Reading an Element From Two Ion Ratios

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A mineral exhibit makes two pure ionic model solids with the same unknown metal M. Each compound contains only metal ions and the one anion listed. Chloride has charge −1. Oxide has charge −2. In this model M has the same charge in both solids.

Solid	Metal ion count	Anion ion count	Anion
P	6	12	Chloride
Q	6	6	Oxide

1 Infer the metal ion charge from P and confirm it independently using Q. [1]

Answer and work

A label lists three possible metals. In the exhibit, sodium from Group 1 forms Na^{+}, magnesium from Group 2 forms Mg^{2+}, and aluminum from Group 13 forms Al^{3+}.

2 Which listed group matches both solids?

(1) Group 1 only

(2) Group 2 only

(3) Group 13 only

(4) All three groups

3 A student says the one-to-one ratio in Q establishes that M has a +1 charge. Use the oxide record to evaluate the claim. [1]

Answer and work

4 The exhibit makes a third solid of M ions and nitride ions with charge −3. Find the smallest whole-number metal-to-nitride ratio and explain. [1]

Answer and work