CHEMISTRY

BOOKS - A N EXCEL PUBLICATION

STRUCTURE OF ATOM

Question Bank

1. Calculate the number of protons, neutrons and electrons in $\overset{80}{\underset{35}{Br}}$

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2. The number of electrons, protons and neutrons in a species are equal to 18, 16 and 16 respectively .Assign the proper symbol to the species.

3. The Vividh Bharati station of All India Radio, Delhi, broadcasts on a frequency of 1,368 kHz (kilo hertz). Calculate the wavelength of the

electromagnetic radiation emitted by transmitter. Which part of the electromagnetic spectrum does it belong to?

4. The wavelength range of the visible spectrum extends from violet (400 nm) to red (750 nm). Express these wavelengths in frequencies(Hz), $\left(1nm = 10^{-9}m\right)$.

5. The Vividh Bharati station of All India Radio, Delhi, broadcasts on a frequency of 1,368 kHz (kilo hertz). Calculate the wavelength of the electromagnetic radiation emitted by transmitter..Calculate wavenumber

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6. Calculate frequency of yellow radiation having wavelength 5800 $\overset{\circ}{A}$

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7. Calculate energy of one mole of photons of radiation whose frequency is 5×10^{14} Hz.

8. A 100 watt bulb emits monochromatic light of wavelength 400 nm. Calculate the number of photons emitted per second by the bulb

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

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

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11. Calculate the energy associated with the first orbit of He^+.

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

13. The mass of an electron is 9.1×10^{-31} kg. If its K.E.is 3.0×10^{-25} J,then calculate it's wavelength

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14. Calculate the mass of a photon with wavelength 3.6 $\overset{\circ}{A}$

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15. What is the total number of orbitals associated with the principal quantum number n = 3 ?

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

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17. Calculate the mass of one mole of electrons

18. Calculate the total number of electrons present in one mole of methane

19. Find (i) the total number and (ii) the total mass of neutrons in 7 mg of $_-^{14}C$ (Mass of

neutron $= 1.675 \times 10^{-27} kg$)

20. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800 $\overset{\circ}{A}$. Calculate the threshold frequency (v_0) and work function (w_0) of the metal.

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

22. What is the energy in joules required 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^{-11} ergs. $\left(1erg = 10^{-7}J\right)$

23. Calculate the energy required to remove an electron completely from n = 2 orbit of hydrogen atom, What is the longest wavelength of light in cm that can be used to cause this transition?

24. Calculate the wavelength of an electron moving with a velocity of $2.05 \times 10^7 ms^{-1}$

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25. What is the atomic number of element whose outer most electrons are represented by $3s^1$

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26. What is the atomic number of element whose outer most electrons are represented by $2p^3$

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27. How many electrons in an atom may have the following quantum numbers? $n = 4, m_s = -\dfrac{1}{2}$

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28. How many electrons in an atom may have the following quantum numbers? N = 3, l = 0

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29. The work function for Ceasium atom is 1.9 eV. Calculate the threshold frequency

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30. The work function for Caesium atom is 1.9 eV. Calculate the threshold wavelength of the radiation. If Caesium is irradiated with a wavelength 500 nm, calculate the kinetic energy and the velocity of the ejected electron.

31. If wavelength of neutron beam used in neutron microscope is 800 pm, calculate the

velocity associated with the neutron (Mass of neutron $1.675 \times 10^{-27} kg$)

32. The quantum numbers of six electrons are given below. Arrange them in order of increasing energy   1)

$n = 4, l = 2, m_l = -2, m_s = -^1/_2$ 2)

$n = 3, l = 2, m_l = 1, m_s = +^1/_2$ 3)

$n = 4, l = 1, m_l = -0, m_s = +^1/_2$ 4)

$n = 3, l = 2, m_l = - -2, m_s = -^1/_2$ 5)

$n = 3, l = 1, m_l = - -1, m_s = +^1/_2$

33. The quantum numbers of 2 electrons are given below. Arrange them in order of increasing energy

$n = 3, l = 2, m_l = 1, m_s = +\dfrac{1}{2}$

$n = 4, l = 1, m_l = 0, m_s = +\dfrac{1}{2}$

34. The quantum numbers of two electrons are given below. Arrange them in order of increasing energy

$$n = 4, l = 1, m_l = 0, m_s = +\frac{1}{2}$$

$$n = 3, l = 2, m_l = -2, m_s = -\frac{1}{2}$$

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35. The quantum numbers of electrons are given below. Arrange them in order of increasing energy

$$n = 3, l = 2, m_l = -2, m_s = -\frac{1}{2}$$

$$n = 3, l = 1, m_l = -1, m_s = +\frac{1}{2}$$

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36. The unparied electrons in Al and Si are in 3p orbital. Which electrons will experience more effective nuclear charge from the nucleus?

