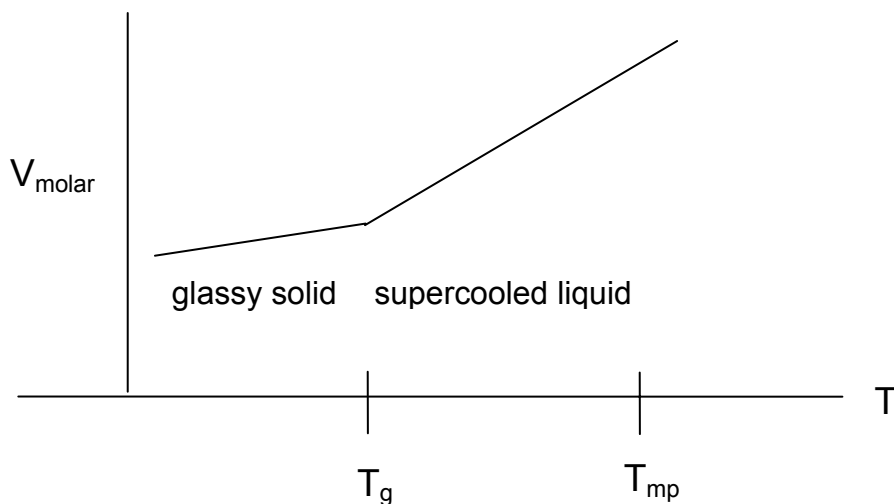


Homework Quiz #8A

solution outline

- (a) Sketch the variation of molar volume with temperature (V_{molar} vs T) for pure silica (SiO_2) cooled at a rate sufficient to promote glass formation. Label the normal melting point, T_{mp} , and the glass transition temperature, T_{g} .



- (b) By referring to what is happening at the molecular level explain how the glass transition temperature changes upon the addition of magnesia (MgO) to a silicate melt. Assume that the comparison is made at a fixed cooling rate.

MgO dissociates to form Mg^{2+} and O^{2-} . The O^{2-} attacks bridging oxygen ($-\text{O}-$) in the silicate network to produce terminal oxygens ($^-\text{O}-$) according to



This shortens the chains, reduces viscosity, and facilitates molecular rearrangement. Thus, for a given cooling rate, the glass transition temperature of the MgO -modified melt will be lower than that of pure silica.