



UNIVERSITI  
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MARA



# International Teaching Aid Competition 2023

Reconnoitering Innovative Ideas in Postnormal Times

# iTAC

# 2023

**iTAC 2023**  
**INTERNATIONAL TEACHING AID COMPETITION**  
**E-PROCEEDINGS**

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## **PREFACE**

iTAC or International Teaching Aid Competition 2023 was a venue for academicians, researchers, industries, junior and young inventors to showcase their innovative ideas not only in the teaching and learning sphere but also in other numerous disciplines of study. This competition was organised by the Special Interest Group, Public Interest Centre of Excellence (SIG PICE) UiTM Kedah Branch, Malaysia. Its main aim was to promote the production of innovative ideas among academicians, students and also the public at large.

In accordance with the theme "Reconnoitering Innovative Ideas in Post-normal Times", the development of novel ideas from the perspectives of interdisciplinary innovations is more compelling today, especially in the post-covid 19 times. Post-pandemic initiatives are the most relevant in the current world to adapt to new ways of doing things and all these surely require networking and collaboration. Rising to the occasion, iTAC 2023 has managed to attract more than 267 participations for all categories. The staggering number of submissions has proven the relevance of this competition to the academic world and beyond in urging the culture of innovating ideas.

iTAC 2023 committee would like to thank all creative participants for showcasing their innovative ideas with us. As expected in any competition, there will be those who win and those who lose. Congratulations to all the award recipients (Diamond, Gold, Silver and Bronze) for their winning entries. Those who did not make the cut this year can always improve and join us again later.

It is hoped that iTAC 2023 has been a worthy platform for all participating innovators who have shown ingenious efforts in their products and ideas. This compilation of extended abstracts published as iTAC 2023 E-Proceedings contains insights into what current researchers, both experienced and novice, find important and relevant in the post-normal times.

Best regards,

**iTAC 2023 Committee**  
**Special Interest Group, Public Interest Centre of Excellence (SIG PICE)**  
**UiTM Kedah Branch**  
**Malaysia**



## CHEMCALC: ONLINE CHEMISTRY CALCULATOR

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### ABSTRACT

A calculator is a device that facilitates rapid and easy mathematical operations on numerical data. Online chemical calculators are essential tools for students, scientists to solve difficult equations. Using an interactive software application that performs a predetermined set of mathematical operations, it might provide any mathematical operation, including unit conversions, pH calculations, and calculations of chemical reactions. The benefits of using an online calculator include accurate, efficient, rapid, and practical online computations in a range of sectors. Nowadays, with the advancement of technology, it is crucial for students to get used to an online calculator, as it provides several advantages like greater convenience, accessibility, and usability. Students studying chemistry in particular encounter challenges as they need to memorize numerous mathematical formulas to solve the chemistry problems. Therefore, the development of an online calculator for chemistry subjects provides the students with the best opportunity to succeed in chemistry class without having to memorize every formula. Numerous mathematical algorithms, including unit conversion, mole conversion, pH calculation, titration, dilution, concentration, and many others, are available in this online chemistry calculator. A total of 124 Basic Chemistry students were introduced to the online calculator. Students were given a set of chemistry questions, and they had to use an online calculator to solve a set of chemistry problems that were provided to them. Many students said it was incredibly convenient to use this online calculator on their tablet or smartphone. They further asserted that using this online calculator would allow them to finish the questions more quickly.

**Keywords:** chemistry, online calculator, interactive calculator

## INTRODUCTION

Today, living in the modern era, gadgets and other electronic devices have become one of the most important instruments in our daily lives. People are assisted by electronic devices in a variety of areas, including education, cleaning, purchasing, and application.

In education, smart learning with the aid of the internet and software has become a convenient method to learn. Almost every university student study using a smartphone, laptop, or tablet. Consequently, the development of online learning platforms has become more engaging and appealing to students in the present day (Zulariffin, 2015). The fact that they can access the online platform using their electronic device simplifies the process, as they can access the information whenever and wherever they desire.

The development of scientific skills necessitates not only content knowledge, but also mathematical abilities to calculate physical quantities and their units (Theis, 2015). The subject of chemistry is a subfield of science that requires the manipulation of various formulas and calculations. In addition, students must memorize concepts and theories such as definitions, reaction mechanisms, etc.

