1. Crystalline solids possess rigid and long-ranged order; its atoms, molecules, or ions occupy specific positions. Amorphous solids lack a regular 3-D arrangement of atoms.

2. a) Ionic crystals have two important characteristics: 1) composed of charged species (ions) 2) cations and anions are generally quite different in size. EX: KI, NaCl

    Force of attraction = electrostatic attraction

    b) Covalent crystals are held together in extensive 3-D network of covalent bonds. EX: C (graphite), Si (diamond), SiO₂

    c) In a molecular crystal, molecules are held together by IMFs. EX: SO₂, H₂O(s), I₂, P₄, S₈

    d) Metallic crystals are the simplest of all the crystals b/c all lattice points are occupied by an atom of the same metal. Positive cations surrounded by the "sea of e⁻" (delocalized or free to move valence e⁻)

    EX: Mg, Na, Ca

3. Good conductors of heat and electricity b/c of the mobility of the delocalized e⁻. Nonmetals. As temp rises, molecular vibrations increase, decreasing the mean free path of molecules, obstructing the flow of free e⁻
4. a) ionic  b) molecular  c) covalent

5. molecular = Se, F, HBr, CO₂, P₄O₁₀, SiH₄
   covalent = Si, C

6. a) molecular  b) covalent  c) molecular  d) ionic  e) metallic  f) covalent  g) ionic  h) metallic

7. In diamond, each C is covalently bonded to 4 other C atoms. Because these bonds are strong and uniform, diamond is a very hard substance. In graphite, the C atoms in each layer are connected by 3 bonds (strong bonds) but the layers are bound by weak dispersion forces. As a result, graphite can be flaked off in layers and isn't hard. The unbonded p orbital (from sp² hybridization) allows graphite to conduct electricity throughout.

8. Crystalline SiO₂. Its regular structure results in a more efficient packing.

9. SiO₂ has an extensive 3-D structure where CO₂ exists as discrete molecules, held by weaker IMF's. Takes much more energy to break the strong network covalent bonds of SiO₂ than the dispersion forces holding CO₂ together. Thus, SiO₂ has a much higher b.p.