A5 · Covalent bonds: bonding capacity, dot diagrams and structural formulas · Worked examples and practice

Name: _____ Date: _____

Worked examples

Read these first. There is one for each kind of question in this lesson.

Example 1 · Draw the electron dot diagram of a molecule

Draw the electron dot diagram of phosphine, PH_3.

1. Draw each atom's electron dot diagram: phosphorus has 5 dots, and each hydrogen has 1.
2. Choose the middle atom: phosphorus forms 3 bonds, the most.
3. Pair single dots between atoms: each single dot on phosphorus pairs with a hydrogen dot.
4. Count the electrons around each atom: phosphorus has 8, and each hydrogen has 2.

Answer: PH_3 has 3 bonding pairs, and 1 lone pair on phosphorus.

Example 2 · Turn an electron dot diagram into a structural formula

Draw the structural formula of phosphine, PH_3, from its electron dot diagram.

1. Copy the symbols in the same places: P in the middle, with 3 H around it.
2. Draw one dash for each bonding pair: 3 dashes.
3. Leave out the lone pairs: the 1 lone pair on phosphorus is not drawn.
4. Check: phosphorus has 3 dashes, and its bonding capacity is 3.

Answer: P in the middle, with one dash to each of the 3 hydrogen atoms.

Practice

Questions 1 to 4 are easy. Questions 5 to 8 are medium. Questions 9 and 10 are harder.

EASY

1. Nitrogen is in group 15. What is its bonding capacity? Say how you know.

EASY

2. What is a covalent bond?

EASY

3. What does the molecular formula F_2 tell you?

EASY

4. Draw the electron dot diagram of hydrogen iodide, HI. Say how many bonding pairs and lone pairs it has.

MEDIUM

5. Which atom goes in the middle of SiH_4? Say why.

MEDIUM

6. Use the four steps to draw the electron dot diagram of hydrogen sulfide, H_2S.

MEDIUM

7. Draw the structural formula of hydrogen sulfide, H_2S. Say how many dashes it has, and how many lone pairs are left out.

MEDIUM

8. In CF_4, how many electrons are around the carbon atom? How many are around each fluorine atom? Show your count.

HARDER

9. Use the four steps to draw the electron dot diagram of nitrogen trichloride, NCl_3. Then say how many lone pairs the whole molecule has.

HARDER

10. A student draws water as H–H–O. Use bonding capacity to explain what is wrong. Then give the correct structural formula.