What do you mean by the term plasma? What are microscopic and macroscopic properties of plasma?

In 1928 Irving Langmuir introduced the ionized gas (+ve column in a discharge tube) as plasma In 1956 spitzer also called plasma as the physics of fully ionized gases In 1959 Alfven described plasma in Greek means formation or configuration.

Now a days the word plasma hasbeen used to represent the fourth state of matter and is the most weide spread in the universe. It is the hottest ionized gasses state having high density so that there exist finite force of intraction between gas particles. The interaction forces are basically the columb electrostatic forces between charged particles of plasma obiviously plasma can be assumed to be mixture at three components :-

i) Free Electrons
ii) Positive Ions
iii) Neutral particles.

with a high density. When the temperature of a gas is raised above certain value, the K.E of particles increase to such an extent that the collision of two particles split then up into electrons and +vely charged ions. The intraction of two particles occurs under coloumbs electro-static forces. The organiszation of such a system, is entirely of a different nature from that existing in the solid, liquid & gases which are organized by short range introcrystalline or cohessive forces, so plasma is known as fourth state of matter hottest and ionized state of gases particles highly densed.

The ionosphere is a plasma envelope ~~Sout~~ surrounding the earth atmosphare. The so called great radiation belt (The van Allen radiation belt) outside the ionosphere contains plasma formation.

The sun and stars can be regarded as "Lamp of hot plasma".

** Macroscopic & microscopic properties of plasma :

The macroscopic properties mean the average properties of all the constituents. which may be observed easely the macroscopic properties of plasma are.

1. Ionized state
2. High temperature
3. High Pressure
4. Quasineutrality property

According to schottky plasma is quasineutral, i.e in each macroscopic volume element +ve & -ve space charge in that macroscopic volume element is zero i.e $n_i = n_e$
Any separation of charges when electrons shift w.r.to ions, gives rise to electron fields which act in the direction of restoring neutrality.
However, in small volume of plasma quasineutrality may be violeted. If the electric field generated by an excess of particles of one sign is too weak to have a significant effect in the motion of particles. but the space charge density adjust themselves so that the major part of plasma is shielded from the field.

For a given temperature and concentration the quasi neutrality is described by a characteristic linear parameter called the Debye length (λd). which indicates the shortest distance at which electrons moving at random in the plasma screen the coulumbs field of the particle i.e Plasma is defined by Langmuir as an ionised gas in which the Deby-length is small compared to the size of the volume occupied by the gas. The electric field is screened off at debye length.

Hence within Debye sphare a particle can interact with large no. of particles of both signs.

The microscopic properties :—

Mean the properties of each individual particle and the interactions among themselves clearly this is a trouble same task and can not be realized in particle. However we can study the behaviour of each charged particle of plasma in electric and magnetic field separately