SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Stochiometric Combustion Pseudocode	Grade 11 Chemistry

Lesson Plan

Coding Tool	Pseudocode
Cross-curricular	Math

Big Ideas

D2. Investigate quantitative relationships in chemical reactions, and solve related problems

- Balancing chemical equations and calculating quantities is an algorithmic activity, consisting of a sequence of IF, THEN/ELSE statements.
- Algorithms can be expressed as pseudocode

Specific Expectations

D2.1 use appropriate terminology related to quantities in chemical reactions, including, but not limited to: stoichiometry, percentage yield, limiting reagent, mole, and atomic mass
D2.5 calculate the corresponding mass, or quantity in moles or molecules, for any given reactant or product in a balanced chemical equation as well as for any other reactant or product in the chemical reaction [AI]

Description

Write pseudocode to balance the chemical formula and find the stochiometric ratio of a combustion reaction between a pure hydrocarbon and oxygen.

Materials

- Pen & paper or word processor

Computational Thinking Skills

- Pseudocode

Introduction

Algorithms can be expressed visually (as the traditional 'tree of life' diagrams) or as pseudocode. There are many ways of writing pseudocode that resemble different programming languages, but the point is to write something that has the structure of code, but is simpler and more abstract than the actual program.

For example, here is a simple psuedoprogram:

```
IF(You see a cat)
THEN
    Pet it.
```

Note how no attempt is made to explain the conditions 'see a cat' or the function 'pet it' (both very non-trivial problems in computer science!) the code is abstracted. No real effort is needed to add the extensive syntax most computer languages need either: that's the point of pseudocode. It needs only be consistent and human-readable.

In this lesson, students will be required to apply the concept of pseudocode to demonstrate how coding can be used to solve every day problems, in this case with chemistry.

Action

Assign your students to attempt to write out instructions in pseudocode to balance a combustion equation between a pure hydrocarbon and oxygen and find the stoichiometric mass ratio of the reagent chemicals.

A handout with one potential solution to this a is included, but note that in coding there is always more than one way to express the answer to a given problem.

Consolidation/Extension

Extension:

- Challenge your students to extend their pseudocode to include the number of molecules of each reagent (and/or product) for a reaction including a set mass of the hydrocarbon.
- Challenge your students to extend their code to give the amount of CO2 produced by the combustion reaction.
- Challenge your class to extend their programs to include impure hydrocarbons: alcohols, for example. You may be surprised by how difficult this is, even in pseudocode!
- If your class is advanced at coding, you can let them try actualizing their pseudocode in scratch, python, or the programming environment of their choice.

Assessment

Assess students on the logic of their code, and its completeness—would it give the right answer? You can also evaluate if the code is properly commented to explain what it does, and if said comments use the proper scientific vocabulary.

Additional Resources

Pseudocode:
https://computersciencementor.com/pseudocode/

https://www.vikingcodeschool.com/software-engineering-basics/what-is-pseudo-coding

https://www.code4example.com/pseudocode/pseudocode-examples