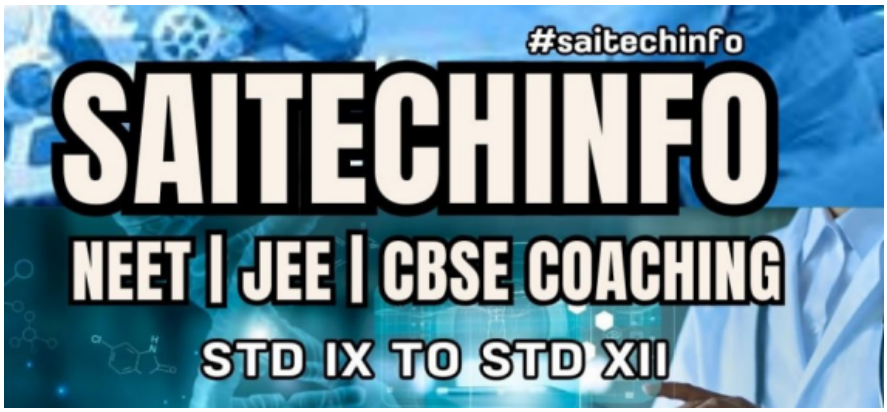
Atomic Structure



16. Energy of an electron is given by $E = -2.178 \times 10^{-18}\,(\frac{Z^2}{n^2})$. Wavelength of light required to excite an electron in a hydrogen atom from level $n = 1$ to $n = 2$ is (h = 6.62×10^{-34} Js and c = 3.0×10^{8} ms^{-1}):

    - (a) 1.214×10^{-7} m
    - (b) 2.816×10^{-7} m
    - (c) 6.500×10^{-7} m
    - (d) 8.500×10^{-7} m

17. If the nitrogen atom had electronic configuration $1s^7$ it would have energy lower than that of the normal ground state configuration $1s^2 2s^2 2p^3$ because the electrons would be closer to the nucleus. Yet $1s^7$ is not observed. It violates:

    - (a) Heisenberg's uncertainty principle
    - (b) Hund's rule
    - (c) Pauli exclusion principle
    - (d) Bohr postulate of stationary orbits

18. In a hydrogen atom, if energy of an electron in ground state is 13.6 eV, then that in the 2nd excited state is:

    - (a) 1.51 eV
    - (b) 3.4 eV
    - (c) 6.04 eV
    - (d) 13.6 eV

19. Of the following sets which one does NOT contain isoelectronic species?

    - (a) BO_3^{3-}, CO_2^{3-}, NO_3^-
    - (b) SO_3^{2-}, CO_2^{3-}, NO_3^-
    - (c) CN^-, N_2, C_2^{2-}
    - (d) PO_4^{3-}, SO_2^{4-}, ClO_4^-

20. The ionization enthalpy of hydrogen atom is 1.312×10^6 J mol^{-1}. The energy required to excite the electron in the atom from $n = 1$ to $n = 2$ is:

    - (a) 8.51×10^5 J mol^{-1}
    - (b) 6.56×10^5 J mol^{-1}
    - (c) 7.56×10^5 J mol^{-1}
    - (d) 9.84×10^5 J mol^{-1}

21. The limiting line in Balmer series will have a frequency of (Rydberg constant, $R_\infty = 3.29 \times 10^{15}$ cycles/s):

    - (a) 8.22×10^{14} s^{-1}
    - (b) 3.29×10^{15} s^{-1}
    - (c) 3.65×10^{14} s^{-1}
    - (d) 5.26×10^{13} s^{-1}

22. The energy required to break one mole of Cl–Cl bonds in Cl_2 is 242 kJ mol^{-1}. The longest wavelength of light capable of breaking a single Cl–Cl bond is (c = 3×10^8 ms^{-1} and $N_A = 6.02 \times 10^{23}$ mol^{-1}):

    - (a) 594 nm
    - (b) 640 nm
    - (c) 700 nm
    - (d) 494 nm

23. The de Broglie wavelength of a car of mass 1000 kg and velocity 36 km/hr is:

    - (a) 6.626×10^{-34} m
    - (b) 6.626×10^{-38} m
    - (c) 6.626×10^{-31} m
    - (d) 6.626×10^{-30} m

24. If the radius of first orbit of H atom is a_0, the de-Broglie wavelength of an electron in the third orbit is:

    - (a) $4\pi a_0$
    - (b) $8\pi a_0$
    - (c) $6\pi a_0$
    - (d) $2\pi a_0$

25. Which of the following radial distribution graphs correspond to $\ell = 2$ for the H atom?

26. If the kinetic energy of an electron is increased four times, the wavelength of the de-Broglie wave associated with it would become:

    - (a) one fourth
    - (b) half
    - (c) four times

- (d) two times

27. The correct set of four quantum numbers for the valence electrons of rubidium atom ($Z = 37$) is:

- (a) $5, 0, 0, +\frac{1}{2}$
- (b) $5, 1, 0, +\frac{1}{2}$
- (c) $5, 1, 1, +\frac{1}{2}$
- (d) $5, 0, 1, +\frac{1}{2}$

28. If λ_0 and λ be threshold wavelength and wavelength of incident light, the velocity of photoelectron ejected from the metal surface is:

- (a) $\sqrt{\frac{2h}{m}(\lambda_0 - \lambda)}$
- (b) $\sqrt{\frac{2hc}{m}(\lambda_0 - \lambda)}$
- (c) $\sqrt{\frac{2hc}{m}\left(\frac{\lambda_0 - \lambda}{\lambda_0 \lambda}\right)}$
- (d) $\sqrt{\frac{2h}{m}\left(\frac{1}{\lambda_0} - \frac{1}{\lambda}\right)}$

29. If m and e are the mass and charge of the revolving electron in the orbit of radius r for hydrogen atom, the total energy of the revolving electron will be:

- (a) $\frac{1}{2}\frac{e^2}{r}$
- (b) $-\frac{e^2}{r}$
- (c) $\frac{me^2}{r}$
- (d) $-\frac{1}{2}\frac{e^2}{r}$

30. The dissociation energy of H_2 is 430.53 kJ mol^{-1}. If hydrogen is dissociated by illumination with radiation of wavelength 253.7 nm the fraction of the radiant energy which will be converted into kinetic energy is given by:

- (a) 100%
- (b) 8.76%
- (c) 2.22%
- (d) 1.22%

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25. Which of the following radial distribution graphs correspond to $\ell = 2$ for the H atom?