

## Exercise walk-through

Molecular Structure of Acids and Bases ■ 8.6

eXercise

## 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)

## Method — What makes an acid ionize

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

## Method — 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.

## Method — 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  $\text{HClO}_4 > \text{HClO}_3 > \text{HClO}_2 > \text{HClO}$ .

## Method — Central atom electronegativity

A more electronegative central atom also strengthens an oxoacid:



## Practice 2.1 ■ 1 mark

Which is the stronger acid, HCl or HI?

## Solution 2.1

Method: Binary acids down a group

### Worked steps

HI **B1**.

## Practice 2.2 ■ 1 mark

Which is stronger,  $\text{HClO}_4$  or  $\text{HClO}$ ?

## Solution 2.2

Method: Oxoacids: more oxygens = stronger

### Worked steps

$\text{HClO}_4$  **B1**.

## Practice 2.3 ■ 2 marks

What two bond properties make an acid ionize more easily?

## Solution 2.3

Method: What makes an acid ionize

### Worked steps

A weaker H–X bond; a more polar H–X bond **B1** **B1**.

## Exam-style 3.1 ■ 1 mark

Among oxoacids of the same central atom, more oxygen atoms make the acid

**A** weaker

**B** stronger

**C** neutral

**D** basic

## Solution 3.1

**A** weaker

**B** stronger 

**C** neutral

**D** basic

### Worked steps

**B** — stronger.

## Exam-style 3.2 ■ 3 marks

Rank  $\text{HClO}$ ,  $\text{HClO}_2$ ,  $\text{HClO}_3$  from weakest to strongest acid, with a reason.

## Solution 3.2

### Worked steps

$\text{HClO} < \text{HClO}_2 < \text{HClO}_3$ ; more oxygen atoms pull electron density from the O–H bond and stabilize the anion, increasing acid strength M1 M1 A1.

## Exam-style 3.3 ■ 2 marks

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

## Solution 3.3

Method: Oxoacids: more oxygens = stronger

### Worked steps

The H-I bond is much weaker than H-F (I is a large atom), so  $\text{H}^+$  is released more easily; the weaker bond outweighs F's higher electronegativity **M1** **A1**.