ConcepTest on the Mole Concept

Suppose we have 5 dozens of people. How many arms would we have? Assume everyone has two arms.

1. 2 dozens
2. 5 dozens
3. 10 dozens
4. None of the above.

Correct Answer: ***#3. 10 dozens***

Comment to Instructor: Students are unlikely to choose a wrong answer. Go on to the next question.

Suppose we have 7 dozens of CO_2 molecules. How many oxygen atoms would we have?

1. 3 dozens
2. 7 dozens
3. 14 dozens
4. I am confused.

Correct Answer: ***#3. 14 dozens***

Comment to Instructor: Don't be surprised if students hang back and are afraid to give an answer. Choice #1 may indicate students figured there are 3 atoms in one CO_2 and cannot see how to work "dozens" into it. Point out that there are twice as many oxygen atoms as there are CO_2 molecules, so there would be 2 x 7 dozens = 14 dozens.
Choice #2 may indicate students think the oxygen in CO_2 is O_2 (having been told that oxygen "always" exists as O_2). You can point out that oxygen does not exist as an O_2 molecule inside CO_2.

Go on to the next question.

After having presented what a mole stands for, the collective number 6.02×10^{23}, just as a dozen stands for the collective number 12, present the following ConcepTest question:

Suppose we have 9 moles of CO_2 molecules. How many oxygen atoms would we have?

1. 3 moles
2. 9 moles
3. 18 moles
4. I need more time to think this over.

Correct Answer: ***#3. 18 moles***

Comment to Instructor: If students have trouble, remind them that there are twice as many oxygen atoms as CO_2 molecules, so there should be 2 x 9 moles = 18 moles. Go on to the next question.

Suppose we have 0.3 moles of $Mg_3(PO_4)_2$. How many moles of atoms are there?

1. 0.9 moles
2. 1.5 moles
3. 3.6 moles
4. 3.9 moles

Correct Answer: ***#4 3.9 moles***

Comment to Instructor: #1 indicates that students may think there are 3 atoms (Mg+P+O).
#2 indicates that students may think there are 5 atoms (3 Mg + 2 PO_4)
#3 indicates that students may think there are 12 atoms (3Mg + P + 8 O).
The number 0.3 is used because students panic when they see a decimal point.

Go on to the next question.

Suppose we have 0.14 moles of $KClO_2$, how many moles of Cl atoms do we have?

1. 0.14 mole
2. 0.28 mole
3. 0.56 mole
4. 0.84 mole

Correct Answer: ***#1 0.14 mole***
There is only one Cl in one $KClO_2$ formula unit.

Comment to Instructor: #2 indicates students may think the subscript 2 applies to Cl as well.
#3 indicates students did not read the question carefully and think you asked "atoms" instead of "Cl atoms". They are thinking 4 atoms per formula unit (K + Cl + 2 O)
#4 indicates students are thinking $(KClO)_2$ giving them 6 atoms per formula unit.

Go on to the next question.

Instead of looking at the atoms in $Ca_3(PO_4)_2$, let us now consider the **<u>ions</u>** it has.
In 0.050 moles of $Ca_3(PO_4)_2$ how many moles of negative ions does it have?

1. 0.10 mole
2. 0.15 mole
3. 0.50 mole
4. none of the above

Correct Answer: ***#1 0.10 mole***
There are 2 phosphate ions per formula unit. 2 x 0.050 mole = 0.10 mole

Comment to Instructor: #2 indicates students are considering 3 calcium ions, not remembering they are positive ions. #3 indicates students may be thinking there are 10 ions (one P + four O) x 2 = 10