

Chemistry 130
Bonding Practice Problems

1) For the following pair of elements, write chemical formula, give the name, and draw the Lewis dot structure for the ionic compound that would form. Remember that cations and anions want to be near each other.

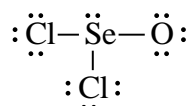
- a) Na and P
- b) Al and N
- c) Ba and Br
- d) K and S
- e) Ca and P (the LDS for this one is a bit more complicated – remember to put cations next to anions and vice versa)

2) Draw a valid Lewis dot structure for each of the following molecules or polyatomic ions. When applicable, show individual resonance structures (resonance is explained in the “Lewis Dot Tutorial...” notes). (**Note: correct answers are in question 3 below...don't look until you've tried first!**)

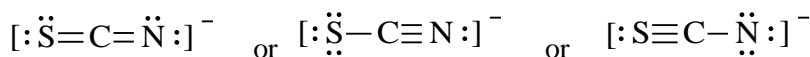
- a) SeOCl₂ (Se in the middle)
- b) SCN⁻¹
- c) CH₃Br (C in the middle)
- d) SO₃
- e) NO⁺¹
- f) N₂F₂ (atoms arranged F N N F)
- g) SO₃⁻²
- h) HONO (atoms arranged H O N O)

3) For each of the following valid Lewis dot structures, predict (i.e. name) the molecular shape and draw a geometric representation showing bond angles.

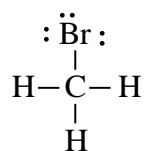
a) SeOCl₂ (Se in the middle)



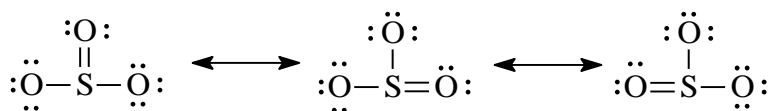
b) SCN⁻¹



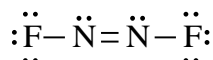
c) CH₃Br (C in the middle)



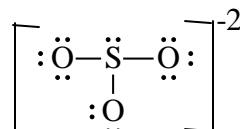
d) SO₃



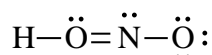
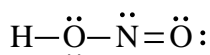
e) N₂F₂ (draw the geometric rep., and name the shape around each N)



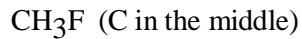
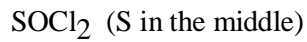
f) SO₃⁻²



g) HONO (draw geometric rep. for both structures, and name the shape around the central O and N)
(**note: which one of the structures below satisfies the valence rules?**)



4) For each of the following molecules, briefly explain whether or not the molecule is polar. You'll need to first draw the Lewis dot structure and determine the molecular shape. When explaining whether or not the molecule is polar, it may be helpful to draw the geometric representation and show the polarity arrows for each bond.



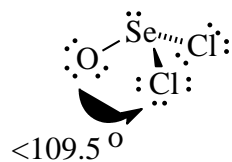
Answers

1) For the following pair of elements, write chemical formula, give the name, and draw the Lewis dot structure for the ionic compound that would form. Remember that cations and anions want to be near each other.

<p>a) Na and P</p> <p>Na⁺¹ P⁻³ → Na₃P sodium phosphide</p> <p style="text-align: center;">Na⁺¹ [: $\ddot{\text{P}}$:⁻³] Na⁺¹ Na⁺¹</p> <p>b) Al and N</p> <p>Al⁺³ N⁻³ → AlN aluminum nitride (+3 and -3 cancel each other 1 to 1)</p> <p style="text-align: center;">Al⁺³ [: $\ddot{\text{N}}$:⁻³]</p> <p>c) Ba and Br</p> <p>Ba⁺² Br⁻¹ → BaBr₂ barium bromide</p> <p style="text-align: center;">[: $\ddot{\text{Br}}$:⁻¹] Ba⁺² [: $\ddot{\text{Br}}$:⁻¹]</p>	<p>d) K and S</p> <p>K⁺¹ S⁻² → K₂S potassium sulfide</p> <p style="text-align: center;">K⁺¹ [: $\ddot{\text{S}}$:⁻²] K⁺¹</p> <p>e) Ca and P</p> <p>Ca⁺² P⁻³ → Ca₃P₂ calcium phosphide</p> <p style="text-align: center;">Ca⁺² [: $\ddot{\text{P}}$:⁻³] Ca⁺² [: $\ddot{\text{P}}$:⁻³] Ca⁺²</p>
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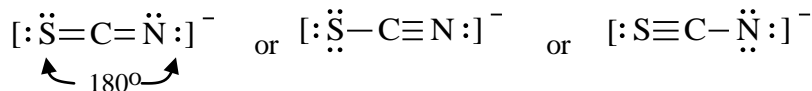
3) For each of the following valid Lewis dot structures, predict the molecular shape and draw a geometric representation showing bond angles.

