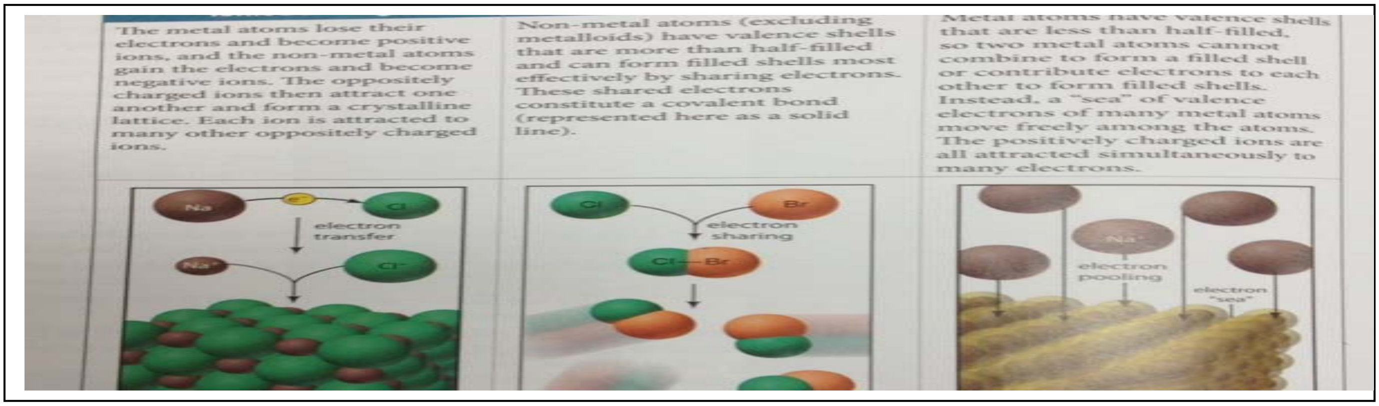
Name: __**ANSWERS**____ Date: ______________________________

# BCI SCIENCE
# SCH 4U

**Bonding Reading Assignment**

Read pages 208-220, 224-225

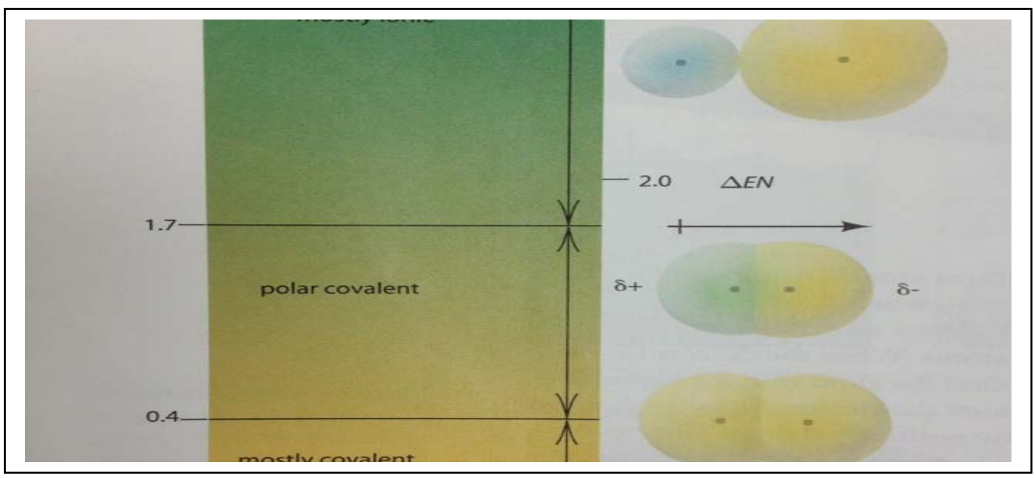
1. Copy table 4.1: The Three Types of Chemical Bonding.




