

45. Since the frequency of an x-ray emission is proportional to  $(Z - 1)^2$ , where  $Z$  is the atomic number of the target atom, the ratio of the wavelength  $\lambda_{\text{Nb}}$  for the  $K_\alpha$  line of niobium to the wavelength  $\lambda_{\text{Ga}}$  for the  $K_\alpha$  line of gallium is given by  $\lambda_{\text{Nb}}/\lambda_{\text{Ga}} = (Z_{\text{Ga}} - 1)^2/(Z_{\text{Nb}} - 1)^2$ , where  $Z_{\text{Nb}}$  is the atomic number of niobium (41) and  $Z_{\text{Ga}}$  is the atomic number of gallium (31). Thus  $\lambda_{\text{Nb}}/\lambda_{\text{Ga}} = (30)^2/(40)^2 = 9/16$ .