a) SeOCl_2 (Se in the middle)



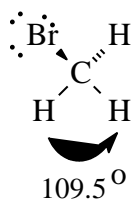
molecular shape is trigonal pyramidal

b) SCN^{-1}



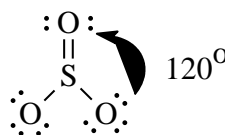
All of these valid structures are linear, with a 180° bond angle

c) CH_3Br (C in the middle)



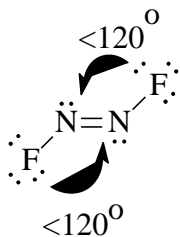
molecular shape is tetrahedral

d) SO_3

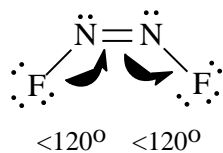


molecular shape is trigonal planar

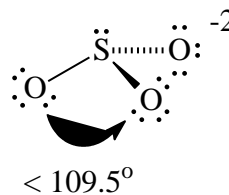
e) N_2F_2 (atoms arranged F N N F)



The molecular shape around each N is bent

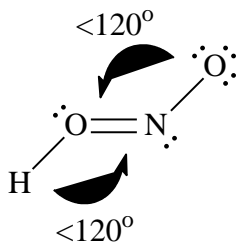
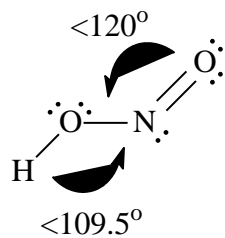


f) SO_3^{-2}

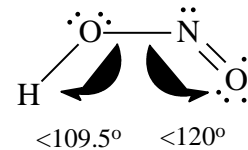


The shape of this ion is trigonal pyramidal

g) HONO



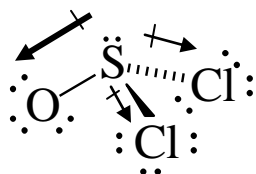
In all of the structures, the shape around O and N is bent.



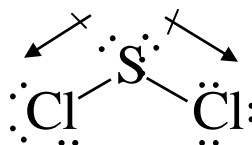
You could also bend the molecule like this

- 4) For each of the following molecules, briefly explain whether or not the molecule is polar. You'll need to first draw the Lewis dot structure and determine the molecular shape.

SOCl₂ (S in the middle)



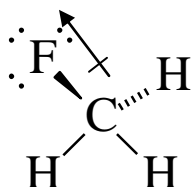
SCl₂



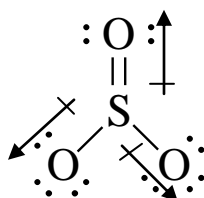
The SO bond is polar with e.n. diff. of 1.0. The SCl bonds are slightly polar with e.n. diff. of 0.5. Because the molecule does not have perfectly symmetrical shape or bond polarities, the molecule is polar.

The SCl bonds are both slightly polar. Because the molecule does not have a perfectly symmetrical shape, the bond dipoles do not cancel each other and the molecule is polar.

CH₃F (C in the middle)



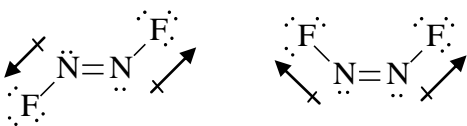
SO₃



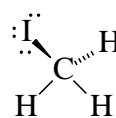
The CF bond is highly polar with e.n. diff. of 1.5. The CH bonds are nonpolar with e.n. diff. of 0.4. Because the molecule is not perfectly symmetrical (because the bonds are different), the bond dipoles do not cancel so the molecule is polar.

The SO bonds are polar, but the molecule has a perfectly symmetrical shape with identical bonds. Therefore, the bond polarities cancel each other and the molecule is nonpolar.

N₂F₂ (atoms arranged F N N F)



CH₃I



In the first structure, the NF bond dipoles are opposed, so these dipoles cancel each other and the molecule is nonpolar. In the second structure, the bond dipoles do not cancel each other, so the molecule is polar.

In this structure, all of the bonds are nonpolar. So, even though the structure is not perfectly symmetrical, the zero dipole bonds make the molecule nonpolar.