the typical atomic size? Why is an atom not, say, thousand times bigger than its typical size? The question had greatly puzzled Bohr before he arrived at his famous model of the atom that you have learnt in the text. To simulate what he might well have done before his discovery, let us play as follows with the basic constants of and see if we can get a quantity with the dimensions of length that is roughly equal to the known of an atom (~ 10^{-10} m).- Construct a quantity with the dimensions of length from the fundamental constants e, m_e, and c. Determine its numerical value.

108. Express 927 in roman numbers.

109. Followig table gives information on three lines observed in the emissin spectrum of hydrogen atoms.

Wavelength (nm)	Photon energy (J)
656	$3·03 \times 10^{-19}$
486	....
1,880	$1·06 \times 10^{-19}$

Complete the above table by calculating the photon energy for the wavelength of 486 nm.

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110. What is the hybridisation of each C in ethene

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111. Express 932 in roman numbers.

▶ Watch Video Solution

112. Express 933 in roman numbers.

▶ Watch Video Solution

113. Answer the following question- Is magnelium a mixture?

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114. Express 936 in roman numbers.

▶ Watch Video Solution

115. Express 937 in roman numbers.

▶ Watch Video Solution

116. Express 1069 in roman numbers.

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117. A compound having empirical formula CH2Cl & its molar mass is 98.96. Find its molecular formula.

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118. Express 938 in roman numbers.

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119. Express 934 in roman numbers.

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120. Express 935 in roman numbers.

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121. Express 939 in roman numbers.

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122. The energy required to remove an electron from a gaseous atom from its ground state is called

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123. X-rays are incident on a target metal atom having 30 neutrons.The ratio of atomic radius of the target atom and $_2He^4$ is $14^{1/3}$.

find the atomic number of the target atom.

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124. Find out the vlaue of 1 Bohr magneton. Givne $h = 6.62 \times 10^{-34} Js$, $e = 1.6 \times 10^{-19} C$ and $m_e = 9.1 \times 10^{-31} kg$

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125. Find the range of - |x|

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Exercise

1. Explain Rutherford's experiment on the scattering of alpha particles from a gold foil and state the significance of the results.

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2. What were the observations and important calculations drawn from a-scattering experiment ?

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3. Discuss Rutherford's experiment on the scattering of alpha particles.What are its consequences ?

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4. Discuss Rutherford's experiment on the scattering of alpha particles.What are its consequences ?

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5. Write the main postulates of Rutherford's atomic model and the cause of failure of this model.

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

7. Write the main postulates of Rutherford's atomic model and the cause of failure of this model.

8. Explain Rutherford's model of the atom. What are its drawbacks ?

9. Draw a labelled diagram of Geiger-Marsden experment on the scatttering of alpha particles.HOw is th size of the nucleius setimated in this experiment?

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10. Describe the aloha particle scattering experiment for the discovery of nucleus.Define the impact parameter b.

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11. What are drawbacks of Rutherford's atomic model ? How did Bohr remove these ?

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12. What are drawbacks of Rutherford's atomic model ? How did Bohr remove these ?

▶ Watch Video Solution

13. What are drawbacks of Rutherford's atomic model ? How did Bohr remove these ?

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14. Express 940 in roman numbers.

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15. Calculate the molecular mass of C12H22O11

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16. State Bohr's postulates for atomic modeland using them derive an expression for the radius of nth orbit in hydrogen atom and show that radii are in the ratio 1 : 4 : 9 :16 :...........

17. Obtain an expression for energy of orbital electron in hydrogen atom using Bohr's postulates.

18. Show that the radius of Bohr's orbit is directly proportional to the square of the principal quantum number.

19. Express 941 in roman numbers.

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20. Express 942 in roman numbers.

▶ Watch Video Solution

21. Express 943 in roman numbers.

▶ Watch Video Solution

22. Express 944 in roman numbers.

▶ Watch Video Solution

23. Express 945 in roman numbers.

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24. Express 946 in roman numbers.

▶ **Watch Video Solution**

25. Express 947 in roman numbers.

▶ **Watch Video Solution**

26. Express 950 in roman numbers.

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27. Answer the following question- Is German silver a metal?

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28. Write the postulates of Bohr's atomic model and find an expression for the total energy of an electron in the nth orbit of an atom.

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29. Calculate the molecular mass of H3PO4

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30. For the innermost orbit of an electron,the binding energy is maximum .Explain.

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31. Express 951 in roman numbers.

▶ Watch Video Solution

32. Express 952 in roman numbers.

▶ Watch Video Solution

33. Express 953 in roman numbers.

▶ Watch Video Solution

34. Answer the following statement- Is brass a metal?

▶ Watch Video Solution

35. Express 954 in roman numbers.

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36. Answer the following question- Is bronze a metal?

> ▶ **Watch Video Solution**

37. Express 955 in roman numbers.

> ▶ **Watch Video Solution**

38. Obtain an expression for energy of orbital electron in hydrogen atom using Bohr's postulates.

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39. On the basis of Bohr's atomic model,find an expression for radius of nth orbit of a hydrogen atom.

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40. Express 956 in roman numbers.

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41. Answer the following question- Is coin metal a metal?

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42. Express 957 in roman numbers.

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43. Express 958 in roman numbers.

44. State whether the statement is true or false- Gun metal is a metal.

45. State whether the statement is true or false- Bell metal is a metal.

46. State whether the statement is true or false- Constantin is a metal.

47. Answer the following question- Is constantin a mixture?

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48. Answer the following question- Is Monel metal a mixture?

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49. A hydrocarbon contains 7.7 % hydrogen. calculate the empirical formula.

