

## Chapter 2: Atomic Structure – Suggested Problem Set

2-1. What is meant by the term *composition* of a material?

2-2. What is meant by the term *structure* of a material?

2-3. What are the different levels of structure of a material?

2-6 (a) Aluminum foil used for storing food weighs about 0.3 g per square centimeter.

How many atoms of aluminum are contained in one square centimeter of the foil?

(b) Using the densities and atomic weights given in [Appendix A](#), calculate and compare the number of atoms per cubic centimeter in

(i) lead and

(ii) lithium.

(b) How many moles of nickel are required?

2-9 Define *electronegativity*.

2-10 Write the electronic configuration of the following elements:

(a) tungsten,

(b) cobalt,

(c) zirconium,

(d) uranium, and

(e) aluminum.

**2-16** Bonding in the intermetallic compound  $\text{Ni}_3\text{Al}$  is predominantly metallic. Explain why there will be little, if any, ionic bonding component. The electronegativity of nickel is about 1.9 .

**2-8** In order to plate a steel part having a surface area of  $1250 \text{ cm}^2$  with a  $0.005 \text{ cm}$ -thick layer of nickel:

(a) How many atoms of nickel are required?

**2-19** Compare and contrast metallic and covalent primary bonds in terms of

(a) the nature of the bond,

(b) the valence of the atoms involved, and

(c) the ductility of the materials bonded in these ways.

**2-20** Differentiate the three principle bonding mechanisms in solids. What is van der Waal's bonding? What are the relative binding energies of the different mechanisms?

**2-21** What type of bonding does KCl have? Fully explain your reasoning by referring to the electronic structure and electronic properties of each element.

**2-22** The compound aluminum phosphide (AlP) is a compound semiconductor having mixed ionic and covalent bonding. Calculate the fraction of the bonding that is ionic.

**2-23** Calculate the fraction of bonding of MgO that is ionic.

**2-24** Calculate the fraction of bonding that is covalent for silica ( $\text{SiO}_2$ ) .

**2-25** Calculate the fraction of bonding that is ionic in nature for zirconia ( $\text{ZrO}_2$ ) .

2-41 Would you expect MgO or magnesium to have the higher modulus of elasticity? Explain.

2-42 Would you expect Al<sub>2</sub>O<sub>3</sub> or aluminum to have the higher coefficient of thermal expansion? Explain.

2-47. An aluminum-alloy bar of length 2 meters at room temperature (300 K) is exposed to a temperature of 100°C ( $\alpha = 25 \times 10^{-6} \text{ K}^{-1}$ ). What will be the length of this bar at 100°C?

2-48. Name at least four allotropes of carbon. Why is graphite electrically conductive while diamond is not if both are pure forms of carbon?