Outer Shell Stories

Use valence electrons to model transfer and sharing.

8.5.a "Use valence electron configuration to model ionic and covalent bonds."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline sentences that describe electrons moving between atoms, circle sentences that describe atoms sharing electrons, and box each stated valence-electron count. Use your marks to help build bond models.

What Happens to Outer Electrons?

1. Inside a battery, atoms can form compounds by moving or sharing electrons. A valence-electron model shows only the electrons in an atom's outer shell. Lithium has one valence electron, while fluorine has seven. Lithium gives its electron to fluorine. Lithium becomes Li^+, and fluorine becomes F^-. Each now has a stable outer shell: lithium's filled inner shell is exposed, and fluorine has eight outer electrons. Their opposite charges attract, forming an ionic bond in LiF. This model tracks a transfer, not a shared pair.

2. A model of a new ionic compound starts with each atom's valence electrons. A sodium atom has one valence electron; a magnesium atom has two. A chlorine atom has seven, and an oxygen atom has six. Metals such as sodium and magnesium tend to lose electrons, while nonmetals such as chlorine and oxygen tend to gain them. Show the electron transfers, then count each ion's charge. For an ionic formula, use enough ions to make the total positive and negative charges cancel. A subscript after an element symbol tells how many of those atoms are present.

3. Sharing electrons builds a different kind of bond. An oxygen atom has six valence electrons, and a hydrogen atom has one. In water, oxygen shares one pair with each of two hydrogen atoms. Oxygen also keeps two unshared pairs. Each hydrogen counts its shared pair as a full first shell, and oxygen counts eight electrons around it. Water's formula is H_2O. Covalent formulas describe atoms joined by sharing; they are not found by balancing ionic charges. Carbon has four valence electrons, nitrogen has five, sulfur has six, and chlorine has seven.

2 ANSWER WITH EVIDENCE

Use the passage

1. Magnesium bonds with chlorine. Model the electron transfer: how many chlorine atoms receive electrons from one magnesium atom? Write the ions and the ionic formula.

2. Sodium bonds with oxygen. How many sodium atoms must transfer electrons to one oxygen atom? Write the ions and the ionic formula.

3. Carbon bonds with hydrogen by sharing electrons. How many hydrogen atoms can share one pair each with a carbon atom so carbon has eight outer electrons? Write the covalent formula.

4. Nitrogen bonds with hydrogen by sharing electrons. How many shared pairs give nitrogen eight outer electrons, and how many unshared electrons remain on nitrogen? Write the covalent formula.

3 YOUR TURN

Your own words

Model a covalent molecule made of one sulfur atom and two chlorine atoms. Write its formula, describe the shared and unshared electron pairs around each atom, and explain how each atom reaches eight outer electrons.

ANSWER KEY

Outer Shell Stories

GRADE 8 · 8.5.a

PART 1 · READ AND MARK

Underline sentences that describe electrons moving between atoms, circle sentences that describe atoms sharing electrons, and box each stated valence-electron count. Use your marks to help build bond models. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Magnesium bonds with chlorine. Model the electron transfer: how many chlorine atoms receive electrons from one magnesium atom? Write the ions and the ionic formula.	**Two chlorine atoms each receive one electron. The ions are Mg^{2+} and two Cl^{-}; the ionic formula is $MgCl_2$.**
2	Sodium bonds with oxygen. How many sodium atoms must transfer electrons to one oxygen atom? Write the ions and the ionic formula.	**Two sodium atoms each transfer one electron. The ions are two Na^{+} and one O^{2-}; the ionic formula is Na_2O.**
3	Carbon bonds with hydrogen by sharing electrons. How many hydrogen atoms can share one pair each with a carbon atom so carbon has eight outer electrons? Write the covalent formula.	**Four hydrogen atoms share four pairs with carbon, giving carbon eight outer electrons. The formula is CH_4.**
4	Nitrogen bonds with hydrogen by sharing electrons. How many shared pairs give nitrogen eight outer electrons, and how many unshared electrons remain on nitrogen? Write the covalent formula.	**Nitrogen forms three shared pairs and keeps two unshared electrons. The formula is NH_3.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The formula is SCl_2. Sulfur shares one pair with each chlorine atom and keeps two unshared pairs; each chlorine keeps three unshared pairs. Counting shared and unshared pairs gives sulfur and each chlorine eight outer electrons.

Accept descriptions or dot models that show the same electron transfers or shared pairs. For ionic formulas, require the total positive and negative charges to cancel; do not use charge balancing to judge covalent formulas.