WORKSHEET-SOLIDS

Set A:

1. Indicate the **type of crystalline** solid each of the following would form upon crystallization. Tell what **type of particles** are located at the lattice points and the **types of attractive forces** that exist between the particles.

	Type of crystalline solid	Type of particles at lattice points	Attractive forces between lattice points
SiC			
HBr			
Cu			
Br_2			
$NH4ClO_3$			

2. a. Draw Born-Haber cycle for the formation of strontium chloride

b.Use the following data to calculate the enthalpy of formation of strontium chloride. You must write all thermochemical equations for the steps of the cycle.
The enthalpy of sublimation of strontium = + 164 kj/mole
First ionization energy for strontium = + 549 kj/mole
Second ionization energy for strontium = + 1064 kj/mole
The enthalpy of dissociation of chlorine, Cl_2 = + 243 kj/mole
The electron affinity of chlorine, Cl = - 349 kj/mole
Lattice energy of strontium chloride = - 2150 kj/mole Answer= - 828 kj

3. Crystalline aluminum has cubic structure. The unit edge length is 4.440×10^{-8}. The density of solid aluminum is 4.096 g/cm^3. Calculate the number of aluminum atoms in one unit cell.

Answer=8.00 atoms/unit cell

4. Name the energy, Δ H, in each of the following processes

a. $2\ Cs^+ (g) + O^{2-} (g) \longrightarrow Cs_2O (s)$ a) _____

b. $O (g) + 1\ e^- \longrightarrow O^- (g)$ b) _____

c. $2\ Cs (s) + 1/2\ O_2 (g) \longrightarrow Cs_2O (s)$ c) _____

Answer: a) Lattice energy b) Electron affinity c) Heat of formation

5. The volume of a manganese **atom** is 9.21×10^{-24} cm^3. Manganese crystallizes in a face-centered cubic system. What is the density of manganese? Answer: 7.34 g/cm^3

Setup:

Set B:

1. a. Draw Born-Haber cycle for the formation of calcium oxide.

b. Use the following data to calculate the lattice energy of calcium oxide. You must write all thermochemical equations for the steps of the cycle.
The enthalpy of formation of calcium oxide (solid) = - 636 kj/mole
The enthalpy of sublimation of calcium= + 192 kj/mole
First ionization energy of Ca = + 590 kj/mole
Second ionization energy of Ca= +1145 kj/mole
The enthalpy of dissociation of O_2 (g) = + 494 kj/mole
First electron affinity of O (g) = - 141 kj/mole
Second electron affinity of O (g) = + 845 kj/mole Answer : -3514 kj

2. $CaCl_2$ (s) crystallizes in a cubic lattice. The unit cell has an edge of 4.77×10^{-8} cm. The density of $CaCl_2$ (s) is 6.80 g/cm^3. How many formula units of $CaCl_2$ must there be per unit cell?

Answer: 4 formula units

3. A metal crystallizes in a cubic closest packing structure and its density is 9.25 g/cm^3. What is the molar mass of the metal, if the volume of its **atom** is 8.23×10^{-24} cm^3?

Answer: 61.8 g/mole

4. a. Name the four types of crystalline solids.

i) _____ ii) _____ iii) _____ iv) _____

b. Indicate the **type of crystalline solid** each of the following would form upon solidification. Tell what **type of particles** are located at the lattice points and the **types of attractive forces** that exist between the particles.

	Type of crystalline solid	Type of particles at lattice points	Attractive forces
S_8			
HF			
potassium permanganate			
Ni			
Si			

Set C :

1. a. Draw Born-Haber cycle for the formation of cesium oxide .

b. Use the following data to calculate the lattice energy of cesium oxide. You must write all thermochemical equations for the steps of the cycle.
Enthalpy of formation of cesium oxide = - 233 kj/mole
Enthalpy of sublimation of Cs = + 78 kj/mole
First ionization energy of Cs = + 375 kj/mole
Enthalpy of dissociation of O_2 (g) = + 494 kj/mole of O_2 molecules
First electron affinity of O = - 141 kj/mole of O atoms
Second electron affinity of O = + 845 kj/mole of O^- ions

Answer : - 2090 kj

2. Nickel has a cubic unit cell. The edge of the unit cell is 3.524×10^{-8} cm. The density of metallic nickel is 8.91 g/cm^3.

a) How many nickel atoms are in the unit cell?

b) Calculate the radius of a nickel atom based on your result of question (a) above.

Answer: a) 4 atoms

b) 1.24×10^{-8} cm

3. The volume of a metal **atom** is 7.24×10^{-24} cm^3. The metal crystallizes in a cubic closest packing structure. The density of the metal is 8.77 g/cm^3. What is the molar mass of the metal?

Answer : 51.5 g/mole

4. Indicate the **type of crystalline solid** each of the following would form upon solidification. Tell what **type of particles** are located at the lattice points and the **types of attractive forces** that exist between the particles.

	Type of crystalline solid	Type of particle(s) at lattice point	Attractive forces between lattice points
NH_4HSO_4			
SiO_2			
Si			
HCl			
Al			
I_2			

5. Manganese crystallizes in a face-centered cubic system. The radius of the manganese **atom** is 1.30×10^{-8} cm. What is the density of manganese? Answer: 7.32 g/cm3

6. Associate each of the solids: CsI, SiO_2, Ni, and $SiCl_3H$ with one of the following sets of properties:

a) A very hard solid subliming at 2900 °C. _____

b) A yellowish solid having a melting point of 40 °C and is a nonconductor of electricity in the molten state. _____

c) A lustrous solid melting at about 1600 °C . Both the solid and the liquid are electrically conductors. _____

d) A white solid melting at about 700 °C . The liquid is electrically conducting although the solid is not. _____