A7 · Electronegativity: from equal sharing to transfer · 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 · Classify a bond between two non-metals

Classify the bond between hydrogen and oxygen. Use the Data Booklet values, and mark δ− and δ+.

1. Find the two electronegativities: hydrogen is 2.2 and oxygen is 3.4.
2. Subtract the smaller from the larger: 3.4 − 2.2 = 1.2.
3. Classify the bond from the difference: two non-metals with different values make a polar covalent bond.
4. Mark δ− on the larger value, δ+ on the other: oxygen is δ− and hydrogen is δ+.
5. Check: the bond dipole arrow points to oxygen, the δ− end.

Answer: The bond is polar covalent. Oxygen is δ− and hydrogen is δ+.

Example 2 · Classify a bond between a metal and a non-metal

Classify the bond between lithium and fluorine. Use the Data Booklet values.

1. Find the two electronegativities: lithium is 1.0 and fluorine is 4.0.
2. Subtract the smaller from the larger: 4.0 − 1.0 = 3.0.
3. Classify the bond from the difference: a metal with a non-metal, and a very large difference, make an ionic bond.
4. The ions have full charges, so δ− and δ+ are not used.

Answer: The bond is ionic.

Practice

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

EASY

1. Find the electronegativity of nitrogen and of phosphorus in the Data Booklet. Which atom attracts shared electrons more strongly?

1. Nitrogen is 3.0. Phosphorus is 2.2.
2. Nitrogen has the larger number, so nitrogen pulls more strongly.

EASY

2. How does electronegativity change across a period, from left to right? Name the element with the highest value.

1. Electronegativity increases across a period, from left to right.
2. Fluorine has the highest value, 4.0.

EASY

3. Two iodine atoms share a pair of electrons in I_2. What kind of bond is it? Use the Data Booklet values.

1. Both atoms are 2.7, so the difference is 0.0.
2. The sharing is equal. It is a non-polar covalent bond.

EASY

4. What does a bond dipole arrow show? Say which end it points to.

1. A polar bond has a δ− end and a δ+ end.
2. The arrow points to the negative end, δ−.

MEDIUM

5. Classify the bond between carbon and oxygen. Use the Data Booklet values, and mark δ− and δ+.

1. Carbon is 2.6. Oxygen is 3.4.
2. 3.4 − 2.6 = 0.8.
3. Two non-metals with different values make a polar covalent bond.
4. Oxygen has the larger value, so oxygen is δ− and carbon is δ+.

MEDIUM

6. Classify the bond between sulfur and chlorine. Use the Data Booklet values, and mark δ− and δ+.

1. Sulfur is 2.6. Chlorine is 3.2.
2. 3.2 − 2.6 = 0.6.
3. Two non-metals with different values make a polar covalent bond.
4. Chlorine has the larger value, so chlorine is δ− and sulfur is δ+.

MEDIUM

7. Classify the bond between potassium and chlorine. Use the Data Booklet values.

1. Potassium is 0.8. Chlorine is 3.2.
2. 3.2 − 0.8 = 2.4.
3. Potassium is a metal and chlorine is a non-metal. The difference is large.
4. So the bond is ionic. The ions have full charges.

MEDIUM

8. Compare two bonds: carbon with hydrogen, and oxygen with hydrogen. In which bond is the sharing less equal? Use the Data Booklet values.

1. Carbon and hydrogen: 2.6 − 2.2 = 0.4.
2. Oxygen and hydrogen: 3.4 − 2.2 = 1.2.
3. A larger difference means less equal sharing. So the bond between oxygen and hydrogen is less equal.

HARDER

9. Here are three bonds: fluorine with fluorine, sulfur with fluorine, and lithium with fluorine. Put them in order, from the most equal sharing to the least equal. Use the Data Booklet values.

1. Fluorine with fluorine: the difference is 0.0.
2. Sulfur with fluorine: 4.0 − 2.6 = 1.4.
3. Lithium with fluorine: 4.0 − 1.0 = 3.0.
4. The order is fluorine with fluorine, then sulfur with fluorine, then lithium with fluorine.

HARDER

10. A student says the bond between carbon and sulfur must be polar, because the two atoms are different. Use the Data Booklet values to check.

1. Carbon is 2.6. Sulfur is 2.6.
2. The difference is 0.0.
3. Neither atom pulls harder, so the sharing is equal.
4. The bond is non-polar covalent. The student is wrong.