Numerous students struggled to memorize the formula and perform the calculation manually to obtain an accurate answer in a reduced amount of time. Students are overwhelmed by the time-consuming, error-prone, and error-prone nature of manual calculations. In addition, the currently available online calculator may lack user-friendliness or fail to meet the specific requirements of chemistry students. Consequently, there is a need for an online application that simplifies calculations, improves chemistry students' comprehension, and enhances their learning experience.

The development of Chemcalc was tailored to satisfy the needs of students seeking solutions to problems in the introductory Chemistry course. The ultimate goal of this Chemcalc development is to create a comprehensive software tool that addresses the challenges chemistry students encounter. Chemcalc also seeks to simplify complex chemical calculations, provide step-by-step solutions, offer interactive features for exploring chemical concepts, and improve the learning experience overall.

## METHODOLOGY

Chemcalc was generally created through a multi-step procedure. An exhaustive analysis of existing chemical calculation tools and educational resources was conducted initially. Then, an inventory of essential functions and features was compiled. Modern programming languages

and frameworks were used to develop the software to ensure a user-friendly interface and efficient performance.

### Trend Analysis

Trend Analysis commenced with an in-depth review and assessment of the existing chemical calculation tools, such as the chemistry calculators. This analysis most likely entailed a review of various software applications, online calculators, and educational resources designed to facilitate chemical calculations and problem-solving. In addition, chemistry-related educational resources were considered. This may include textbooks, online tutorials, educational websites, and other resources typically utilized by chemistry students to learn and practice chemical calculations. The objective was to identify common chemistry education topics, concepts, and problem-solving strategies.

Based on the analysis performed in the preceding stages, a list of Chemcalc's essential features and functions was compiled. This list would include the particular skills and resources regarded indispensable for assisting chemistry students in their learning and problem-solving processes. Examples of fundamental characteristics include mole calculation, pH calculation, solution concentration, titration, and quantum energy. In addition, this Chemcalc contains interactive elements such as a list of common ions, periodic table trends, a definition term, and many others.

### Chemcalc Development

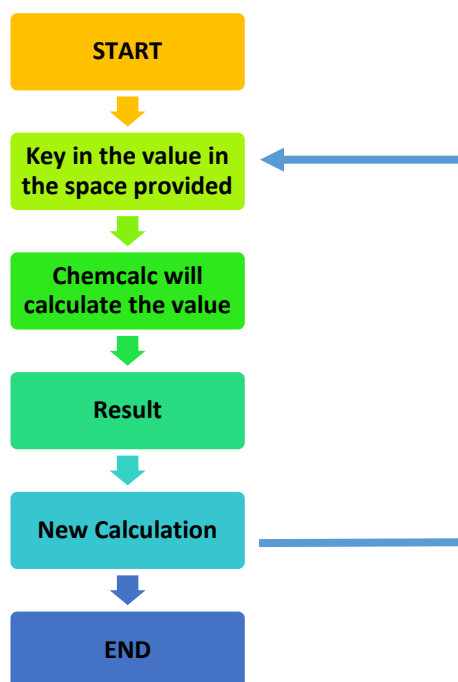
The Chemcalc development process consisted of three primary steps: design, demonstration, and refinement. After the prototype has been developed, the Chemcalc will be utilized for testing. And the final step is execution, where any adjustments will be made if any problems were discovered during testing. This online calculator was designed using modern programming languages and frameworks. The interface was designed with a user-friendly interface to provide a straightforward and intuitive layout and button design. The software's development was optimized to guarantee its efficiency. The calculator was subjected to rigorous testing to identify and resolve any issues or flaws. This exhaustive testing ensures that the calculator functions properly and produces accurate results in a variety of scenarios. Figure 1 displayed an example of Chemcalc development code.

```

74 <div class="card resultsection col-12 col-md-6">
75 <div class="card-body d-flex justify-content-center"
76 <div id="resultvalue">
77 <div id="result"></div>
78 <div id="result"></div>
79 <div id="result"></div>
80 <div id="result"></div>
81 <div id="result"></div>
82 </div>
83 </div>
84 </div>
85 </div>
86 </div>
87 </section> End Get Started Section -->
88 @endsection
89
90 @section('scripts')
91 <script type="text/javascript">
92
93
94 function calculateEnergyDifference() {
95 // get input values
96 let initialEnergy = document.getElementById("initial-energy").value;
97 let finalEnergy = document.getElementById("final-energy").value;
98
99 // calculate energy
100 let R = 2.18e-18;
101 let energyDifference = R * ((1 / (initialEnergy * initialEnergy)) - (1 / finalEnergy));
102
103 // display result
104 document.getElementById("result").innerHTML = "Energy (J) = " + energyDifference.toExponential(5) + " J";
105
106 }
107
108 function calculateInitialEnergy() {
109 // get input values
110 let energyDifference = document.getElementById("energy-difference").value;
111 let finalEnergy = document.getElementById("final-energy").value;

