

Sample Questions (Unit-1 Atomic Structure)

Q1). Two particles A and B are in motion. If the wavelength associated with particle A is $5 \times 10^{-8} \text{ m}$, calculate the wavelength associated with particle B if its momentum is half of A.

Q2). Calculate the de Broglie wavelength of an electron that has been accelerated from rest through a potential difference of 1 kV.

[Hint: (i) $K.E = \frac{1}{2}mv^2 = eV$, (ii) $\lambda = \frac{h}{mv}$]
($1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$)

Q3). Calculate the de Broglie wavelength of an electron moving with 1% of the speed of light.

Q4). If an electron is moving with a velocity of 600 ms^{-1} which is accurate upto 0.005%, then calculate the uncertainty in its posⁿ ($m_e = 9.1 \times 10^{-31} \text{ kg}$)
[Hint: uncertainty in velocity, $= \frac{0.005}{100} \times 600 \text{ ms}^{-1}$]

Q5). An electron is confined in a 1-D box of length 1 \AA . Calculate its ground state energy. Is quantization of energy levels observable.
[Hint: Find E_1 , E_2 and ΔE]

Q6). Which of the following sets of quantum numbers are not permitted and why?

(i) $n=2, l=2, m=-1, s=+1/2$ (iii) $n=2, l=0, m=0, s=0$
(ii) $n=2, l=1, m=-1, s=-1/2$ (iv) $n=2, l=1, m=2, s=+1/2$



- Q7. Give the values of the quantum numbers for electron with the highest energy in sodium atom.
- Q8. A p-subshell which contains p_y , p_z and p_x orbitals contains only one electron. In which of these three orbitals should the electron be located? Justify your answer.
- Q9. The atomic mass of an element is double its atomic number. If there are 4 electrons in the 2p-orbital, then draw the model of the atom showing the arrangement of protons, neutrons and electrons. Give its valency and name the element.
- Q10. Arrange the following in increasing order of their radii:
ii. I, I^+, I^- ; (ii) C, N, Si, P ; (iii) $O^{2-}, N^{3-}, F^-, S^{2-}$
- Q11. Which from each set, predict which one has lower first ionization enthalpy?
(i) Be^- or Mg^{2+} ; (ii) N and O ; (iii) I or I^-
(iv). Mg, P, Ar ; (v). Na or Na^+
- Q12. Which one in the following pairs has higher electron gain enthalpy?
(i) O^-, S ; (ii). O, S^- ; (iii) O^-, S^- ; (iv). N^-, P
- Q13. On the basis of VSEPR theory, predict the shapes of
(i). CF_3 and (ii) BF_3 .
- Q14. Draw the MO diagrams for O_2, O_2^- and O_2^{2-} . Calculate their bond order and comment on their magnetic behavior, and their order of bond length.



Q15. Compare the bond angles in NH_3 and NF_3 based on VSEPR theory.

Q16. How many σ and π bonds are there in allyl cyanide



Q17. What is the difference between electron affinity and electronegativity?

Q18. What are the primary and secondary valencies in the following compounds:

(i) $\text{K}_4[\text{Fe}(\text{CN})_6]$ (ii) $[\text{Ni}^0(\text{CO})_4]$ (iii) $\text{Na}_2[\text{Mg}(\text{EDTA})]$

Q19. Calculate percentage of ionic character in CsF .
($\chi_{\text{Cs}} = 0.7$ & $\chi_{\text{F}} = 0.4$)

Q20. Draw the Born-Haber cycle for MgCl_2 and MgO .

Ans.