Code Documentation for Chem 1 Creative Output Midyear 2025

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https://jfabuchem1creativeoutput.on.drv.tw/www.chem1.com/

Main logic (and chem concepts):

stoich.js

(This also uses chemcalc.js which is a javascript library that allows getting information about molecules and toms)

Converting within the same molecule/atom:

```
// mol to grams
function convertMolToGrams(mols, molar_mass) {
    return mols * molar_mass;
}

// mol to amount
function convertMolToAmount(mols) {
    return mols * AVOGADRO;
}

// grams to mol
function convertGramsToMol(grams, molar_mass) {
    return grams * 1/(molar_mass);
}

// grams to amount
function convertGramsToAmount(grams, molar_mass) {
    return convertMolToAmount( convertGramsToMol(grams, molar_mass) );
}
```

```
// amount to mol
function convertAmountToMol(amount) {
    return amount * 1/AVOGADRO;
}

// amount to grams
function convertAmountToGrams(amount, molar_mass) {
    return convertMolToGrams(convertAmountToMol(amount), molar_mass);
}

// molecule to its atoms
function convertMolecToItsAtoms(molec, ratio) {
    return molec * ratio;
}
```

The functions above are used to convert from one unit to another. From lessons, we know that the general way to convert is "grams->mol->amount". This is reflected in the functions like how "convertGramsToAmount" needs to call "convertGramsToMolI" then "convertMolToAmount". This is also seen in "convertAmountToGrams".

As such, we apply these functions as seen in the following code snippets, wherein we check the starting and ending unit, and convert as such.

```
if (element_for_CI == element_for_CI_2) {
    if (starting_unit == "grams") {
        if (ending_unit == "mol") {
            result_ = convertToLatexSciNotation(convertGramsToMol(rawInput, result.mw));
            ansLatex = `Answer: ${result_}~mol~${element}`;
```

```
if (element_for_CI == element_for_CI_2) {
    if (starting_unit == "grams") {
        if (ending_unit == "mol") {…
        } else if (ending_unit == "atoms/molecules") {
            result_ = convertToLatexSciNotation(convertGramsToAmount(rawInput, result.mw));
            ansLatex = `Answer: ${result_}~atoms/molecules~${element}`;
```

```
} else if (starting_unit == "mol") {
    if (ending_unit == "grams") {
        result_ = convertToLatexSciNotation(convertMolToGrams(rawInput, result.mw));
        ansLatex = `Answer: ${result_}~g~${element}`;
```

```
} else if (starting_unit == "mol") {
    if (ending_unit == "grams") {···
    } else if (ending_unit == "atoms/molecules") {
        result_ = convertToLatexSciNotation(convertMolToAmount(rawInput));
        ansLatex = `Answer: ${result_}~atoms/molecules~${element}`;
```

```
else if (starting_unit == "atoms/molecules") {
  if (ending_unit == "grams") {
    result_ = convertToLatexSciNotation(convertAmountToGrams(rawInput, result.mw));
    ansLatex = `Answer: ${result_}~g~${element}`;
```

```
else if (starting_unit == "atoms/molecules") {
  if (ending_unit == "grams") {···
  } else if (ending_unit == "mol") {
    result_ = convertToLatexSciNotation(convertAmountToMol(rawInput));
    ansLatex = `Answer: ${result_}~mol~${element}`;
```

Converting from a molecule to one of its atoms:

```
// molecule to its atoms
function convertMolecToItsAtoms(molec, ratio) {
    return molec * ratio;
}
```

```
// get the number of each atom for ratios
const atoms = result.parts[0].ea;

// make a new dictionary from the info above for ease
const atoms_dict = new Object;
var atoms_dictLatex = "With these no. of atoms: ";
for (let i = 0; i < atoms.length; i++) {
    atoms_dict[atoms[i].element] = atoms[i].number;
    atoms_dictLatex += atoms[i].number + " " + atoms[i].element + " atom(s), ";
}
```

The process of converting here is the same as the one above with just an added step. Here, everything is first converted to its “amount”, then multiplied by the ratio (atoms/molecule) to get the number of atoms, which is then converted to whatever unit the user specifies.

