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Letter

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Comment on "Unpacking the Meaning of the Mole Concept for Secondary School Teachers and Students"

Andrzej Barański*

Faculty of Chemistry, Jagiellonian University, 30-060 Kraków, Poland

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ABSTRACT: The remarks are formulated on the paper by Fang et al. entitled "Unpacking the Meaning of the Mole Concept for Secondary School Teachers and Students".

KEYWORDS: *First-Year Undergraduate, General, High School, Introductory Chemistry, Physical Chemistry, Nomenclature, Units, Symbols, Stoichiometry*

The paper by Fang et al.[1] is a milestone in the stoichiometry teaching literature, undoubtedly. However, the section What Does the SI Definition Tell Us? is lacking a definition of Avogadro's number (N_A). The current SI definition of the mole yields directly the ratio[2]

$$\frac{\text{mass of carbon-12 mole}}{\text{mass of carbon-12 atom}} = \frac{12\ \text{grams}}{12\ \text{u}} = \frac{\text{gram}}{\text{u}} = N_A \qquad (1)$$

Chemists are thinking simply. **Mole is a collection of Avogadro's number of entities, where Avogadro's number is the ratio gram/atomic mass unit** as seen above. From this common definition and eq 1, let us calculate the mass of one mole ($m_{1\ \text{mol Y}}$) of substance Y. Its relative atomic or molecular mass is M_Y.

$$\begin{aligned} m_{1\ \text{mol Y}} &= N_A \times (M_Y \times \text{u}) = M_Y \times (N_A \times \text{u}) \\ &= M_Y \times \text{gram} \end{aligned} \qquad (2)$$

Equation 2 shows the relationship between the number of entities and the mass of the one-mole sample. The number of entities is the extensive quantity. Hence, eq 2 explains the commonly known phrase *"counting by weighing"* so fundamental for teaching, comprehension, and applications of stoichiometry. The equation shows also that the current, official SI definition of mole and the common, unofficial one, are equivalent.

The basic assumption of the paper by Fang et al. reads: "[I]t is necessary that student conceptions of the mole should be consistent with the SI definition". The word *consistent* is pivotal. What does it really mean? Is it acceptable, in teaching, to rename "amount of substance" into "collection of entities"? Is it acceptable to use an equivalent, common definition instead of the current SI one? If so, stoichiometric calculations will be exactly the same whereas comprehension of the basic concepts will be much easier.

There are the question marks, and there is a need for discussion.

AUTHOR INFORMATION

Corresponding Author

*E-mail: baranski@chemia.uj.edu.pl.

Notes

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