A6 · Double and triple bonds · Practice key

This is the worked key. Every practice question is worked step by step.

Worked examples

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

Example 1 · Place a double bond

Ethene is C_2H_4. Each carbon atom is joined to the other carbon and to 2 hydrogen atoms. Find the bonds in ethene.

1. Join the atoms with single bonds: C to C, and 2 hydrogen atoms on each carbon.
2. Find atoms with single dots left over: carbon forms 4 bonds and has used 3, so each carbon has 1.
3. Pair left-over dots of two joined atoms: the two carbon atoms share a second pair.
4. Count the electrons around each atom: each carbon has 4 + 4 = 8, and each hydrogen has 2.

Answer: The two carbon atoms share a double bond. Every other bond is a single bond.

Example 2 · Count the electrons around an atom with a double bond

In CO_2, carbon shares a double bond with each oxygen atom. How many electrons are around the carbon atom?

1. A double bond counts as 4 electrons.
2. Carbon has 2 double bonds.
3. 4 + 4 = 8 electrons.

Answer: Carbon has 8 electrons around it.

Practice

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

EASY

1. How many shared pairs are in a double bond? How many dashes show it in a structural formula?

1. Two shared pairs between the same two atoms are a double bond.
2. It is drawn as 2 dashes.

EASY

2. How many electrons does a triple bond count as? Show your count.

1. A triple bond is three shared pairs.
2. 3 × 2 = 6 electrons.

EASY

3. Each fluorine atom forms 1 bond. What kind of bond joins the two atoms in F_2? Say why it is not a double bond.

1. A single bond uses the 1 single dot of each atom.
2. No dots are left over, so there is no second pair.

EASY

4. In the structural formula of CO_2, how many dashes join carbon to each oxygen atom? Say why.

1. Carbon shares a double bond with each oxygen atom.
2. A double bond is 2 dashes, so there are 2 dashes to each oxygen.

MEDIUM

5. A molecule has the formula N_2H_2. Each nitrogen atom forms 3 bonds, and is joined to the other nitrogen and to 1 hydrogen. Use the four steps to find its bonds.

1. Step 1: join N to N, and add one hydrogen to each nitrogen.
2. Step 2: each nitrogen has used 2 bonds, so each has 1 dot left over.
3. Step 3: pair the two dots. The nitrogen atoms share a double bond.
4. Step 4: each nitrogen has 2 + 4 + 2 = 8, with 1 lone pair. Each hydrogen has 2.

MEDIUM

6. In N_2, the two nitrogen atoms share a triple bond. How many electrons are around each nitrogen atom? Show your count.

1. The triple bond counts as 6.
2. Each nitrogen has 1 lone pair. That is 2 more.
3. 6 + 2 = 8 electrons.

MEDIUM

7. Hydrazine is N_2H_4. Each nitrogen forms 3 bonds. Use the three steps for two middle atoms to find its structural formula.

1. Step 1: join the two nitrogen atoms.
2. Step 2: each nitrogen needs 2 more dashes.
3. Step 3: add 2 hydrogen atoms to each nitrogen. Every bond is a single bond.

MEDIUM

8. In ethene, C_2H_4, each carbon has 2 single bonds to hydrogen and 1 double bond to the other carbon. How many electrons are around one carbon atom?

1. The 2 single bonds count as 4 electrons.
2. The double bond counts as 4.
3. 4 + 4 = 8 electrons.

HARDER

9. Carbonyl fluoride is COF_2. Carbon is the middle atom. Use the four steps to find its bonds. Then count the electrons around carbon.

1. Step 1: join carbon to oxygen and to each fluorine with single bonds.
2. Step 2: carbon has 1 dot left over, and oxygen has 1.
3. Step 3: pair them. Carbon and oxygen share a double bond.
4. Step 4: carbon has 2 single bonds and 1 double bond. 4 + 4 = 8.

HARDER

10. A student draws N_2 with a single bond and says each nitrogen atom is full. Count the electrons to show the mistake. What is the correct bond?

1. Each nitrogen atom has 5 valence electrons.
2. With a single bond, each atom has 2 shared electrons and 4 of its own. That is only 6.
3. Each atom has 2 dots left over, so the atoms share 2 more pairs.
4. The bond is a triple bond. Then each nitrogen has 6 + 2 = 8.