**Fundamentals of Materials Science Homework 4**

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Checklist before you start this homework. (The boxes are clickable.)

🗹I have read the atomic structure related portion (p.18-26) of the chapter.

I have worked on the Example Problems and Concept Check questions.

**Homework Problems:**

1. **Calculate the number of atoms contained in a cylinder 1 m in diameter by 1 m deep of (a) magnesium and (b) lead.**

**Solution:**

Density: Mg 1.74g/cm3 Pb 11.34g/cm3

Amu: Mg 24.31amu Pb 207.21amu

 

 

1. **Using the density of MgO calculated in Problem 2 of Homework 3, calculate the mass of an MgO refractory (temperature-resistant) brick with dimensions 50 mm X 100 mm X 200 mm.**

**Solution:**

ρ=3.6g/cm3



1. **Calculate the dimensions of (a) a cube containing 1 mol of copper and (b) a cube containing 1 mol of lead.**

**Solution:**

Density: Cu 8.92g/cm3 Pb 11.34g/cm3

Amu: Cu 63.54amu Pb 207.21amu

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1. **Silicon has three naturally-occurring isotopes: 92.23% of 28Si, with an atomic weight of 27.9769 amu, 4.68% of 29Si, with an atomic weight of 28.9765 amu, 3.09% of 30Si, with an atomic weight of 29.9738 amu. On the basis of these data, confirm that the average atomic weight of Si is 28.0854 amu.**

**Solution:**

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1. **Allowed values for quantum numbers of electrons are as follows:**

***n*=1, 2, 3, …**

***l*=0, 1, 2, 3, …, n-1**

***ml*=0,±1,±2,±3, … ,±l**

***ms*=**

**The relationship between n and the shell designation are noted in Table 2.1. Relative to the subshells,**

***l*=0 corresponds to an *s* subshell**

***l*=1 corresponds to a *p* subshell**

***l*=2 corresponds to a *d* subshell**

***l*=3 corresponds to an *f* subshell**

**For the *K* shell, the four quantum numbers for each of the two electrons in the 1s state, in the order of *nlmlms*, are 100() and 100(-).**

**Write the four quantum numbers for all of the electrons in the *L* and *M* shells, and note which correspond to the *s*, *p*, and *d* subshells.**

**Solution:**

**L shell :**

2s subshell: 

2p subshell: 

**M shell:**

3s subshell:

3p subshell:

3d subshell:



1. **Give the electron configurations for the subshells of the following ions: Fe2+, Fe3+, Cu+, Ba2+, Br-, and S2-.**

**Solution:**

Fe2+——1s²2s²2p63s²3p63d6

Fe3+——1s²2s²2p63s²3p63d5

Cu+ ——1s²2s²2p63s²3p63d10

Ba2+——1s²2s²2p63s²3p63d104s²4p64d105s²5p6

Br- ——1s²2s²2p63s²3p63d104s²4p6

S2- ——1s²2s²2p63s²3p6