



## 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)  $KE = \frac{1}{2}mv^2 = eV$ , (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  $600 \text{ ms}^{-1}$  which is accurate upto 0.005%, then calculate the uncertainty in its pos<sup>n</sup> ( $m_e = 9.1 \times 10^{-31} \text{ kg}$ )  
[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  $1\text{\AA}$ . Calculate its ground state energy. Is quantization of energy levels observable.  
[Hint: Find  $E_1, E_2$  and  $\Delta E$ ]
- 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  $p_x$ ,  $p_y$  and  $p_z$  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:  
(i)  $I$ ,  $I^+$ ,  $I^-$ ; (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)  $ClF_3$  and (ii)  $BrF_5$ .
- 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.



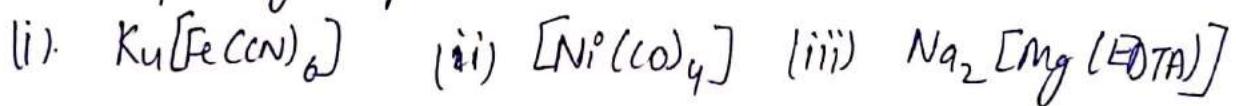
Q15. Compare the bond angles in  $\text{NH}_3$  and  $\text{NF}_3$  based on VSEPR theory.

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:



Q19. Calculate percentage of ionic character in GF.

$$(x_A = 0.7 \text{ & } x_F = 0.4)$$

Q20. Draw the Born-Haber cycle for  $\text{MgCl}_2$  and  $\text{MgO}$ .

~~Ans.~~