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 MgI_2, how many ions are there?

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

Correct Answer: **3.   3 ions**
one Mg^{2+} and two Cl^-

Comment to Instructor: Choice #2 may mean students are considering I_2^{2-} as one ion. They often confuse the iodine in its elemental state being diatomic to mean that it should <u>always</u> 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 $Mg(NO_3)_2$, how many ions are there?

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

Correct Answer: **2.   3 ions**
(one Mg^{2+} and two NO_3^- ions)

Comment to Instructor: Students have trouble with the concept that NO_3^- 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 NO_3^- 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.

In one formula unit of $(NH_4)_3PO_4$, how many ions are there?
1. 4 ions
2. 8 ions
3. 11 ions
4. 20 ions

Correct Answer: **1. 4 ions**
Three NH_4^+ and one PO_4^{3-} ions.

Comment to Instructor: Choice #2 may mean students are counting $3\ NH_4^+ + P + 4O$, not realizing that PO_4^{3-} is an ion. Choice #3 may mean they are looking at PO_4 as P_4O_4, and counting $3NH_4^+ +4P+4O$. Choice #4 means they are counting <u>all</u> the atoms ($3N+12H+P+4\ O$). If they are still having trouble with this question, they need to study the formulas of polyatomic ions.

In one formula unit of $(NH_4)_2S$, 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 $(NH_4)_2S$, 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 $(NH_4)_2S$, how many cations are there?
1. 2
2. 1 mole
3. 2 moles
4. None of the above.

Correct Answer: **3. 2 moles of NH_4^+ 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 $Mg(ClO_3)_2$?

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.*