

India's Number 1 Education App

# **CHEMISTRY**

# **BOOKS - VGS PUBLICATION-BRILLIANT**

# **ATOMIC STRUCTURE**

Very Short Answer Questions

1. What is the charge , mass and charge to

mass ratio of an electron ?



3. Calculate the charge of one mole of

electrons .

4. Calculate the charge of one mole of protons.
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**5.** Calculate the charge of one mole of neutrons.



6. How many neutrons and electrons are present in the nuclei of  ${}^{13}_{6}C,{}^{16}_{8}O,{}^{24}_{12}$  Mg, ${}^{56}_{26}$  Fe and  ${}^{88}_{38}$ Sr ? Watch Video Solution

7. What is a black body ?

8. Which part of electromagnetic spectrum

does Balmer series belong?



**10.** When an electron is transferred in hydrogen atom from n = 4 orbit to n = 5 orbit

to which spectral series does this belong?



**12.** What are the values of principal quantum number (n) and azimuthal quantum number (l) for a 3d electron ?



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**14.** What is the complete symbol for the atom with the given atomic number (Z) and atomic

mass (A) ?

Z = 17, A = 35



**15.** What is the complete symbol for the atom with the given atomic number (Z) and atomic

mass (A)?

Z = 92, A = 233

**16.** Draw the shape of  $d_{z^2}$  orbital .



#### 19. What is Zeeman effect ?



#### 20. What is Stark effect ?

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**21.** To which element does the following electronic configuration correspond ?

 $1s^2 2s^2 2p^6 3s^2 3p^1$ Watch Video Solution

**22.** To which element does the following electronic configuration correspond ?

 $1s^2 2s^2 2p^6 3s^2 3p^6$ 

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**23.** To which element does the following electronic configuration correspond ?



**25.** Electrons are emitted with zero velocity from a metal surface when it is exposed to

radiation of wavelength  $4000 {
m \AA}$  . What is the

threshold frequency  $(v_0)$  ?



**26.** Explain Pauli's Exclusion principle with an example.

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27. What is Aufbau principle ?



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29. Explain Heisenberg's uncertainty principle .

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**30.** What is the wavelength of an electron moving with a velocity of  $2.0 imes 10^7 {
m ms}^{-1}$  ?



**32.** Which of the following orbitals are possible ? (2s,1p,3f,2p)

33. The static electric charge on the oil drop is

 $-3.2044 imes 10^{-19} C$  . How many electrons are

present on it?



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

(a) X- rays (b) visible radiation (c) microwave

radiation and (d) radiation from radio waves .



35. How many electrons in an atom may have

$$n=4 \,\, {
m and} \,\, m_s=\, +\, {1\over 2}$$
 ?

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#### 36. How many sub-shells are associated with n

= 5 ?





**38.** Explain the significance of Heisenberg's uncertainty principle .



39. What series of lines are observed in hydrogen spectra ?
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### Short Answer Questions

**1.** What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 5 to an energy level with n = 3?



**2.** An atom of an element contains 29 electrons ans 35 neutrons . Deduce (i) the number of protons and (ii) the electromic configuration of the element .



**3.** Explain giving reasons , which of the following sets of quantum numbers are not possible .



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**4.** Show that the circumfernce of the Bohr orbit for the hydrogen atom is an integral multiple of the de-Broglie wavelength as-

sociated with the electron revolving around

the orbit .



5. The longest wavelength doublet absorption
transition is observed at 589.0 ans 589.6nm .
Calculate the frequency of each transition and
energy difference between two excited states .

6. What are the main features of quantum

mechanical model of an atom?

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7. What is a nodal plane ? How many nodal

plance are possible for 2p and 3d - orbitals ?

**8.** The Lyman series occurs between 91.2 nm and 121.6 nm , the Balmer series occurs between 364.7 nm and 656.5 nm and the Paschen series occurs between 820.6 nm and 1876 nm, Identify the spectral regions to which these wavelengths correspond .



**9.** How are the quantum numbers n , 1  $m_1$  for

hydrogen atom are obtained ?



10. A line in Lyman series of hydrogen atom has a wavelength of  $1.03 imes 10^{-7}m$  . What is the initial energy level of the electron ?

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11. If the position of the electon is meaured within an accuracy of  $\pm 0.002$  nm , calculate the uncertainty in the momentum of the electron .



12. If the velocity of the electron is  $1.6 \times 10^6 {
m ms}^{-1}$ , calculate the de-Broglie wavelength associated with this electron .



13. Explain the difference between emission

and absorpation spectra.



