

Numerical Problem's

1. When a certain crystal was studied by Bragg's method using X-rays of wavelength 229 pm, first order X-ray reflection was observed at an angle of $23^{\circ}20'$:
 - (i) What is corresponding inter-planar spacing?
 - (ii) When another X-ray source was used, a reflection was observed at $15^{\circ}26'$. What was the wavelength of these X-rays?
2. How many independent Bravais lattices are there in a cubic crystal system? Name them. Using a diagram show 100 and 110 planes in a primitive cubic lattice.
3. Determine the interplanar spacing between the (221) planes of a cubic lattice of length 450 pm.
4. The distance between two consecutive (110) planes of a crystal is 1.678×10^{-10} m. What will be the glancing angle for an X-ray of wavelength 0.65×10^{-10} m incident on the plane for first order reflection?
5. Calculate the most probable velocity, average velocity and root mean square velocity of CO at 298K.
6. A certain gas has critical pressure of 45.6 atm, critical volume = $0.0987 \text{ dm}^3 \text{ mol}^{-1}$ and critical temperature is 190.6 K. Calculate van der Waals constants of this gas and radius of the gaseous molecule assuming it to be spherical.
7. Calculate the collision number, Z_1 and mean free path, λ of oxygen gas at 1 atm pressure and 27°C temperature. Given that Collision cross section is 0.27 nm^2 .
8. Calculate the critical temperature of a van der Waals gas for which P_c is 100 atm and b is $50 \text{ cm}^3 \text{ mol}^{-1}$.
9. Calculate the root mean square speed of CO_2 gas at 27°C .

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