

# Quantum & Statistical Mechanics II

Test-0 : 16.10.17

*(This test would NOT be graded.)*

**Duration : 20 minutes**

1. The Planck length is a combination of the factors  $G$ ,  $\hbar$  and  $c$ . Find the appropriate combination.
2. How would the hydrogen atom energy levels be modified on the surface of a white dwarf ( $M = 1.4M_{\odot}$ ,  $R = 10\text{KM}$ ) compared to those on the surface of the Earth? Just give a qualitative idea.
3. Can you explain why, at the present time, the Jovian planets (Jupiter, Saturn etc.) are mostly gaseous whereas the terrestrial planets (Earth, Mars, Venus etc.) are mostly rocky, assuming they formed from the same primordial material?
4. Certain amount of water in a vessel is boiling at  $100^{\circ}\text{C}$  and undergoing a transition to steam. Which statistical formalism - micro-canonical, canonical, grand-canonical - would be most suitable for describing the physics of this system? Why?
5. The Bosons and the Fermions follow different statistical distributions. Do you know how this difference comes about?
6. Think of an astrophysical situation where you need to use statistical mechanics. Also mention whether you should use classical or quantum statistics.