

## Exercise walk-through

Chemical periodicity of other elements ■ 9.3

eXercise

## You must be able to

- predict the characteristic properties of an element from its group
- deduce the likely position and identity of an unknown element from its properties

## Method — Predicting from position

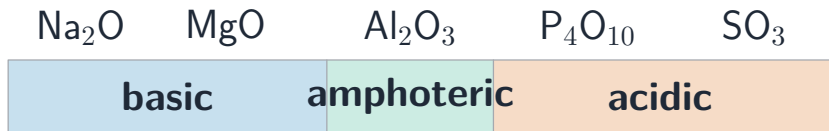
Use the patterns you know:

- **down a group** — properties change steadily (e.g. Group 1: more reactive, larger atoms going down).
- **across a period** — metal  $\rightarrow$  non-metal; oxides basic  $\rightarrow$  acidic; bonding ionic  $\rightarrow$  covalent.

**Predict:** a Group 1 element forms a +1 ion, is a reactive metal, and has a basic oxide.

**Deduce:** an element with a basic oxide, high conductivity and a +2 ion is a Group 2 metal.

## Method — Predicting from position



pH  $\approx$  14

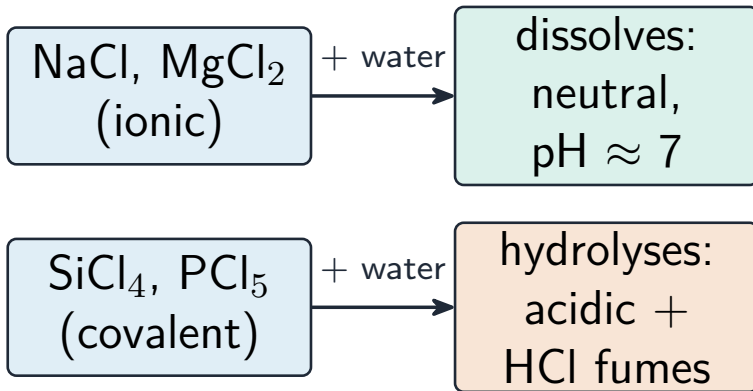
pH  $\approx$  7

pH  $\approx$  0

metal oxides (left) are basic; non-metal oxides (right) are acidic

*A bar showing the Period 3 oxides changing from basic through amphoteric to acidic*

## Method — Predicting from position



*Period 3 chlorides react differently with water*

## Practice 2.1 ■ 1 mark

Predict the charge of the ion formed by an element in Group 2.

## Solution 2.1

Method: Predicting from position

### Worked steps

2+ **B1**.

## Practice 2.2 ■ 1 mark

State whether the oxide of a Group 1 element is acidic or basic.

## Solution 2.2

Method: Predicting from position

### Worked steps

basic **B1**.

## Exam-style 3.1 ■ 1 mark

An element X has a giant metallic structure, conducts electricity, and forms a basic oxide of formula XO. X is most likely in:

**A** Group 1

**B** Group 2

**C** Group 16

**D** Group 17

## Solution 3.1

Method: Predicting from position

**A** Group 1

**B** Group 2 

**C** Group 16

**D** Group 17

### Worked steps

**B.** A basic oxide XO (+2) and metallic conductivity point to Group 2.

## Exam-style 3.2 ■ 1 mark

Going **down** Group 17 (the halogens), the elements become:

- A** less reactive
- B** more reactive
- C** more metallic in their oxides
- D** smaller atoms

## Solution 3.2

Method: Predicting from position

- A** less reactive
- B** more reactive
- C** more metallic in their oxides
- D** smaller atoms



### Worked steps

- A.** Reactivity decreases down Group 17.

## Exam-style 3.3 ■ 2 marks

An unknown element Y forms a chloride that fumes in moist air and gives an acidic solution with water; Y's oxide is acidic.

- (a) Deduce whether Y is a metal or a non-metal, and explain.
- (b) Suggest the region of the Periodic Table where Y is found.

## Solution 3.3

Method: Predicting from position

### Worked steps

- (a) a non-metal **M1**; its oxide and chloride are acidic/covalent and the chloride hydrolyses — typical of non-metals **A1**.
- (b) the right-hand side (non-metal region) of the Periodic Table **B1**.

## Exam-style 3.4 ■ 2 marks

Using periodic trends, predict **two** properties of caesium (Cs), in Group 1 below sodium.

## Solution 3.4

Method: Predicting from position

### Worked steps

any two: it is a (very) reactive metal; forms a  $+1$  ion; has a basic oxide; reacts vigorously with water; larger atom / lower melting point than sodium **B1** *each, max 2.*