

## PHAS0058 – Tutorial 2 - Perovskites

1. Assess the viability of a perovskite with the compositions below. Support your analysis with appropriate calculations.
  - a.  $\text{KFeO}_3$
  - b.  $\text{NaMnF}_3$
  - c.  $\text{MgTiO}_3$
  - d.  $\text{BaTiO}_3$
  - e.  $\text{LaAlO}_3$
2. Predict how substitution of MA in  $\text{MAPbI}_3$  perovskite with FA and Cs affects structure stability and optoelectronic properties of a perovskite.
3. A perovskite film has a charge carrier mobility of  $20 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$  and a carrier lifetime of 100 ns. Calculate the carrier diffusion length. How does this value compare to typical diffusion lengths in other semiconductors?
4. A perovskite solar cell has a defect density of  $10^{15} \text{ cm}^{-3}$ . Assuming that each defect acts as a recombination centre, estimate the carrier lifetime due to defect-assisted recombination. How does this compare to the radiative recombination lifetime in a high-quality perovskite?
5. A perovskite film has an absorption coefficient of  $10^5 \text{ cm}^{-1}$  at a particular wavelength. Calculate the film thickness required to absorb 90% of the incident light at that wavelength.