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50. On the basis of Bohr's atomic model,find an expression for radius of nth orbit of a hydrogen atom.

▶ **Watch Video Solution**

51. State whether the statement is true or false- Artificial gold is a metal.

▶ **Watch Video Solution**

52. State whether the statement is true or false- German silver is a metal.

▶ **Watch Video Solution**

53. Explain Energy level diagram for the Hydrogen atom and show different series in Hydrogen atom spectrum.

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54. Show that the radius of Bohr's orbit is directly proportional to the square of the principal quantum number.

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55. State whether the statement is true or false- Magnelium is a metal.

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56. An alpha particle having kinetic energy equal to 8.7 MeV is projected towards the nucleus of copper with Z=29.Calculate its distance of closet approach.

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57. If we heat 245 g OF KClO3 it will produce 67.2L of O2. how much KClO3 should be heated to produce 2.24 L of O2 at NTP ?

58. Estimate the radius of the gold nucleus,when alpha particle of eneryg 6 Me V is incident at its centre and gets deflected through $180°$.Given that atmic number of gold=79.

59. An alpha particle having 12.5 MeV kinetic energy collides with copper nucleus (Z=29) and retraces it s path .What is the size of the nucleus?

Given, $\dfrac{1}{4\pi e_0} = 9 \times 10^9 Nm^2C^{-2}$.

60. In a head on collision between an alpha particle and a gold nucleius (Z=79),the distnace of closet approach is 39.5 fermi.Calculate the enrgy of alpha particle.

61. What is the impact parameter at which the scattering angle is $90°$ of rZ=79 and alpha particle of initial kinetic energy of 10 MeV.

62. Calculate the impact parameter of 5 MeV alpha particle scattered by $10°$,when it approaches a gold nucleus.

63. The radius of 2nd Bohr's orbit of an electron in H - atom is $2.12\overset{\circ}{A}$ .Calculate th radius of 3 rd orbit of the same atom.

64. Write down the expression for the radii of orbits of hydrogen atom.Calculate the radius of the smallest orbit.

65. Calculate the radius of the third orbit of the electron in hydrogen atom.Given that Planck's constant, $h = 6.62 \times 10^{-34} Js, m = 9.1 \times 10^{-31} kg, e = 1 = 1.6 \times 10^{-19} C.$

66. Calculate the frequency of rtevolution of electron in the first Bohr orbit of hydrogen atom,if the radius of the first Bohr orbit is $0.5\overset{\circ}{A}$ and the velocity of electron in the first orbit is $2.24 \times 10^6 ms^{-1}$.

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67. What is the SI unit of density.

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68. Answer the following statement- Is hydroleum a mixture?

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69. The total energy of an electron in the second excited state fo hydrogen atom is -1.51 eV .Calculate

the potential energy of the electron in this state.

70. State whether the given statement is true or false- Durelumin is a

metal.

71. The eergy of the electron in the first Bohr orbit is -13.6 eV.Calculate

energy of the electron in hte third orbit.

72. Give the empirical formula of C2H4Cl2

73. The electron in given Bohr orbit has a total energy of -3.4 eV.Calculate its

kinetic energy

74. The electron in given Bohr orbit has a total energy of -3.4 eV.Calculate its

potential energy adn

75. The electron in given Bohr orbit has a total energy of -3.4 eV.Calculate its

wavelength of the light eitted ,if an electron makes a transition to the

ground state.(Ground state energy = -13.6 eV).

76. What is the difference between molecules and compound .

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77. Express 959 in roman numbers.

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78. What is formula mass. What is the formula mass of water.

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79. At NTP , what will be the volume of molecules of 6.022 . 10(23) H2

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80. Calculate the number of molecules present in 0.5 moles of CO2 ?

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81. Rydberg's constant is equal to $1.09678.\ 10^7 m^{-1}$.Calculate the wavelength of the first member of Lyman series.

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82. Convert 35 °C to °F

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83. Convert 35 °C to K

> ▶ **Watch Video Solution**

84. The second member of Lyman series in hydrogen spectrum has wavelength of $5400\overset{\circ}{A}$.What is the wavelength of first member in the same series ?

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85. The wavelength of first member of Balmer series in the hydrogen spectrum is $6563\overset{\circ}{A}$.

Calculate the wavelength of second member of Balmer series.

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86. The wavelength of first spectral line in the balmer series is 6561 angstrom. Calculate the wavelength of second spectral line in balmer series.

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87. The wavelength of first spectral line in the balmer series is 6561 angstrom. Calculate the wavelength of second spectral line in balmer series.

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88. Calculate the molecular mass of H2SO4

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89. A potential difference of 20 kV is aplied across an X-ray tube.Findt eh miimum wavelength of X-rays produced.

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90. Answer the following statement- Durelumin is a mixture.

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91. Express 1012 in roman numbers.

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92. Express 971 in roman numbers.

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93. Give one example of molecule in which empirical formula and molecular formula are same.

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94. Answer the following question- Is solder an alloy?

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95. Give one example of molecule in which empirical formula and molecular formula are different.

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96. State whether the statement is true or false- Solder is a metal.

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97. Calculate the number of moles in the following masses : 3.68 g of Fe

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98. Using Bohr's formula for energy quantisation, determine the ionisation potential of the ground state of Li^{++} atom.

99. The wavelength of K_α X-rays produced by an X-ray tube is $0.76 \overset{\circ}{A}$ .Find the atomic number of anode material of the X-ray tube .Take $R = 1.097 \times 10^7 m^{-1}$.

100. Calculate the number of moles in the following masses : 83.5 mg of F

101. Answer the following question- Is solder a metal?

102. How many significant figures are present in 8.256

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