

NSE Materials Oral Exam Mandatory Question – February 2018

(1) Describe the geometric (e.g. degrees of freedom) and energetic characteristics of grain boundaries and dislocations. List the roles these defects play in a material's response to radiation.

(2) Explain the **asymmetry** between vacancies and interstitials in the context of a material's response to radiation. What happens when vacancies aggregate? What happens when interstitials aggregate? How would He gas interfere with these processes?

(3) It has been discovered that austenitic (FCC) stainless steels (Fe-18Cr-10Ni) become magnetic upon irradiation *without mechanical deformation*. Explain, starting with primary radiation damage and through the length scales, mechanistically how this process could occur.

(4) Design an experiment to recreate the damage done by 14MeV neutrons to fusion first wall materials using any type/combination of ions. Be specific - justify your choices of which type(s) of ions, materials/conditions to study, temperature, and any other variables you feel are critical to recreating neutron damage.