GROUP 4: THE TREND FROM NON-METAL TO METAL

1. a) Carbon (as diamond), silicon, germanium and grey tin (alpha-tin) all share the same giant covalent structure. Draw a simple diagram to show a part of this structure.

   b) Why would you expect the melting and boiling points of carbon (diamond), silicon , germanium and grey tin to fall as you go down the group?

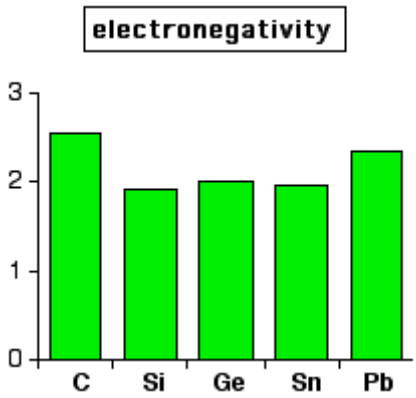
   c) Grey tin has a more common allotrope know as white tin (beta-tin). Briefly describe the bonding in white tin and lead.

   d) How would you expect the brittleness of the elements to vary as you go from carbon to lead? Explain your answer.

   e) In electrical terms, an element might be a non-conductor, a semiconductor or a conductor of electricity. Which categories do the following fit into: carbon (as diamond), silicon, germanium, tin (both allotropes – grey and white tin), and lead?

   f) Briefly explain the electrical conductivity of graphite.

2. The electronegativities of the elements change as you go down the group as shown in the chart (source of data: www.webelements.com).



   a) How would you *expect* the electronegativity to change as you go down a typical group of the Periodic Table? Explain your answer.

   b) In terms of the change in non-metal / metal behaviour as you go down the group, why is this chart surprising?

   c) What happens to ionisation energies as you go down most groups of the periodic table? Explain your answer.

   d) Typical metal behaviour is the formation of a positive ion. Explain why carbon doesn't form a C^{4+} ion (or, in fact, any positive ions).