

Draw the Lewis electron-dot structures for CO_3^{2-} , CO_2 , and CO , including resonance structures where appropriate.

(b) Which of the three species has the shortest C-O bond length? Explain the reason for your answer.

(c) Predict the molecular shapes for the three species. Explain how you arrived at your predictions.

The first ionization energy of sodium is +496 kilojoules per mole, yet the standard heat of formation of sodium chloride from its elements in their standard state is -411 kilojoules per mole.

(a) Name the factors that determine the magnitude of the standard heat of formation of solid sodium chloride. Indicate whether each factor makes the reaction for the formation of sodium chloride from its elements more or less exothermic.

(b) Name the factors that determine whether the reaction that occurs when such a salt dissolves in water is exothermic or endothermic and discuss the effect of each factor on the solubility.

5) Average score = 1.63

a) five points

Heat of sublimation of sodium	Endothermic
First ionization energy of sodium	Endothermic
Heat of dissociation of Cl_2	Endothermic
Electron affinity of chlorine	Exothermic
Lattice energy of NaCl	Exothermic

c) three points

Lattice energy of NaCl	Endothermic to solution
Hydration energy of the ions	Exothermic

Solvent expansion is endothermic

OR

Increased exothermicity is associated with increased solubility

4. Molecules that have planar configurations include which of the following?

- I. BCl_3
- II. CHCl_3
- III. NCl_3

- (A) I only
- (B) III only
- (C) I and II only
- (D) II and III only
- (E) I, II, and III

62. The electron-dot structure (Lewis structure) for which of the following molecules would have two unshared pairs of electrons on the central atom?

- (A) H_2S
- (B) NH_3
- (C) CH_4
- (D) HCN
- (E) CO_2

68. Which of the following molecules has a dipole moment of zero?

- (A) C_6H_6 (benzene)
- (B) NO
- (C) SO_2
- (D) NH_3
- (E) H_2S

40. The geometry of the SO_3 molecule is best described as

- (A) trigonal planar
- (B) trigonal pyramidal
- (C) square pyramidal
- (D) bent
- (E) tetrahedral

41. Which of the following molecules has the shortest bond length?

- (A) N_2
- (B) O_2
- (C) Cl_2
- (D) Br_2
- (E) I_2

60. Which of the following has a zero dipole moment?

- (A) HCN
- (B) NH_3
- (C) SO_2
- (D) NO_2
- (E) PF_5