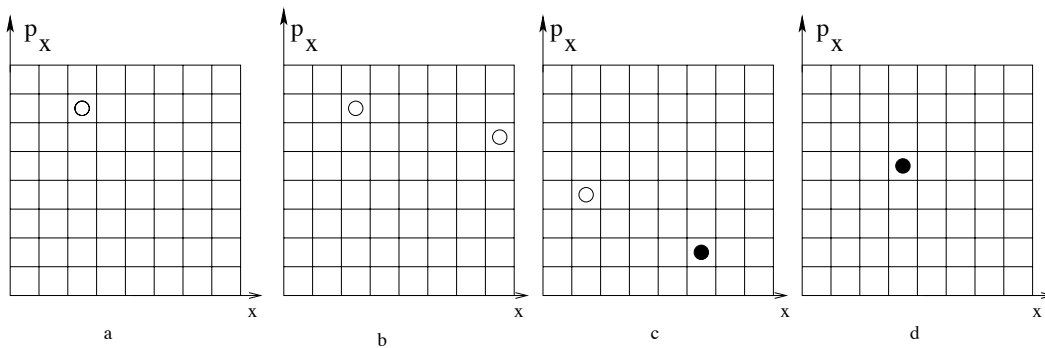


Statistical Physics (PHY 201)
IISER Bhopal
Practice Questions (12-10-2010)

1. A particle is stationary at a point $x = a$ where $a > 0$. Point out the ‘position’ of the particle in the phase space.
2. A particle is freely moving along the x-axis with a constant velocity v . If the particle is allowed to move within the range $-\infty < x < \infty$ draw the trajectory of the particle in the phase space.
3. Name the physical quantities you need to specify the *state* of a dynamical particle. How do you represent *state* of the particle in the phase space.
4. Explain in your own words how the conception of *state* for a single particle in the phase space can be generalized from a point to an infinitesimal volume. Can you suggest an (order of magnitude) estimate of the phase space volume using quantum mechanics? Can we do the same using classical mechanics?
5. Explain the conceptions of *distinguishability* and *indistinguishability* of particles in statistical physics.
6. i) Take a system of N particles. Write in your own words the conception of macrostate.
 ii) Take a single particle. How would you define its state in the phase space?
 iii) Consider phase space area as shown in the figure a), b), c) and d) below. The mesh area in each case shows the allowed region in the phase space for one or two particle system, as the case may be. The area of each cell in the mesh is $dx dp_x = h_0$. Assume that, the filled and unfilled circles are distinguishable particles, whereas two filled (or two unfilled) circles represent indistinguishable particles.
 A) Count total number of cells (C) in each case.
 B) Define the total number of *possible* microstates (call it W) in each case as the number of possible ways all particles in the system can be accommodated in the C cells. Find the total number of microstates in each case. (Assume that each cell can contain at the most one particle.)



7. What is the basic postulate of statistical physics?