

## "Amorphous Materials"

Class # \_\_\_\_\_ Name \_\_\_\_\_

### 1. Fill in the blank. (8 points)

(a) When a liquid is cooled, the loss of ( ) energy leads to an ( ) of the constituent elements, which then crystallize at the ( ) temperature. However, if cooled fast enough through ( ), some glass-forming materials are capable of sustaining a ( ) liquid state and, upon further cooling, of freezing into a disordered glass state. When the time need for the ( ) of the local atomic structure reaches approximately 100 seconds, the system becomes "( )" for any practical purpose, and this defines the ( ). Approaching this transition from the liquid side, different systems show qualitatively different temperature dependencies of the ( ), and accordingly they have been classified by introducing the concept of "( )". In order to ( ) the fragility, fragility parameter was introduced, which measure the ( ) of the slope of the viscosity curve at ( ). Generally, ( ) liquids are associated with  $m < 30$  and ( ) liquids are associated with  $m > 100$ .

(b) Kauzmann showed that the ( ) of a liquid ( ) rapidly on cooling toward the ( ) glass transition temperature and ( ) to unreasonable values at lower temperature. The temperature where the extrapolated statement of liquid entropy meets the ( ) is now called the ( ). ( ), with Planck's statement of the third law, shows that the entropy of a liquid cannot be ( ) than the entropy of a glass with the same ( ).

crystal entropy/ glass entropy/ more/ less/ thermodynamics/ kinetic/ entropy/ enthalpy/ heat capacity/ decreases/ increases/ extend/ extrapolates/ randomness/ ordering/ stable/ metastable/ unstable/ rearrangement/ stabilization/ amorphous/ solid/ viscosity/ fragility/ brittleness/ quantify/ qualify/ saturation/ extrapolation/ steepness/  $T_K$  /  $T_g$  /  $T_x$  /  $T_m$  / strong/ fragile/ vitrification/ glass-forming ability

### 2. Explain controversies in amorphous solids at Kauzmann temperature. (3 points)

**\* Suggestion for class or request for personal conversation:**