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37. What is the shape of p- orbital?

38. Find the maximum number of emission lines, when the excited electron of hydrogen atom in n = 6, drops to the ground state (n = 1)

39. Neils Bohr was the first to explain quantitatively the general features of hydrogen atom structure and its spectrum. Calculate the wave number of radiation due to transition of an electron from fourth orbit to second orbit $\left(R_h = 109677 cm^{-1}\right)$

40. During Rutherford α-ray experiment, it was observed that most of the α-particule passed

through the goldfoil without any deflection, a small fraction deflected by small angles and very few bounced back. What are the main conclusion made by Rutherford?

41. During Rutherford α-ray experiment, it was observed that most of the α-particule passed through the goldfoil without any deflection, a small fraction deflected by small angles and

very few bounced back. Give the atom model proposed by him.

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42. What is chromatography?

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43. Name the principle which restricts the pairing of electrons in degenerate orbitals.

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44. Based on his α- ray scattering experiment, Rutherford proposed the nuclear model of an atom. Write the important demerits of the Rutherford model.

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45. Based on his α- ray scattering experiment, Rutherford proposed the nuclear model of an atom. The threshold frequency $\nu 0$ for a metal

is $6.2 \times 10^{14} s^{-1}$. Calculate the K.E. emitted for an electron when the radiation of frequency $v = 8.7 \times 10^{14} s^{-1}$ strikes the metal.

46. The electrons in an atom are designated by a set of quantum numbers labelled as n,l,m and s. Give the values of n,l,m and s for the valence electron of sodium atom, (atomic number =11)

47. How many sub-shells ssociated with n=4?

48. The electrons in an atom are designated by a set of quantum numbers labelled as n,l,m and s. Which of the following set of quantum numbers are not allowed?

$$n = 2, 1 = 1, m = 0, s = -1/2$$

49. The electrons in an atom are designated by a set of quantum numbers labelled as n,l,m and s. Which of the following set of quantum numbers are not

$$n = 1, 1 = 0, m = 0, s = \ +1/2$$

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50. The electrons in an atom are designated by a set of quantum numbers labelled as n,l,m and s. Which of the following set of quantum

numbers are not

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

51. The electrons in an atom are designated by a set of quantum numbers labelled as n,l,m and s. State Pauli's exclusion principle.

52. The results of Rutherford's α-ray scattering experiment were quite unexpected. Write the observation of Rutherford's α-ray scattering experiment which leads to the conclusion that most of the space in an atom is empty.

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53. Mention any one drawback of Rutherford's nuclear model of an atom.

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54. Write any postulate of the Bhor's model of the hydrogen atom

55. Heisenberg's uncertainty principle rules out the existence of definite paths for electrons and othe similar particles. Calculate the uncertainty in the velocity of a cricket ball of mass 130g, if the uncertainity in its position is of the order of $1.2\overset{\circ}{A}$

56. The photon has a momentum as well as wavelength Which property of matter is revealed in the above statement?

57. The photon has a momentum as well as wavelength A photon has a mass of

8.6×10^{-30} kg. Calculate the wavelength

$$\left(h = 6.626 \times 10^{-34} Js\right)$$

58. Write the 4 quantum numbers

59. Represent the orbital with the following quantum numbers, n = 4 and / = 0

60. State the rules behind the electronic configuration in an atom.

61. Photoelectric effect was first observed by Hertz. The number of electrons ejected in the photoelectric effect is proportional to____of light used (frequency, intensity)

62. Photoelectric effect was first observed by Hertz. Select the correct statement related to the photoelectric effect: Threshold frequency is the maximum frequency required to cause photoelectric emission from a particular metal

63. Photoelectric effect was first observed by Hertz. Select the correct statement related to the photoelectric effect: The kinetic energy of

the photoeiectrons is directly proportional to the frequency of incident light.

64. Photoelectric effect was first observed by Hertz. Select the correct statement related to the photoelectric effect: Work function is the same for all metals.

65. The general features of the structure of a hydrogen atom and hydrogen like species were quantitatively explained by Niels Bohr:

Write any postulate of the Bohr's model of the hydrogen atom.

