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2. (20 points.)

(a) Write the chemical equations corresponding to the Born-Haber cycle for the formation of $\text{Cu}_2\text{O}(s)$ from $\text{Cu}(s)$ and $\text{O}_2(g)$.

(b) Use the following information to calculate the lattice energy of the Cu_2O crystal:

First Ionization energy of Cu: 745.5 kJ/mol	Heat of formation of Cu_2O : -168.6 kJ/mol
First Electron Affinity of O: -141 kJ/mol	Second Electron Affinity of O: 844 kJ/mol
Enthalpy of sublimation of Cu: 339.3 kJ/mol	ΔH_f° of $\text{O}(g)$: 249.2 kJ/mol

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5. (20 points.) Short answers.

(a) (1 pt. each) Write the electronic structures for the following atoms and ions. You may use “core” notation, except where specified.

i. oxygen

ii. Al^{3+}

iii. Te

iv. Si

v. argon (don't use “core” notation.)

(b) (1 pt. each) Draw the Lewis symbols for the following atoms and ions.

i. carbon

ii. xenon

iii. Be

iv. Ca^{2+}

v. F^-

(c) (2 pts. each) Draw reasonable Lewis structures for the following molecules.

i. CH_4

ii. N_2

iii. CO_2

iv. NF_3

v. BH_3

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6. (15 points.) On the blank periodic table below, *clearly* label the following:
- (a) The atom with the lowest first ionization energy.
 - (b) The first transition series
 - (c) The noble gases
 - (d) The trends in atomic size (draw arrows outside the table and label them clearly)
 - (e) The alkaline earths
 - (f) The halogens
 - (g) The row with valence electrons having $n = 5$
 - (h) The column of elements with three half-filled p orbitals.

Constants and other useful information:

Planck's constant: $h = 6.63 \times 10^{-34}$ J·s

Speed of light: $c = 3.00 \times 10^8$ m/s

mass of electron: $m_e = 9.11 \times 10^{-31}$ kg.

Avogadro's number: $N_A = 6.022 \times 10^{23}$ mol⁻¹.

Bohr model constant: $B = 2.179 \times 10^{-18}$ J.