

Homework:

1. Read pages 187 to 189.
2. On page 188: Q 23 – 26.
3. On page 189: Q 1 – 3 & 5 – 7.

Page 189, question 1:

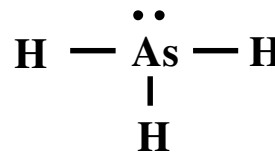
a) AsH ₃	b) CH ₃ CN	c) Cl ₂ O
$\begin{array}{c} \cdot\cdot \\ \text{H} - \text{As} - \text{H} \\ \\ \text{H} \end{array}$ <ul style="list-style-type: none"> • trigonal pyramidal • polar 	$\begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{C} \equiv \text{N} : \\ \\ \text{H} \end{array}$ <ul style="list-style-type: none"> • polar 	$\begin{array}{c} \cdot\cdot \quad \cdot\cdot \\ : \text{O} - \text{Cl} : \\ \quad \cdot\cdot \\ : \text{Cl} : \\ \cdot\cdot \end{array}$ <ul style="list-style-type: none"> • bent (V-shaped) • polar

Page 189, question 2: Discuss the validity of the statement: “All polar molecules must have polar bonds and all non-polar molecules must have non-polar bonds.”

Both parts of this statement are untrue.

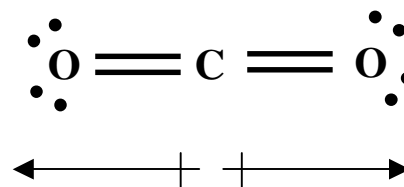
- Molecules are polar when they are asymmetrical. If a central atom has different types of atoms bonded to it, or if the arrangement of lone pairs around the central atom is asymmetrical, then the molecule is polar, regardless of whether or not it contains any polar bonds.

eg. AsH₃ is a polar molecule because it is asymmetrical, even though the ΔEN between As and H is only 0.02



- Molecules are non-polar when they are symmetrical. Even if a molecule contains polar bonds, the dipoles will cancel out if the molecule is symmetrical.

eg. CO₂ contains polar bonds, but it is non-polar because the molecule is symmetrical in all planes, so the dipoles cancel out



Page 189, question 3: What similarities and what differences would you expect in the molecular shape and the polarity of CH_4 and CH_3OH ? Explain your answer.

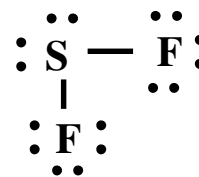


CH_4 is a tetrahedral, non-polar molecule. Because it is non-polar, it is a gas at SATP.

CH_3OH is tetrahedral around the carbon atom, but bent around the oxygen atom. CH_3OH is a polar molecule and this substance (methanol) is a liquid at SATP.

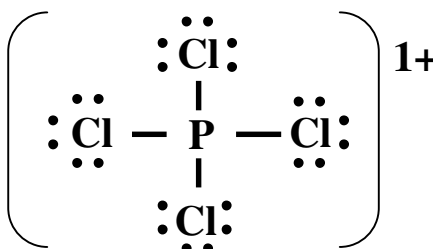
Page 189, question 5:

The shape of SF_2 is bent or V-shaped. Because it is asymmetrical, it is a polar molecule.



Page 189, question 6:

The PCl_4^+ ion is a tetrahedral shape. It is a non-polar molecule, although it does carry an ionic charge.



Page 189, question 7:

The factors that determine the structure and polarity of molecules are the number and arrangement of bonded pairs and lone pairs around the central atom:

- each number of bonded pairs and lone pairs is associated with a different molecular shape (structure).
eg. AX_2E_2 is bent
 AX_3E_0 is trigonal pyramid
 AX_5E_1 is square based pyramid.
- the polarity of a molecule depends on its symmetry. If a molecule is symmetrical in all planes, it will be non-polar. If a molecule is asymmetrical (due to arrangement of lone pairs or atoms), then it will be polar.