Class-Test-3

This is a case of anion Frenkel defect.
Let V be the volume of AgCl in cm^3.
Only 1 Cl vacancy, so

$$[V_{Cl}^{\cdot}] = \frac{1}{V} \ cm^{-3}$$

But $[V_{Cl}^{\cdot}] = N\sqrt{K_F \alpha}$

$$K_F = \exp.\left[-\frac{(\Delta H^\circ - T\Delta S^\circ)}{RT}\right]$$

$$= \exp.\left[\frac{-140\times10^3}{8.314\times300} + 9.4\right]$$

$$\approx 5.074 \times 10^{-21}$$

$$\alpha = \frac{\text{No. of interstitial sites (per unit cell)}}{\text{No. of atomic sites (per unit cell)}}$$

$$= \frac{8+4}{4+4} = \frac{12}{8} = 1.5$$

(8 tetrahedral + 4 octahedral = 12)
(4 Ag + 4 Cl = 8)

$$N = \frac{8}{(0.5622\times10^{-7})^3} \ cm^{-3}$$

$$= 45.02 \times 10^{21} \ cm^{-3}$$

So $$\frac{1}{V} = 45.02 \times 10^{21}\sqrt{5.074\times10^{-21}\times1.5} \ cm^{-3}$$

$$= 45.02 \times 10^{21}\sqrt{0.7611\times10^{-22}} \ cm^{-3}$$

$$= 39.276 \times 10^{10} \text{ cm}^{-3}$$

$$\Rightarrow V \approx 0.02546 \times 10^{-10} \text{ cm}^3$$

$$= 2.546 \times 10^{-12} \text{ cm}^3$$

$$= \boxed{2.546 \ \mu\text{m}^3}$$