2. Define electronegativity.

**- the relative ability of the atoms of the element to attract shared $e^-$ in a chemical bond.**

3. Copy figure 4.3.




4. Summarize metallic bonding.

**- the electrostatic attraction between postive metal ions and the delocalized electrons surrounding them. This electron sea-model shows a metal as a relatively ordered array of cations in a "sea" of freely moving electrons. These forces are very strong which is why metals have very high melting points. The more charge an ion has will increase its melting point as the electrostatic attraction will be higher.**

**Properties of metals**

5. State and explain the trends in melting points for metals.

**- Group 1: as the atomic # (Z) ↑, melting point ↓ b/c atoms in each period have one more $e^-$ shell, thus free $e^-$ are farther from the nucleus and therefore, the strength of the attractive forces ↓**
**- Across period through first 1-7 groups: as atomic number ↑, melting point ↑ b/c there is greater $Z_{eff}$ for valence $e^-$ with higher positive ions with greater # of valence $e^-$**
**- Group 12: d sublevel is full and so $e^-$ cannot freely move away and so fewer $e^-$ are delocalized and thus not as many available for $e^-$ sea model so melting point is ↓**

and the strength of the bonding or attractive forces. ... shows the melting points of many of the metals.

Melting Points of Metals (°C)

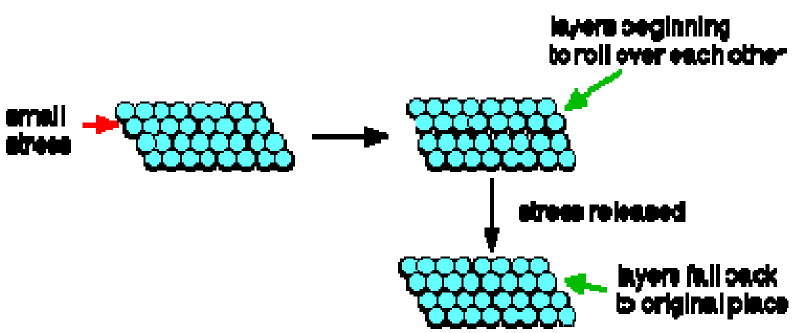
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| Li 180.5 | Be 128.7 | | | | | | | | | |
| Na 97.794 | Mg 650 | | | | | | | | | |
| K 63.38 | Ca 842 | Sc 1541 | Ti 1668 | V 1910 | Cr 1907 | Mn 1246 | Fe 1538 | Co 1495 | Ni 1455 | Cu 1084.6 |
| Rb 39.30 | Sr 777 | Y 1522 | Zr 1854.7 | Nb 2477 | Mo 2623 | Tc 2157 | Ru 2334 | Rh 1964 | Pd 1554.8 | Ag 9612.2 |
| Cs 28.44 | Ba 727 | | | | W 3422 | | Os 3033 | | Pt 1768.2 | Au 1064.2 |

Analysis of **Figure 4.5** reveals some trends involving melting point. For ex...

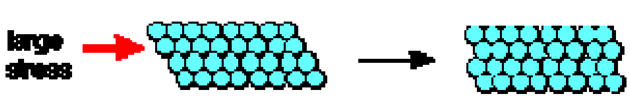
6. Explain how the electron-sea model for metallic bonding allows metals to be malleable and ductile.

**- Metals are described as *malleable* (can be beaten into sheets) and *ductile* (can be pulled out into wires). This is because of the ability of the atoms to roll over each other into new positions without breaking the metallic bond.**

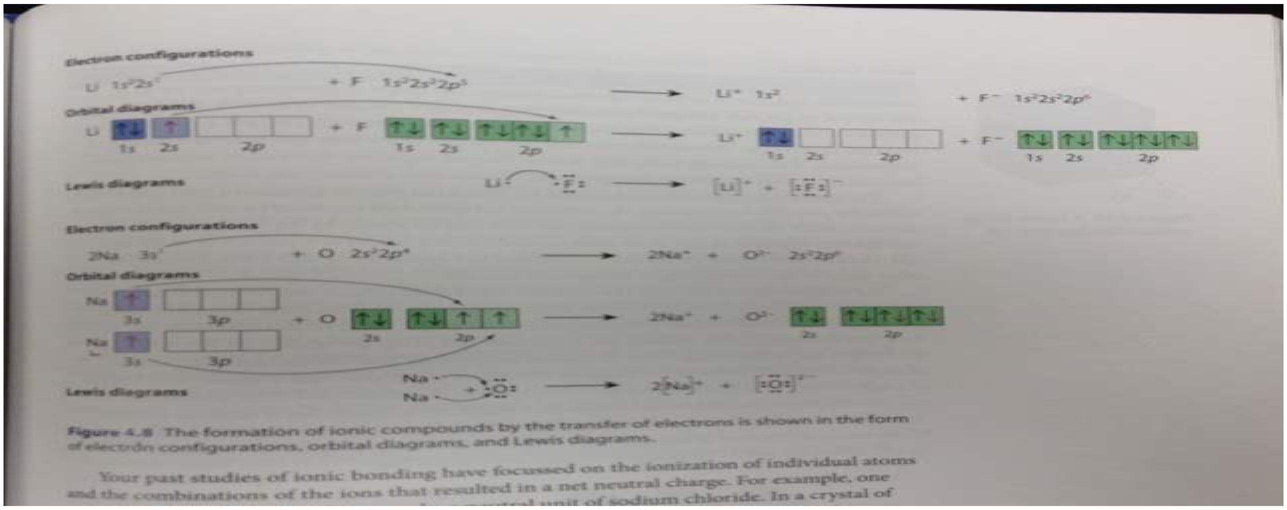
**If a small stress is put onto the metal, the layers of atoms will start to roll over each other. If the stress is released again, they will fall back to their original positions. Under these circumstances, the metal is said to be *elastic.***




