

1982 D

- Draw the Lewis electron-dot structures for CO_3^{2-} , CO_2 , and CO , including resonance structures where appropriate.
- Which of the three species has the shortest C-O bond length? Explain the reason for your answer.
- 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.

- The bond length between the two carbon atoms is shorter in C_2H_4 than in C_2H_6 .
- The H-N-H bond angle is 107.5° , in NH_3 .
- The bond lengths in SO_3 are all identical and are shorter than a sulfur-oxygen single bond.
- The I_3^- ion is linear.

1992 D



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

- Draw the Lewis electron-dot structure for each of the three species.
- List the species in order of increasing bond angle. Justify your answer.
- Select one of the species and give the hybridization of the nitrogen atom in it.
- 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.

- At ordinary conditions, HF (normal boiling point = 20°C) is a liquid, whereas HCl (normal boiling point = -114°C) is a gas.
- Molecules of AsF_3 are polar, whereas molecules of AsF_5 are nonpolar.
- The N-O bonds in the NO_2^- ion are equal in length, whereas they are unequal in HNO_2 .
- 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 .

- Draw the Lewis electron-dot structures for PF_3 and PF_5 and predict the molecular geometry of each.
- Is the PF_3 molecule polar, or is it nonpolar? Explain.
- On the basis of bonding principles, predict whether each of the following compounds exists. In each case, explain your prediction.
 - NF_5
 - AsF_5