**ConcepTests Involving Which & How Many Ions Are Present in a Compound**

This is a series of ConcepTests that asks progressively harder questions on the topic. The instructor should have covered the term formula unit and students should have learned the formulas of polyatomic ions.

In a formula unit of MgI₂, how many ions are there?

1. 1 ion
2. 2 ions
3. 3 ions
4. none

**Correct Answer:** 3. 3 ions

*one Mg²⁺ and two Cl⁻*

**Comment to Instructor:** Choice #2 may mean students are considering I₂⁻ as one ion. They often confuse the iodine in its elemental state being diatomic to mean that it should always be diatomic, even in a compound. Choice #4 may mean students think there are no ions because the formula does not show any charges.

In a formula unit of KOH how many ions are there?

1. 1 ions
2. 2 ions
3. 3 ions
4. none

**Correct Answer:** 2. 2 ions

*one K⁺ and one OH⁻*

**Comment to Instructor:** Choice #3 shows students did not recognize OH⁻ as an ion but are thinking of K, O, H are 3 different ions. Remind them to learn the formulas of polyatomic ions.

In a formula unit of Mg(NO₃)₂, how many ions are there?

1. 2 ions
2. 3 ions
3. 9 ions
4. 10 ions

**Correct Answer:** 2. 3 ions

*(one Mg²⁺ and two NO₃⁻ ions)*

**Comment to Instructor:** Students have trouble with the concept that NO₃⁻ counts as only one ion instead of 4. They don’t quite understand what an ion is. It is just a name of something with a charge, and they are viewing NO₃⁻ as being made of N ions and O ions. Choice #1 means they see the subscript 2 and think that tells them the number of ions.
Choice #3 means they are looking it as Mg + 2N + 6O.
Choice #4 means they are looking at \((\text{Mg} + N + 3\text{O}) \times 2\). After explaining the answers, let them practise with the next question.

In one formula unit of \((\text{NH}_4)_3\text{PO}_4\), how many ions are there?

1. 4 ions
2. 8 ions
3. 11 ions
4. 20 ions

Correct Answer: 1. 4 ions

Three \(\text{NH}_4^+\) and one \(\text{PO}_4^{3-}\) ions.

Comment to Instructor: Choice #2 may mean students are counting \(3\text{NH}_4^+ + P + 4\text{O}\), not realizing that \(\text{PO}_4^{3-}\) is an ion. Choice #3 may mean they are looking at \(\text{PO}_4\) as \(\text{P}_4\text{O}_4\), and counting \(3\text{NH}_4^+4\text{P}+4\text{O}\). Choice #4 means they are counting all the atoms \((3\text{N}+12\text{H}+\text{P}+4\text{O})\). If they are still having trouble with this question, they need to study the formulas of polyatomic ions.

In one formula unit of \((\text{NH}_4)_2\text{S}\), how many cations are there?

1. 1 cation
2. 2 cations
3. 3 cations
4. 4 cations

Correct Answer: 3. 2 cations

Comment to Instructor: Students may need a review on what the term “cation” refers. Having established that, go on to the next question. This question reinforces the use of the term “cation”.

In one dozen formula units of \((\text{NH}_4)_2\text{S}\), how many cations are there?

1. 2
2. 2 dozens
3. 3 dozens
4. None of the above.

Correct Answer: 2. 2 dozens

Comment to Instructor: Hopefully students don’t have a problem with this. Go on to the next question. This question is leading to the use of moles asked in the next question.
In one mole of (NH₄)₂S, how many cations are there?
   1. 2
   2. 1 mole
   3. 2 moles
   4. None of the above.

**Correct Answer:** 3. 2 moles of NH₄⁺ ions.

*Comment to Instructor:* This is paving the way to problems usually dealt in the second semester when concentrations of ions rather than the entire compound become important. If they need more practice, go to the next question.

How many moles of anions are in 5 moles of Mg(ClO₃)₂?
   1. 2 moles
   2. 3 moles
   3. 5 moles
   4. 10 moles

**Correct Answer:** 4. 10 moles

*Comment to Instructor:* Students may be careless and are still thinking about ions per mole, or cations instead of anions.