Semi-conductors:
1) How many atoms does a silicon atom bond to?________________________
2) What does the term, “n-type,” tell you about the semi-conductor?________________________
3) Why does doping with antimony create an n-type semi-conductor?________________________
4) What does the term, “p-type,” tell you about the semi-conductor?________________________
5) Why does doping with gallium create a p-type semi-conductor?________________________
6) Which can be added to silicon to enhance its properties as a semiconductor?
   a. Pb  b. Ca  c. Zn  d. As
7) Which type of alloy and which type of doping would be present in the situation described in previous question?
   a. substitutional alloy; N-type doping  c. interstitial alloy; N-type doping
   b. substitutional alloy; P-type doping  d. interstitial alloy; P-type doping

Polymers
8) Hair fibers which consist of a fibrous protein called keratin have long chains with various attractions between the chains.
   a. Which type(s) of attraction shown in this hair fiber would be the strongest?________________________
   b. If you were to get a perm to make your hair curly, first chemicals would be added, then your hair would be wrapped on curlers and then a different set of chemicals would be applied. What do you think these two sets of chemicals do?

Alloys: Use the chart of atomic radii to answer these questions.
9) Sterling silver consists of 92% silver and 8% Copper. Is this an interstitial alloy or a substitutional alloy?________________________
   Why?
10) Cast iron consists of 98% iron and 2% carbon. Is this an interstitial alloy or a substitutional alloy?________________________ Why?
11) Which should be stronger—cast iron or pure iron?________________________ Why?
Review of Properties of Solids

12) Experimental data provide the basis for interpreting differences in properties of substances. *(AP 1991)*

<table>
<thead>
<tr>
<th>Compound</th>
<th>Melting Point (°C)</th>
<th>Electrical Conductivity of Molten State</th>
</tr>
</thead>
<tbody>
<tr>
<td>BeCl₂</td>
<td>405</td>
<td>0.086</td>
</tr>
<tr>
<td>MgCl₂</td>
<td>714</td>
<td>&gt; 20</td>
</tr>
<tr>
<td>SiCl₄</td>
<td>−70</td>
<td>0</td>
</tr>
<tr>
<td>MgF₂</td>
<td>1261</td>
<td>&gt; 20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substance</th>
<th>Bond Length (angstroms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F₂</td>
<td>1.42</td>
</tr>
<tr>
<td>Br₂</td>
<td>2.28</td>
</tr>
<tr>
<td>N₂</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Account for the differences in properties given in Tables 1 and 2 above in terms of the differences in structure and bonding in each of the following pairs.

(a) MgCl₂ and SiCl₄

(b) MgCl₂ and MgF₂

(c) F₂ and Br₂

(d) F₂ and N₂

13) Explain each of the following in terms of atomic and molecular structures and/or attractions between particles. *(Taken from AP 1992 and 2004)*

(a) Solid K conducts an electric current, whereas solid KNO₃ does not.

(b) The normal boiling point of CCl₄ is 77°C, whereas that of CBr₄ is 190°C.

(c) Iodine has a greater boiling point than bromine even though the bond energy in bromine is greater than the bond energy in iodine.

(d) The melting point of NaF is 993°C, whereas the melting point of CsCl is 645°C.