As such, we can see those in action in the following code snippets. Again, we convert from the starting unit of the molecule to the ending unit of the atom within that molecule.

```
if (element.includes(element_2) && element_2 in atoms_dict) {
    good_input = true;
    var ratio = atoms_dict[element_2];
    if (starting_unit == "grams") {
        if (ending_unit == "mol") {
            result_ = convertGramsToAmount(rawInput, result.mw);
            result_ = convertMolecToItsAtoms(result_, ratio);
            result_ = convertToLatexSciNotation(convertAmountToMol(result_));
```

```
if (starting_unit == "grams") {
    if (ending_unit == "mol") {···
    } else if (ending_unit == "atoms/molecules") {
        result_ = convertGramsToAmount(rawInput, result.mw);
        result_ = convertToLatexSciNotation(convertMolecToItsAtoms(result_, ratio));
```

```
if (starting_unit == "grams") {
    if (ending_unit == "mol") {···
    } else if (ending_unit == "atoms/molecules") {···
    } else {
        result_ = convertGramsToAmount(rawInput, result.mw);
        result_ = convertMolecToItsAtoms(result_, ratio);
        result_ = convertAmountToMol(result_);

        result_ = convertToLatexSciNotation(convertMolToGrams(result_, mass_second));
```

```
else if (starting_unit == "mol") {
  if (ending_unit == "grams") {
      result_ = convertMolToAmount(rawInput);
      result_ = convertMolecToItsAtoms(result_, ratio);
      result_ = convertAmountToMol(result_);

      result_ = convertToLatexSciNotation(convertMolToGrams(result_, mass_second));
```

```
else if (starting_unit == "mol") {
  if (ending_unit == "grams") {···
  } else if (ending_unit == "atoms/molecules") {
      result_ = convertMolToAmount(rawInput);
      result_ = convertToLatexSciNotation(convertMolecToItsAtoms(result_, ratio));
      ansLatex = `Answer: ${result_}~atoms/molecules~${element_2}`;
```

```
else if (starting_unit == "mol") {
  if (ending_unit == "grams") {···
  } else if (ending_unit == "atoms/molecules") {···
  } else {
      result_ = convertMolToAmount(rawInput);
      result_ = convertMolecToItsAtoms(result_, ratio);
      result_ = convertToLatexSciNotation(convertAmountToMol(result_));
```

```
else if (starting_unit == "atoms/molecules") {
  if (ending_unit == "grams") {
      result_ = convertMolecToItsAtoms(rawInput, ratio);
      result_ = convertAmountToMol(result_);

      result_ = convertToLatexSciNotation(convertMolToGrams(result_, mass_second));
```

```
else if (starting_unit == "atoms/molecules") {
  if (ending_unit == "grams") {···
  } else if (ending_unit == "mol") {
      result_ = convertMolecToItsAtoms(rawInput, ratio);
      result_ = convertToLatexSciNotation(convertAmountToMol(result_));
```

```
else if (starting_unit == "atoms/molecules") {
  if (ending_unit == "grams") {···
  } else if (ending_unit == "mol") {···
  } else {
      result_ = convertToLatexSciNotation(convertMolecToItsAtoms(rawInput, ratio));
      ansLatex = `Answer: ${result_}~atoms/molecules~${element_2}`;
```

Other stuff:

To make inputting numbers, multiplication and exponents, we convert symbols like “*” and “^” into its LaTeX equivalent to make the output pretty. Moreover, since Javascript shows exponents as “e”, we convert that to the form 10^(n) for a pretty output.

