

REVIEW QUESTIONS

Chapter 9

1. Draw Lewis structures for each of the following structures and assign formal charges to each atom:
 - a) SF₂

 - b) NH₂OH (N and O are bonded to one another)

 - c) PO₄³⁻

2. Draw two possible resonance structures for the isocyanate ion (NCO⁻) and using formal charges determine which structure has greater contribution to the resonance hybrid.

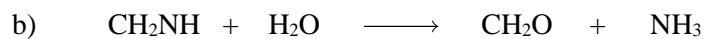
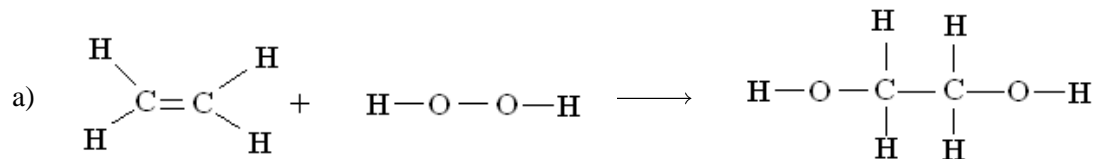
3. Arrange the bonds in each of the following sets in order of increasing polarity:



4. Classify each of the following bonds as ionic, polar covalent or non-polar covalent:



5. Use bond energies listed in Table 9.3 in your textbook to find ΔH_{rxn} for the reactions shown below:



6. Use the data provided below to calculate the lattice energy of RbCl. Is this value greater or less than the lattice energy of NaCl? Explain.

Electron affinity of Cl = -349 kJ/mol

1st ionization energy of Rb = 403 kJ/mol

Bond energy of Cl₂ = 242 kJ/mol

Sublimation energy of Rb = 86.5 kJ/mol

ΔH_f [RbCl (s)] = -430.5 kJ/mol

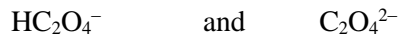
7. Arrange the following compounds in order of increasing lattice energy. Provide explanation for your choices.

NaF

CaO

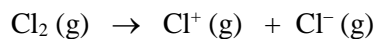
CsI

8. Oxalic acid ($\text{H}_2\text{C}_2\text{O}_4$) is a weak acid that can lose two hydrogens to form the following anions:



Draw Lewis structures for the two anions above, and comment on the relative strength and length of their C–O bonds.

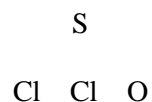
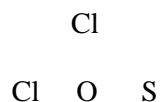
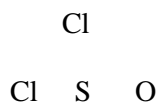
9. Bond energies can be combined with values for other atomic properties to obtain ΔH values that cannot be measured directly. Use bond energy and other data found in your textbook to calculate $\Delta H^\circ_{\text{rxn}}$ for the ionic dissociation of chlorine gas:



10. Tetrazene (N_4H_4) is a thermally unstable nitrogen hydride with the atom sequence shown below. It decomposes above 0°C to form hydrazine (N_2H_4) and nitrogen gas. Draw a Lewis structure for tetrazene and calculate the $\Delta H^\circ_{\text{rxn}}$ for its decomposition.



11. Thionyl chloride (SOCl_2) can have the 3 skeletal structures shown below. Complete the Lewis structure for each, assign formal charges and determine which structure is the most plausible for this compound.



12. Rank the length of the N–O bond length in the following ions:



13. Two compounds are isomers if they have the same chemical formula but a different arrangement of atoms. Use bond energies available in Table 9.3 in your test to estimate ΔH_{rxn} for each of the following isomerization reactions and indicate which isomer is more stable.

