

8.6 Molecular Structure of Acids and Bases

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS oxoacid 含氧酸 • acid 酸 • base 碱 • neutral 中性

Objective

Build the skills to answer exam questions on the **molecular structure of acids and bases** — what makes an acid strong.

You must be able to:

- link acid strength to bond **polarity** and bond **strength**
- compare **oxoacid** 含氧酸 strength (more O atoms → stronger)
- explain trends down a group (binary acids)

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ What makes an acid ionize

An acid ionizes more easily when the bond to H is **weaker** or **more polar**, so H^+ leaves readily, and when the resulting anion is **stable**.

■ Binary acids down a group

Down a group the H–X bond gets **weaker** (larger atom), so the acid is **stronger**: $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$. Bond strength wins over polarity here.

■ Oxoacids: more oxygens = stronger

For oxoacids, more **electronegative O atoms** pull electron density away from the O–H bond, making it more polar and stabilizing the anion. So $\text{HClO}_4 > \text{HClO}_3 > \text{HClO}_2 > \text{HClO}$.

■ Central atom electronegativity

A more electronegative central atom also strengthens an oxoacid: $\text{HClO} > \text{HBrO} > \text{HIO}$.

2 Practice

Now apply the methods above.

2.1 Which is the stronger acid, HCl or HI? [1]

2.2 Which is stronger, HClO_4 or HClO ? [1]

2.3 What two bond properties make an acid ionize more easily? [2]

3 Exam-style questions

3.1 Among oxoacids of the same central atom, more oxygen atoms make the acid [1]

- **A** weaker
 - **B** stronger
 - **C** neutral
 - **D** basic
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3.2 Rank HClO , HClO_2 , HClO_3 from weakest to strongest acid, with a reason. [3]

3.3 Explain why HI is a stronger acid than HF, even though F is more electronegative. [2]

Solutions

2.1 HI.

2.2 HClO_4 .

2.3 A weaker H–X bond; a more polar H–X bond.

3.1 B — stronger.

3.2 $\text{HClO} < \text{HClO}_2 < \text{HClO}_3$; more oxygen atoms pull electron density from the O–H bond and stabilize the anion, increasing acid strength.

3.3 The H–I bond is much weaker than H–F (I is a large atom), so H^+ is released more easily; the weaker bond outweighs F's higher electronegativity.