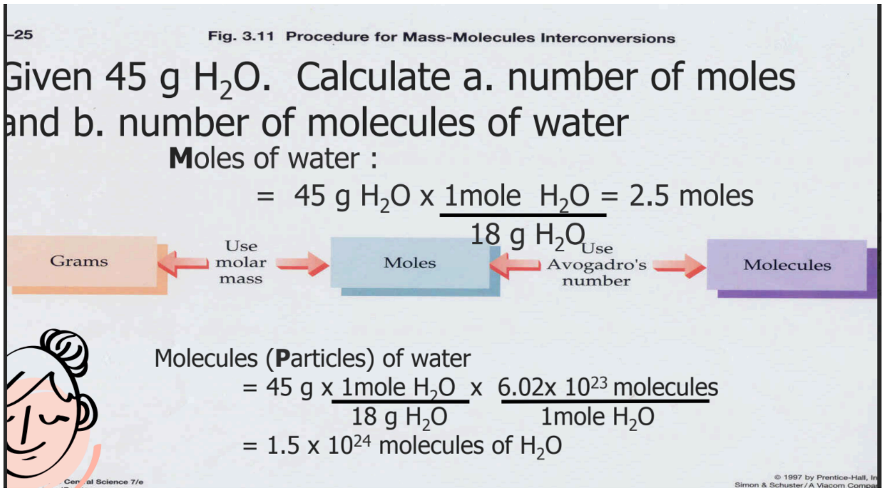
```javascript
// for ease
function convertToLaTeX(input) {
    return input
        .replace(/\*/g, ' \\cdot ')                 // replace * with \cdot
        .replace(/\^\(([^)]+)\)/g, '^{\$1}');       // replace ^(n) with ^{n}
}

function convertToLatexSciNotation(JS_SCI_NOTATION) {
    if (JS_SCI_NOTATION.toString().includes("e")) {
        const parts = JS_SCI_NOTATION.toString().split("e");
        const left = parts[0];
        const exponent = parts[1];

        return `${left}~\\times~10^{${exponent}}`;
    }

    return JS_SCI_NOTATION;
}

function convertToJSSciNotation(LATEX_SCI_NOTATION) {
    if (LATEX_SCI_NOTATION.includes("\\cdot 10^")) {
        LATEX_SCI_NOTATION = LATEX_SCI_NOTATION.replace("\\cdot 10^{", "e");
        LATEX_SCI_NOTATION = LATEX_SCI_NOTATION.replace("}", "");
        LATEX_SCI_NOTATION = LATEX_SCI_NOTATION.replace(/ /g, "");

        return LATEX_SCI_NOTATION;
    }
    return LATEX_SCI_NOTATION;
}
```

In “updatePreview”, this is what runs whenever the user inputs something or does something in the website. This function tries to get the molar mass of the molecule (or atom) that the user inputs, the value, the starting unit, and the ending unit. Afterwards, it calculates it and outputs it.

```javascript
// main meat showing the given, known, and step-by-step solution
async function updatePreview() {
    // get the input
    var rawInput = input_text.value.trim();
    const latexInput = convertToLaTeX(rawInput);
    rawInput = convertToJSSciNotation(latexInput);

    // get element or compound and the units
    const element = element_compound_molecule_type.value.trim();
    const element_2 = element_compound_molecule_type_2.value.trim();

    if (element == "" || element_2 == "") {
            previewText.innerHTML = "";
            return;
    }

    const starting_unit = start_unit.value;
    const ending_unit = end_unit.value;

    const element_for_CI = element.replace("_", "");
    const element_for_CI_2 = element_2.replace("_", "");

    var result;

    try {
        result = CI.Chemcalc.analyseMF(element_for_CI);
        element_compound_molecule_type.classList.remove("error");
    } catch (error) {
        element_compound_molecule_type.classList.add("error");
        previewText.innerHTML = `\\[\\text{Bad input: Make sure no trailing symbols are p
        MathJax.typesetPromise();
        return;
    }
```

index.html contains the basic html structure of the website.
stoich.css contains basic css of the website wherein everything is organized and made pretty.

