Conceptual Questions Sections 4.1-4.6

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1. Given a gas or fluid, under which circumstances is it appropriate to model the dynamics of said fluid or gas with ideal hydrodynamics? And under which conditions is it necessary to use viscous corrections? With $\frac{1}{\tau_{coll}}$ defined as the collision rate of the atoms in the gas and $\frac{1}{\tau_{exp}}$ as the expansion rate. Label ideal case(s) with an "*I*", viscous case(s) with a "*V*", and leave the others blank.

   (a) $\frac{1}{\tau_{coll}}$ much greater than $\frac{1}{\tau_{exp}}$ _____

   (b) $\frac{1}{\tau_{coll}}$ greater than $\frac{1}{\tau_{exp}}$ _____

   (c) $\frac{1}{\tau_{coll}}$ equals $\frac{1}{\tau_{exp}}$ _____

   (d) $\frac{1}{\tau_{coll}}$ less than $\frac{1}{\tau_{exp}}$ _____

   (e) $\frac{1}{\tau_{coll}}$ much less than $\frac{1}{\tau_{exp}}$ _____

2. Assume there is a fixed number of particles of an ideal gas. Based on the following PV diagram, describe what is happening to the system in each step and list the overall efficiency. Also assume $P_b = 2P_a$ and $V_b = 2V_a$.