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66. The general features of the structure of a hydrogen atom and hydrogen like species were quantitatively explained by Niels Bohr:

Calculate the radius of the second orbit of Li^{2+} (Express the answer in nm)

67. The dual behaviour of matter was proposed by the French physicist, de Broglie. State the dual behaviour of matter.

68. The dual behaviour of matter was proposed by the French physicist, de Broglie. A moving electron has a de Broglie wavelengh $7 \times 10^{-7}m$ Calculate its kinetic energy. (Planck's constant $= 6.626 \times 10^{-34} Js$ Mass of an electron $9.1 \times 10^{-31} kg$)

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69. A large number of orbitals are possible in an atom. Using s,p,d,f notation, describe the

orbital with the following quantum numbers.

$$n = 4, l = 0$$

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70. A large number of orbitals are possible in an atom. Using s,p,d,f notation, describe the orbital with the following quantum numbers.

$$n = 3, l = 2$$

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71. The Balmer series of lines in the hydrogen spectrum appear in the visible region of the electromagnetic spectrum. Calculate the wave number of the second line in the Balmer series.

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72. Bohr model of hydrogen atom contradicts dual behaviour of matter and Heisenberg's uncertainty principle. Justiy.

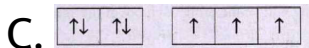**73.** The number of electrons, protons and neutrons in a species are equal to 18,16 and 16 respectively. Assign the proper symbol to the species.

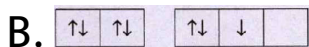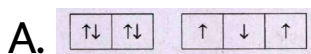**74.** Write any two drawbacks of the Rutherford model of an atom.

75. Among the following electronic configurations, which one is correct?

A. $\boxed{\uparrow\downarrow}\,\boxed{\uparrow\downarrow}\quad\boxed{\uparrow}\,\boxed{\downarrow}\,\boxed{\uparrow}$

B. $\boxed{\uparrow\downarrow}\,\boxed{\uparrow\downarrow}\quad\boxed{\uparrow\downarrow}\,\boxed{\downarrow}\,\boxed{\ }$

C. $\boxed{\uparrow\downarrow}\,\boxed{\uparrow\downarrow}\quad\boxed{\uparrow}\,\boxed{\uparrow}\,\boxed{\uparrow}$

D.

Answer: C

76. Write the subshellwise electronic configurations of the following elements: Cu (Z = 29) Give reason for the extra stability of these atoms.

77. Write the subshellwise electronic configurations of the following elements: Cr (Z = 24) Give reason for the extra stability of these atoms.

78. Canal rays were discovered by discharge tube experiments conducted in a modified cathods ray tube. Give any two characteristics of canal rays.

**79.** A microscope with suitable photons is employed to locate an electron in an atom

within a distance of 0.4A. What is the uncertainty involved in the measurement of its velocity?

80. The number of protons, electrons and neutrons in a species are equal to 17,18 and 18 respectively. Which of the following will be the proper symbol of the species

A. $^{32}_{17}Cl$

B. $^{35}_{17}Cl^-$

C. $^{36}_{17}Cl$

D. $^{36}_{17}Cl^-$
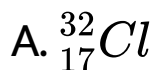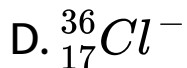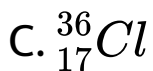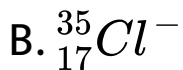
Answer: A::C

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81. Give any two postulates of Rutherford's nuclear model of an atom

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82. Write two main drawbacks of Rutherford's atomic model

83. Representation of the orbital with quantum numbers n = 3,1 = 1 is

A. 3s

B. 3d

C. 3p

D. 1s

Answer: C

84. Which of the following sets of quantum numbers are NOT possible?

$$n = 2, l = 2, m_l = 0, m_s = +\frac{1}{2}$$

85. Which of the following sets of quantum numbers are NOT possible?

$$n = 1, l = 0, m_l = 0, m_s = -\frac{1}{2}$$

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86. Which of the following sets of quantum numbers are NOT possible?

$$n = 3, l = 2, m_l = 3, m_s = +\frac{1}{2}$$

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87. Which of the following sets of quantum numbers are NOT possible?

$n = 2, l = 1, m_1 = 1, m_s = +\dfrac{1}{2}$

88. In the photoelectric effect experiment certain soft metals are exposed to light of particular frequency. Write any two observations of the photoelectric effect experiment.

89. Atomic orbitals are precisely distinguished by what are known as quantum numbers. Name the four quantum numbers

90. Atomic orbitals are precisely distinguished by what are known as quantum numbers. Represent the orbitals given below: a) n= 1, l = 0 b) n= 2, l = 1

91. Represent the orbitals given below: n = 2, l=

1

92. Atomic orbitals are precisely distinguished

by what are known as quantum numbers. The

number of unpaired electrons, present in Ni

is_____ (Atomic number of Ni = 28) a) 2 b) 0 c) 1

d) 3

A. 2

B. 0

C. 1

D. 3

Answer: B

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