```

**Figure 1.** Coding template for Chemcalc application



**Figure 2.** Proposed Activity of Chemcalc

Figure 2 displayed the Chemcalc activity flow. Referring to the diagram above, the calculation procedure begins by entering the value or quantities in the provided space. The inputted values were linked to the formula, and Chemcalc calculated and displayed the answer based on the specified formula. If the new values were entered into the designated space, the system will restart. Although the Chemcalc aids students in solving chemistry problems, it is their responsibility to determine the appropriate quantities or values before letting the Chemcalc

perform the calculation.

## RESULT AND DISCUSSION

### Background on Target User

The target user were the Chemistry students taking course Basic Chemistry. The students were from Faculty of Agrotechnology and Plantation and enrolled the Basic Chemistry subject as an elective course. The age of the users was in the range 19 – 20 years old.

### Chemcalc Overview

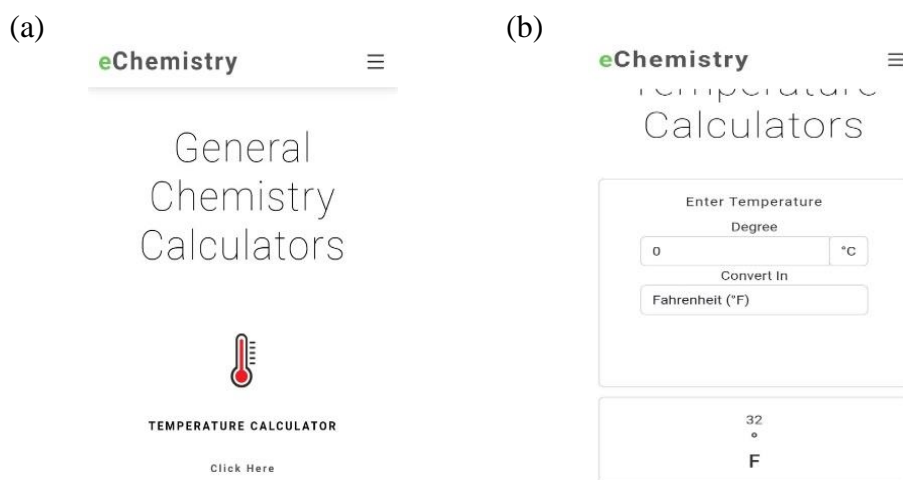
Chemcalc provides an intuitive user interface. It is extremely user-friendly, and students will receive immediate calculation results. Chemcalc requires the input of parameters and values, then return the result. Figures 3 and 4 (a) and (b) depicted the Chemcalc homepage an example of the Chemcalc mobile site, respectively.



**Figure 3.** Homepage of the Chemcalc

The homepage of this system consists of “GET STARTED” button that will direct to calculator page after the students click the button.





**Figure 4 (a) and (b).** Example of Chemclac page

In this page, the users need to choose the specific calculator such as temperature calculator, concentration calculator, density calculator and others. Users need to fill in the values and Chemclac will calculate it.

### Chemcalc Testing

The testing phase is conducted in class with 124 students enrolled in CHM138 Basic Chemistry. Students were separated into two different groups. Each student was provided with a set of questions. One group of students will use a conventional calculator to answer the questions, while the other will use a Chemcalc. The time required to complete the question by these two groups will be compared manually. A group of students who utilized Chemcalc consumed less time compared to other groups. This indicates that the use of Chemcalc facilitates the calculation process. Figure 5 (a) and (b) depicted students participating in testing.

(a)



(b)



**Figure 5.** Students used Chemcalc to solve the questions.

## CONCLUSION

Chemical provides a simple for students to use it anywhere and at any time. It was beneficial to the student's ability to solve mathematical calculations in Chemistry courses. It also addressed the difficulties students face in conducting calculations and appreciating chemical concepts in Chemistry courses. However, there are numerous areas for enhancement, particularly the design and user interfaces.

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