
PHYSICS OF MATERIALS



Physics School Autumn 2025

Series 9

14 November 2025

Exercise 1 Creep

- a) Show that when Frank-Read sources are activated, the density of dislocations

varies as $\Lambda = \left(\frac{\sigma}{\mu b} \right)^2$.

- b) Show that the climb velocity of dislocations is given by :

$$v_c = C_j \frac{\sigma b^2}{kT} D$$

where C_j is the jog concentration and D is the coefficient of diffusion.

- c) Show that in the case of dislocation climb, we have $\dot{\epsilon} \sim \sigma^3$.