Part I: True/False
Indicate in the space provided whether a statement is true (T) or false (F).

1. ______ Elastic deformation is characterized by temporary and slight shifts of atoms from their equilibrium position.
2. ______ An edge dislocation is characterized by its burgers vector, which is perpendicular to the dislocation line vector.
3. ______ CeCl is an ionic crystal that exhibit directionality in its bonds.
4. ______ Van der Waals force, observed in supercooled inert gases, is an example of primary bonding.
5. ______ Allotropy or polymorphism is a property exhibited by many elements that they crystallize in different crystal structures at different ranges of temperature and pressure.

Part II: Multiple Choice
Circle the correct answer(s) for each question. There may be more than one correct answer for each question.

6. Charpy testing is conducted to determine:
   a. the yield and tensile strength of a specimen
   b. the energy absorbed at bending fracture of a specimen
   c. the resistance of a material to dynamic loading
   d. the resistance of a material to loading at cryogenic temperatures

7. The coordination number of:
   a. a BCC crystal structure is 8
   b. an FCC crystal structure is 12
   c. an HCP crystal structure is 6
   d. all of the above

8. The number of atoms per unit cell of:
   a. an HCP crystal structure is 3
   b. a BCC crystal structure is 4
   c. an FCC crystal structure is 4
9. Dislocations glide on slip planes characterized by:
   a. planes denoted by high miller indices
   b. close-packed planes
   c. large number of vacancies on the glide plane
   d. large number of solute atoms on the glide plane

Part III. Short Problems
Show all work in the space provided!

10. a. Determine the tensile stress that must be applied to the \(\{1\bar{1}0\}\) axis of a high purity copper single crystal to cause slip on the \((1\bar{1}T)\{0\bar{T}1\}\) system. The resolved shear stress for the crystal is 0.85 MPa.

   b. Draw the loading axis, slip plane and slip direction on the following unit cube.
11. Nickel has a lattice spacing of 0.354 nm, calculate the interplanar spacing for the \( \{111\} \) planes. Is it greater than the interplanar spacing for the \( \{123\} \) planes which is approximately 0.1 nm? Show work!

12. For the Cu-Ag equilibrium phase diagram below, \( L \) represents the liquid phase, \( \alpha \) and \( \beta \) are the two solid phases present in the system.
   a. Identify the invariant reaction, the invariant temperature, and the corresponding composition. Indicate the reaction on the phase diagram. (4 points)
   
   ![Phase Diagram](image)

   b. Apply the Lever Rule to calculate the percent of each phase present at a temperature slightly below the invariant temperature for an alloy that contains 50 wt.pct. Ag. (6 points)
13. Using the load-deformation curve shown below, and assuming that a cylindrical specimen of radius “R” was used in the determination of this graph, illustrate how you would estimate: (3 points)
   a. Young’s Modulus
   b. Yield strength,
   c. Ultimate tensile strength
Provide simple mathematical expressions for all three. Mark on the diagram the loads used for your equations.

d. If the tensile load is released at point B, show on the load-deformation curve the elastic and plastic components of the deformation. (3 points)