Indicate if each of the following statements is either true (T) or false (F). A correct response is awarded +1, an incorrect response is awarded −1/2, and no response is awarded 0 points. Ambiguous marks are counted as incorrect responses.

1. ___ An elastic collision means that both the momentum and energy of the system are conserved. An inelastic collision is one for which the system momentum is conserved, but the energy is not.

2. ___ As shown in the schematic, the inverse collision is defined as the inverse of a direct collision since it is defined to be a collision that replenishes the molecules in velocity class $c_1$.

3. ___ The force between molecules is weakly attractive at close distances and strongly repulsive at larger distances. The inverse power law model (also called the point center of repulsion model) only models the repulsive part.

4. ___ For a binary collision, the center of mass of the system is deflected through an angle $\chi$, where $\chi$ is a function of two impact parameters, the distance of closest approach $b$ and and the angle $\epsilon$ between the collision plane and some reference plane in addition to the translational velocities.

5. ___ For the inverse power law model, the total collision cross section $\sigma_T$ is infinite. A finite cut-off based on either the miss distance $b$ or the deflection angle $\chi$ is required both practically and theoretically.

6. ___ For a dilute gas, the viscosity increases with temperature. This means that the effective cross section of real molecules increases as the relative speed $c_r$ and relative translational energy $E_r = \frac{1}{2} m c_r^2$ increase.

7. ___ The variable hard sphere (VHS) model accounts for the fact that the effective collision cross section is a function of the relative speed of the colliding molecules, but the deflection angle $\chi$ is the same as for the hard sphere model. The variable soft sphere (VSS) model accounts for the relative speed dependence of both the effective cross section and the deflection angle $\chi$.

8. ___ The Lennard-Jones potential is an example of an attractive-repulsive model.

9. ___ A model that reproduces the overall effects in a gas flow of some physical feature of real molecules, but does not explicitly incorporate that feature is said to be a phenomenological model. The use of the VHS model, rather than one of the models with a more realistic scattering law, to produce the required temperature dependence of the transport properties is an example of phenomenological modeling.

10. Briefly, why does Bird say that the total number of molecules within a given flow field increase as the density decreases?