1) What ionic compound would be formed from Al and O? 1 pt

Al₂O₃

2) Provide the equation for the formation of the compound in 1) that is associated with the lattice energy. 1 pt

2 Al³⁺ (g) + 3 O²⁻ (g) → Al₂O₃ (s)

3) Match the following lattice energies with the appropriate ionic compound. 2 pts

Charge considerations make Ca²⁺ compounds have a more negative value than Na⁺ compounds. Size considerations make Se compounds have a more negative value than Te compounds.

CaSe  d  a) -2095 kJ/mol
Na₂Se  b  b) -2130 kJ/mol
CaTe  c  c) -2721 kJ/mol
Na₂Te  a  d) -2862 kJ/mol

4) Use the following information to calculate the enthalpy of formation of MgCl₂ (s) from its elements. 2.5 pts

Mg (s) + Cl₂ (g) → MgCl₂ (s)

ΔHreaction = ΔH (Mg sublimation) + ΔH (Mg first ionization) + ΔH (Mg second ionization) + ΔH (Cl₂ bond dissociation) + 2 ΔH (Cl electron affinity) + ΔH (lattice energy for MgCl₂)

ΔHreaction = 1 mol x 148 kJ/mol + 1 mol x 738 kJ/mol + 1 mol x 1588 kJ/mol + 1 mol x 243 kJ/mol + 2 mols x (-349 kJ/mol) + 1 mol x -2975 kJ/mol = -956 kJ/mol

5) The lattice energy for formation of MgCl (Mg⁺ and Cl⁻) is 783 kJ/mol. What is the energy of formation for MgCl? 2.5 pts

ΔHreaction = ΔH (Mg sublimation) + ΔH (Mg first ionization) + ΔH (Mg second ionization) + ΔH (Cl₂ bond dissociation) + ΔH (Cl electron affinity) ΔH (lattice energy for MgCl)

ΔHreaction = 1 mol x 148 kJ/mol + 1 mol x 738 kJ/mol + 0.5 mol x 243 kJ/mol + 1 mol x (-349 kJ/mol) + 1 mol (-783 kJ/mol) = -124.5 kJ/mol

6) Given values calculated for formation of the ionic solids MgCl and MgCl₂, which is more likely to form and why? 1 pt

MgCl₂ – the reaction is more exothermic (gives off more energy) and thus is a more stable compound.

7) For the following elements:

a) circle those that will accept less than an octet (indicated here by *)

b) underline those that will accept more than an octet

O  P  B*  N  As  Be*  Kr  F
8) Which of the following bonds would be the most polar? 1 pt
   a) Si-Cl  b) Si-Br  c) P-Cl  d) P-Br

9) What cation has a +3 charge and one 3d electron? _____ Ti ________ 1 pt

10) In each group, circle the largest atom/ion. 2 pts
    a) Sr  Mg  P  b) Ba\(^{2+}\)  Xe  Te\(^{2-}\)

11) Provide a correct Lewis dot structure for each compound below. 9 pts
    a) BBr\(_3\)  24 valence electrons, B center atom with 3 bonds, each Br complete octet
    b) CBrF\(_3\)  32 valence electrons, C center atom, Br and F with a complete octet
    c) SO\(_2\)  18 valence electrons, S center atom, single bond to one O, double bond to other, one non-bonding electron pair on S, single bonded O has three non-bonding pairs of electrons and double bonded O has two non-bonding pairs of electrons.
    d) H\(_2\)CO  12 valence electrons, C center atom, single bond to H, double bond to O, which has two non-bonding pairs of electrons
    e) PF\(_5\)  40 valence electrons, P center atom with a single bond to each F, each F complete octet
    f) I\(_3^-\)  22 valence electrons, center I has a single bond to other two I, non center I have an octet, center I has three non-bonding pairs of electrons. Do not put double bonds in this structure. Surround structure with box and – sign.
    g) N\(_2\)  10 valence electrons, triple bond between the N, each has a non-bonding pair of electrons
    h) PH\(_4^+\)  8 valence electrons, P central atom with single bond to each H, surround structure with box and +
    i) XeF\(_4\)  36 valence electrons, Xe center atom, single bond to each F which have a complete octet, Xe has two non-bonding pairs of electrons