I will discuss some basic theoretical issues about collisions, irreversibility and dissipation. Many results in this domain are considered as well established and not questionable. But one has to be careful that most of our knowledge is based on neutral gas close to thermodynamic equilibrium. I will show that some of these results deserve to be questioned when dealing with kinetic plasma physics, especially in the case of low collisionality.

I will discuss first the differences between collisions in gas dynamics and in plasmas. In neutral gas, from which our common intuition mainly comes, the hard sphere model can approximately apply and the adjective "binary", concerning these collisions, is justified. It has actually very little in common with the notion of collision in plasmas, where each particle is always submitted to the field of many others, and where the most remote ones, which are more numerous, have more influence on the trajectory (which is smooth) than the closest ones. The notion of collision is then closely related to the notion of “thermal noise” in the electric field. I will recall the main properties that this basic difference brings, how the classical calculation of the mean free path takes it into account, and the strong dependence with respect to the velocity that derives from it. I will also recall the different methods of the literature to account for this extended notion of “collisions” in kinetic modeling, why it is difficult, and how the usual approximations used to simplify the "collision operator" can make lost the main properties of the phenomenon.

I will then discuss the relation between the above concept of collisions and the concepts of irreversibility and dissipation. When trying to give general definitions, applicable for neutral gas and plasmas, close or not to thermal equilibrium, it appears that irreversibility and dissipation are not absolute concepts: they are associated with a given model, *i.e*. with a certain level of description of the medium. The same phenomenon can appear dissipative in one description and non dissipative in another one, an entropy function possibly quantifying the "incompleteness" of one model with respect to the other. Landau damping will serve as an example for this theoretical issue. In turbulence theory, the different parts of the spectrum are likely to be described by different levels of description (MHD, e-MHD, collisional). The above discussion may shed a different light on the debates concerning the "dissipative" or "non-dissipative" parts of the spectrum.