Some tests



Stoichiometry Conversion

From: 45 grams of H2O
To: H2O mol

$$Goal: 45 \text{ grams } H2O \text{ to mol } H2O$$

$$Know: 18.015286 \text{ g/mol } H2O \text{ and } 6.022 \times 10^{23} \text{ [atoms or molecules]/mol } H2O$$

With these no. of atoms: 2 H atom(s), 1 O atom(s),

$$Answer: 2.4978787458605987\ mol\ H2O$$

$$Solution: (45\ g\ H2O)(\frac{1\ mol\ H2O}{18.015286\ g\ H2O}) = 2.4978787458605987\ mol\ H2O$$

Stoichiometry Conversion

From: 45 grams of H2O
To: H2O atoms/molecules

$$Goal: 45 \text{ grams } H2O \text{ to atoms/molecules } H2O$$

$$Know: 18.015286 \text{ g/mol } H2O \text{ and } 6.022 \times 10^{23} \text{ [atoms or molecules]/mol } H2O$$

With these no. of atoms: 2 H atom(s), 1 O atom(s),

$$Answer: 1.5042225807572526 \times 10^{+24}\ atoms/molecules\ H2O$$

$$Solution: (45\ g\ H2O)(\frac{1\ mol\ H2O}{18.015286\ g\ H2O})(\frac{6.022 \times 10^{23}\ atoms/molecules\ H2O}{1\ mol\ H2O}) = 1.5042225807572526 \times 10^{+24}\ atoms/molecules\ H2O$$

[Matches!]

Atoms of oxygen and hydrogen

$$\#\text{ atoms H} = 1.5 \times 10^{24}\text{ molecules } H_2O \times \frac{2\text{H atoms}}{H_2O\text{ molecule}}$$

$$= 3.0 \times 10^{24}\text{ atoms H}$$

$$\#\text{ atoms O} = 1.5 \times 10^{24}\text{ molecules } H_2O \times \frac{1\text{ O atom}}{H_2O\text{ molecule}}$$

$$= 1.5 \times 10^{24}\text{ atoms O}$$

Stoichiometry Conversion

From: 45 | grams | of H2O

To: H | atoms/molecules

Goal : 45 grams *H2O to* atoms/molecules *H*

Know : 18.015286 g/mol *H2O* and 6.022×10^{23} [atoms or molecules]/mol *H2O*

With these no. of atoms: 2 H atom(s), 1 O atom(s),

Answer : $3.008445161514505 \times 10^{+24}$ *atoms/molecules H*

$$Solution : (45\ g\ H2O)\left(\frac{1\ mol\ H2O}{18.015286\ g\ H2O}\right)\left(\frac{6.022 \times 10^{23}\ atoms/molecules\ H2O}{1\ mol\ H2O}\right)\left(\frac{2\ atom(s)\ H}{1\ molecule\ H2O}\right) = 3.008445161514505 \times 10^{+24}\ atoms/molecules\ H$$

Stoichiometry Conversion

From: 45 | grams | of H2O

To: O | atoms/molecules

Goal : 45 grams *H2O to* atoms/molecules *O*

Know : 18.015286 g/mol *H2O* and 6.022×10^{23} [atoms or molecules]/mol *H2O*

With these no. of atoms: 2 H atom(s), 1 O atom(s),

Answer : $1.5042225807572526 \times 10^{+24}$ *atoms/molecules O*

$$Solution : (45\ g\ H2O)\left(\frac{1\ mol\ H2O}{18.015286\ g\ H2O}\right)\left(\frac{6.022 \times 10^{23}\ atoms/molecules\ H2O}{1\ mol\ H2O}\right)\left(\frac{1\ atom(s)\ O}{1\ molecule\ H2O}\right) = 1.5042225807572526 \times 10^{+24}\ atoms/molecules\ O$$

[Matches!]