14. The quantum numbers of electrons are given below. Arrange them in order of increasing energies . Do any of these combinations have same energy? a)  $n=4, \, l=2, \, m_l=\, -\, 2, \, m_s=\, +\, 1\,/\, 2$ b)  $n=3, l=2, m_l=\,-\,1, m_s=\,-\,1/2$ c) $n=4,\,l=1,\,m_l=0,\,m_s=\,+\,1\,/\,2$ d)  $n=3, l=1, m_l=\,-1, m_s=\,-1/2$ 

**15.** The work function for Cesium atom is 1.9 eV . Calculate the threshold frequency of the radiation . If the Cesium element is irradiated with a wavelength of 500 nm , calculate the kinetic energy of the ejected photoelectron .



**16.** Calculate the wavelength for the emission transition if it starts from the orbit having radius 1.3225 nm and ends at 211.6 pm . Name

the series to which this transition belongs and

the region of the spectrum.



**18.** Explain the photoelectric effect .



Long Answer Questions

1. Explain Rutherford 's nuclear of an atom .

What are its drawbacks ?

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2. Explain the influence of Planck's quantum

theory on Bohr's model of structure of atom.

**3.** What are the postulates of Bohr's model of hydrogen atom ? Discuss the importance of this model to explain various series of line spectra in hydrogen atom.



4. Explain the success of Bohr's theory for

hydrogen atom.

**5.** What are the consequences that lead to the development of quantum mechanical model of an atom?



### 6. What are the main features of quantum

mechanical model of an atom?

7. What are the limitation of Bohr's model of

an atom?

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8. What are the evidence in favour of dual

behaviour of electron?

**9.** How are the quantam numbers n, l and m arrived at ? Explain the significance of these quantam numbers.



**10.** Explain the dual behaviour of matter. Discuss its significance to microscopic particles like electrons.

**11.** What are various ranges of electromagnetic radiation ? Explain the characteristics of electromagnetic radiation.

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12. Define atomic orbital . Explain the shapes of

s, p and d orbitals with the help of diagrams.

**13.** Explain diagrammatically the boundary surfaces for three 2p orbitals and five 3d orbitals.



14. Illustrate the reaasons for the stability of

completey filled and half -filled subshells .



**15.** Explain emission and absorption spectra. Discuss the general description of line spectra in hydrogen atom .



## Additional Questions Answers

1. Calculate the number of protons , neutrons

and electrons in  $^{80}_{35}\mathrm{Br}$ 

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 .

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**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 transitter . 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 (750nm). Express these wavelengths in frequencies (Hz). (1nm  $= 10^{-9}$ m)



wave number

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6. Calculate

frequency of yellow radiation having

wavelength 5800 Å.

7. Calculate energy of one mole of photons of

radiation whose frequency is  $5 imes 10^{14}$  Hz.

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8. A 100 watt bulb emits monochromatic light

of wavelength 400 nm . Calculate the number

of photons emitted per second by the bulb.



9. When electromagnetic radiations of wave length 300nm falls on the surface of sodium, electrons are emitted with a kinetic energy of  $1.68 imes 10^5 J \mathrm{mol}^{-1}$  . What is the minimum energy needed to remove an electron from sodium ? What is the maximum wavelength that will cause a photoelectron to be emitted ?

10. The threshold frequency  $v_0$  for a metal is  $7.0 imes 10^{14} s^{-1}$  . Calculate the kinetic energy of an electron emitted when radiation of frequency  $v=1.0 imes 10^{15} s^{-1}$  hits the metal .

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11. 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?



**12.** Calculate the energy associated with the first orbit of  $He^+$  . What is the radius of this orbit?

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

**14.** 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 .

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**15.** Calculate the mass of a photon with wavelength 3.6 Å.

**16.** A microscope using suitable photons is employed to locate an electron in an atom within a distance of 0.1 Å . What is the uncertainty involved in the measurement of its velocity ?

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17. A golf ball has a mass of 40g , and a speed of 45m/s . If the speed can be measured within accuracy of 2% , calculate the uncertainty in the position.



**18.** What is the total number of orbitals associated with the principal quantum number n = 2 ?



**19.** Using s, p, d , f notations , describe the orbital with the following quantum numbers . n = 2, l = 1





20. Using s, p, d , f notations , describel the

orbital with the following quantum numbers .

n = 4, l = 0

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**21.** Using s, p, d , f notations , describel the orbital with the following quantum numbers . n = 5 , l = 3

**22.** Using s, p, d , f notations , describel the orbital with the following quantum numbers .

n = 3, l = 2