SCIENCE FOUNDATIONS

Electronegativity and polarity

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you explain why oil and water refuse to mix while sugar dissolves easily in your tea, because uneven sharing of electrons makes some molecules attract water and others not. A cook knows that soap lifts grease off a pan because one end of the soap molecule likes water and the other likes oil. A pharmacist uses polarity to work out whether a drug will dissolve in blood or in fatty tissue. Knowing polarity tells you what will mix, what will dissolve, and what will stay stubbornly separate.



Rule

Electronegativity and polarity: when two atoms share electrons unequally because one pulls harder, the bond is polar.

A molecule is polar overall only if its polar bonds do not cancel out, which depends on its shape.

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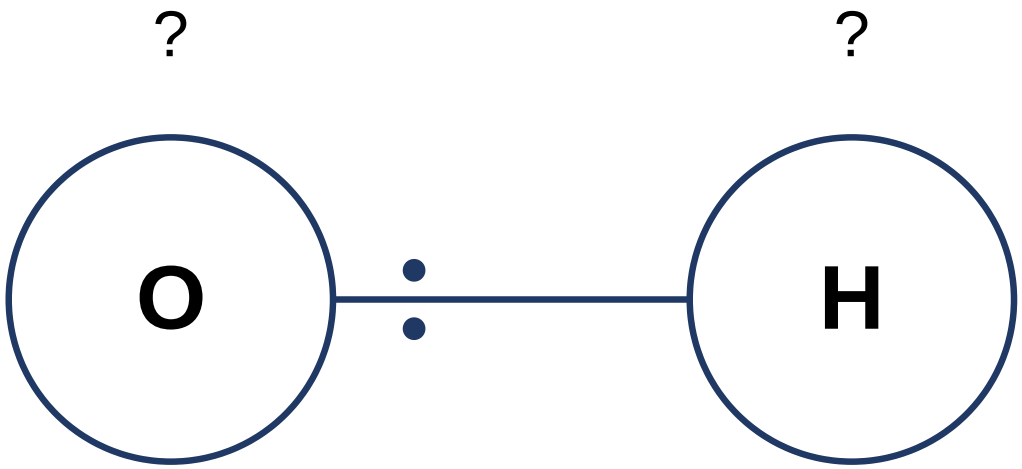
Worked examples

EXAMPLE 1

Q Is the O-H bond polar?



SOLUTION

Compare electronegativity: oxygen pulls harder than hydrogen. Electronegativity is how strongly an atom pulls shared electrons.

Sharing is therefore unequal, with electrons nearer oxygen.

Label the bond polar, oxygen partly negative, hydrogen partly positive.

The result is polar O-H bond.

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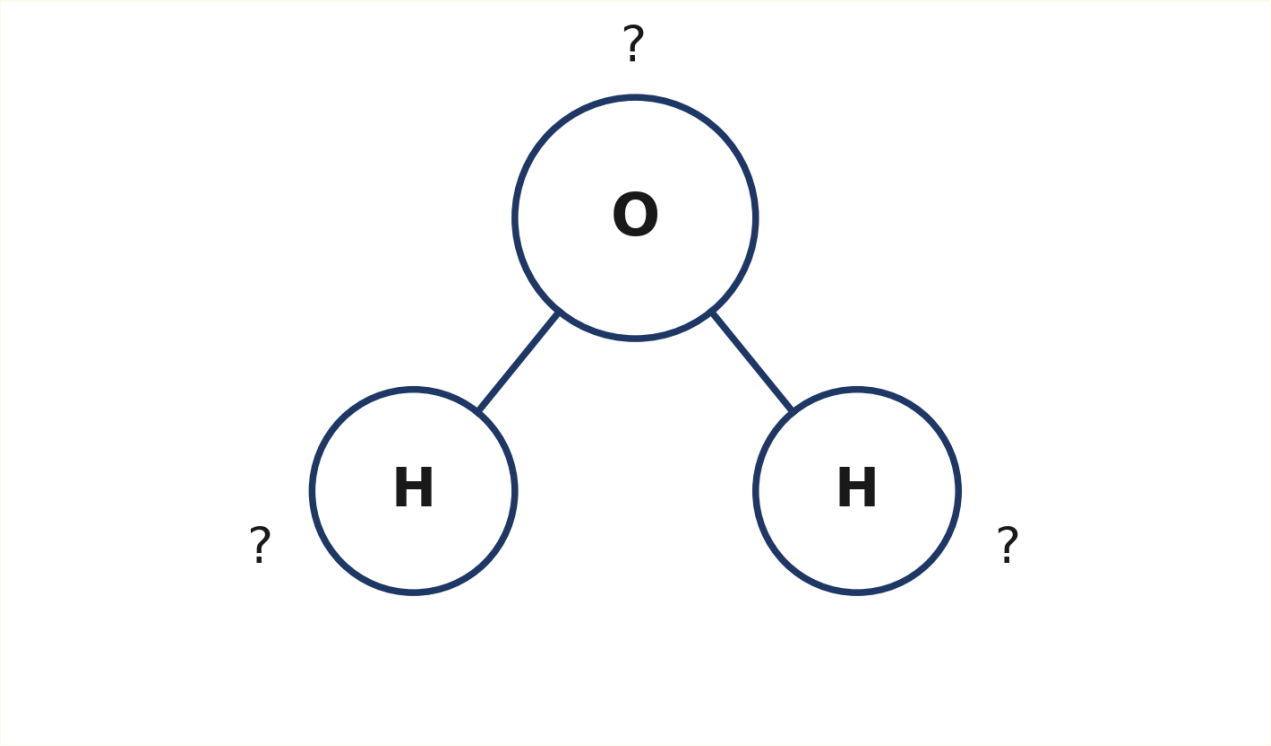
EXAMPLE 2

Q Is water a polar molecule?



SOLUTION

Check the bonds: both O-H bonds are polar.

Check the shape: bent, so the partial charges do not cancel.

Label the molecule polar.

The result is water is polar.

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Practice questions

1 Which element is most electronegative?

- A Chlorine
- B Oxygen
- C Hydrogen
- D Fluorine

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2 Does electronegativity rise across a period?

- A Yes
- B No

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3 Is the N-H bond polar?

A Yes

B No

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4 Is a C-H bond strongly polar?

A Yes, strongly

B No, only slightly

C No, not at all

D Yes, it is ionic

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5 What is a polar bond?

A Equal sharing of electrons

B Unequal sharing of electrons

C No sharing of electrons

D Transfer of protons

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6 Is hydrogen fluoride polar?

A Yes

B No

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7 Is carbon dioxide polar overall?

- A Yes
- B No

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8 Why is carbon dioxide non-polar overall?

- A Its bonds are not polar at all
- B Its shape is bent
- C Its polar bonds cancel in a linear shape
- D It has no electrons to share

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9 What does partly negative mean?

- A. A partial negative charge, not a full ion
- B. A full negative ion
- C. A positive charge
- D. No charge at all

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10 Do polar molecules dissolve well in water?

- A. Usually no
- B. Usually yes
- C. Never
- D. Only when heated

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ANSWER KEY

1. Fluorine

2. Yes

3. Yes

4. No, only slightly

5. Unequal sharing of electrons

6. Yes

7. No

8. Its polar bonds cancel in a linear shape

9. A partial negative charge, not a full ion

10. Usually yes

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