SCIENCE ONE 2024/2025 **HOMEWORK #13**

NAME:

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1. Reading: Atomic Weight History (from https://science.jrank.org/pages/634/Atomic-Weight-History.html)

Although the atomic theory of matter, in its various forms, existed a good two thousand years before the time of **John Dalton, he was the first to propose**, in his 1808 book "A New System of Chemical Philosophy", **that atoms had weight**. Atoms, as Dalton defined them, were hard, solid, indivisible particles with no inner spaces, rather than something that could not be seen, touched, or tasted. They were indestructible and preserved their identities in all chemical reactions. Furthermore, each kind of element had its own specific kind of atom different from the atoms of other elements. These assumptions led him to propose that atoms were tangible matter and therefore had weight.

Because atoms were much too small to be seen or measured by any common methods, **absolute weights of atoms could not be determined**. Rather, these first measurements were made by comparing weights of various atoms to hydrogen. Hydrogen was chosen as the unit of comparison because it was the lightest substance known and the weights of the other elements would be very close to whole numbers.

The weight of oxygen could then be calculated because of earlier work by **Humboldt and Gay-Lussac, who found that water consisted of only two elements, hydrogen and oxygen, and that there were eight parts of oxygen for every one part of hydrogen**. Lacking any knowledge about how many atoms of hydrogen and oxygen combine in a molecule of water, Dalton again had to make some assumptions. He assumed that nature is basically very simple and, therefore, one atom of hydrogen combines with only one atom of oxygen. Using this hypothesis and the fact that hydrogen was assigned a weight of one unit, it follows that oxygen, which is eight times heavier than hydrogen, would have a weight of eight units. Of course, if the ratio between hydrogen and oxygen in water were not one to one, but some other ratio, the weight of oxygen would have to be adjusted accordingly. Dalton used experimental results and similar reasoning to prepare the **very first Table of Atomic Weights (Slide #8 of Classwork #13, note the atomic weights are all wrong😊)**, but because of the lack of knowledge about the real formulas for substances, many of the weights were incorrect and had to be modified later.

2. Question A: what *erroneous assumption about water* led to Dalton's incorrect relative atomic weight of Oxygen?

3. Question B: can you correct that assumption and derive the correct relative atomic weight of Oxygen?