**If a larger stress is put on, the atoms roll over each other into a new position, and the metal is permanently changed.**



7. Copy figure 4.8




8. Define an allotrope.

**- Allotropes are different forms of the same element, where the atoms combine in different ways, so at the same temperature and pressure they can exist in different forms. The most striking allotropes are of carbon in the forms of diamond and graphite.**

9. Explain the differences between graphite and diamond.

**GRAPHITE**

**- carbon atoms in graphite have three short bonds with other carbon atoms forming an array of layers.**

**- this bond can be easily broken and re-formed with another atom, allowing layers to slide past each other.**

**- as you push a graphite pencil across paper, the layers slide off the pencil and onto the paper.**

**DIAMOND**

**- each carbon atom is perfectly tetrahedral. Carbon-carbon bonds have their greatest strength in this formation.**

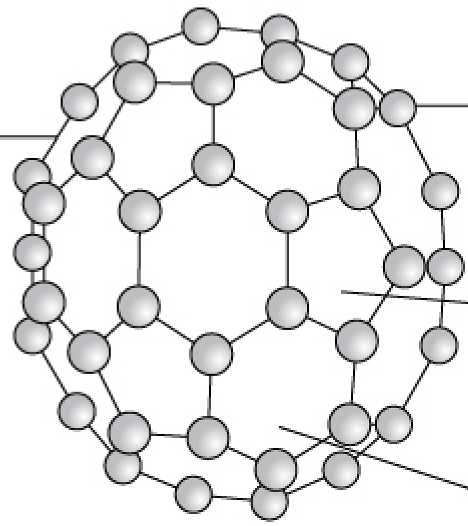
**- 3-dimensional array makes diamond the hardest naturally occurring substance**

**- 3-D array creates many planes of carbon atoms within diamonds, which reflect light making them sparkle.**

10. Describe a "buckyball" and nanotubes.

**BUCKYBALL**

**- Buckyballs are composed of carbon atoms linked to three other carbon atoms by covalent bonds. However, the carbon atoms are connected in the same pattern of hexagons and pentagons you find on a soccer ball, giving a buckyball the spherical structure as shown in the following figure. It resembles a hollow soccer ball the size of a nanometer.**




**The most common buckyball contains 60 carbon atoms and is sometimes called C60.Other sizes of buckyballs range from those containing 20 carbon atoms to those containing more than 100 carbon atoms.**

**NANOTUBES**

**- Nanotubes look like a powder or black soot, but they're actually rolled-up sheets of graphene that form hollow strands with walls that are only one atom thick. Nanotubes, which are sometimes called *buckytubes*, were developed from the Fullerene,**
**- Nanotubes, which are grown in a laboratory, are strong and exhibit many thermal and electrical properties that are desirable to chip makers. Carbon nanotubes have the potential to be used as semiconductors, for example, potentially replacing silicon in a wide variety of computing devices.**

11. Define a network solid.

**- A network solid or covalent network solid is a chemical compound in which the atoms are bonded by covalent bonds in a continuous network. In a network solid there are no individual molecules and the entire crystal may be considered a macromolecule.**
**- examples include: diamond, quartz = $SiO_2$, graphite**

12. Answer review questions p. 227 # 1, 2, 7, 8, 11