1982 D

(a) 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.

1990 D (Required)

Use simple structure and bonding models to account for each of the following.

(a) The bond length between the two carbon atoms is shorter in C_2H_4 than in C_2H_6.

(b) The H-N-H bond angle is 107.5º, in NH_3.

(c) The bond lengths in SO_3 are all identical and are shorter than a sulfur-oxygen single bond.

(d) The I_3^- ion is linear.

1992 D

NO_2 NO_2^- NO_2^+

Nitrogen is the central atom in each of the species given above.

(a) Draw the Lewis electron-dot structure for each of the three species.

(b) List the species in order of increasing bond angle. Justify your answer.

(c) Select one of the species and give the hybridization of the nitrogen atom in it.

(d) Identify the only one of the species that dimerizes and explain what causes it to do so.

1996 D

Explain each of the following observations in terms of the electronic structure and/or bonding of the compounds involved.

(b) Molecules of AsF_3 are polar, whereas molecules of AsF_5 are nonpolar.

(c) The N-O bonds in the NO_2^- ion are equal in length, whereas they are unequal in HNO_2.

(d) For sulfur, the fluorides SF_2, SF_4, and SF_6 are known to exist, whereas for oxygen only OF_2 is known to exist.

1997 D (Required)

Consider the molecules PF_3 and PF_5.

(a) Draw the Lewis electron-dot structures for PF_3 and PF_5 and predict the molecular geometry of each.

(b) Is the PF_3 molecule polar, or is it nonpolar? Explain.

(c) On the basis of bonding principles, predict whether each of the following compounds exists. In each case, explain your prediction.

(i) NF_5

(ii) AsF_5