
Synthesis, Characterization and Crystal Structures of Novel Transition Metal Aggregates using the Butterfly Complex $Pt_2(PPh_3)_4(\mu-2-S)_2$ as a Metalloligand μ 新加坡 Raffles Junior College 作者:叶恩得Yap Woon Teck 指導老師:李麗仙Lee Lin Sin **Abstract** synthesize major industrial catalysts while platinum and palladium are extensively used as catalysts for the hydrogenation of hydrocarbons, for example, in the manufacture of margarine from vegetable oils. Platinum and gold compounds are well-known medications; platinum compounds are amongst the most effective medications used for the treatment of advanced cancer. There are, however, some toxic side-effects. Thus, the potential application of the project lies in the synthesis of new platinum, palladium, nickel and gold compounds which may have unprecedented medical and catalytic properties. The main aim of the project is to explore the versatility of the "butterfly" aggregate, $Pt_2(PPh_3)_4(\mu-2-S)_2$, in its capacity as a metalloligand. The nucleophilicity of the $\{Pt_2-S_2\}$ core has been greatly researched upon and recently reviewed. However, few adducts of the butterfly aggregate with mercury(II), tin(IV), or nickel(II) are known. This paper describes the synthesis of adducts of $Pt_2(PPh_3)_4(\mu-2-S)_2$ containing mercury(II), tin(IV), nickel(II), palladium(II), platinum(II) and gold(III) fragments, respectively. The products were then characterized using 1H and ^{31}P nuclear magnetic resonance spectroscopy and single crystal X-ray diffraction crystallography. Nickel, palladium and platinum are highly-prized as catalysts and are extensively used in the petroleum industry. Nickel compounds are important as starting materials to 131 評語 參展作品在學術研究方面之氣息相當濃厚，整個作品主要是研究有機金屬化合物之反應結構鑑定，對基礎化學科學領域提供了重要資訊，對一個高中生而言，是一件水平相當高之作品，本作品可以繼續往醫藥或催化方面作深入之研究，值得期待

Music Without Media A Hard Drive based MPEG audio player 泛太平洋地區國家參加第四十屆中小學科學展覽會一等獎 加拿大Kelowna Secondary School 作者:Michael Nevfeld 指導老師:John Moxor data off an EPROM and send it to the decoder, whose output was connected to the DAC. The circuit worked, proving that the 8051 would be fast enough to read CD-quality MP3 files and that the MAS3507 was capable of decoding them. To interface an IDE hard drive to the 8051, I added an 8255 I/O chip and wired its I/O lines to the sixteen IDE data lines. I programmed the 8051 to manipulate the control lines in order to read information off the drive. Next, I programmed routines to write to the disk data received over a serial cable by the microcontroller. I wrote a playback program to read data from the disk and send it to the decoder. I created a simple file system that could keep track of the locations of individual songs, allowing song songs to be individually accessed with the press of push buttons. I also wired an LCD display to the IDE bus and programmed it to display the song title and status during playback. Next, I added an infrared detector and programmed the 8051 to decode signals produced by a remote control. With the system working on wire-wrap boards, I designed a printed circuit board that could fit in a compact case. **1.Purpose** The purpose of this project is to create a device capable of storing and playing back large amounts of music by compressing it under the MPEG(Motion Picture Experts Group) Layer 3 audio compression format and storing it on a Hard Drive. This allows the equivalent of many CDs to be stored on a small, compact unit, without having to change CDs each time the music from one is played.**2.Procedure** Obviously, the system would require a microcontroller, and since I had some experience with the Intel 8051, I used it. For the decoding of the MPEG data, I chose the Micronas MAS3507 MPEG decoder chip. With these parts, I assembled on solderless breadboards a circuit to read MPEG

moment. This shortened point is the value of kinetic frictional force and it is maintained until the puller stops moving. Fourth, the fluctuation of friction per time is recorded on the graphic paper.

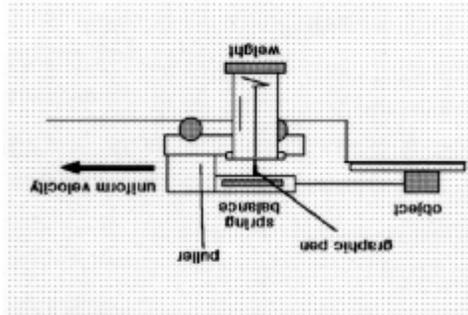
b. Function

- 1) The drawing of realtime friction graph that we can see in the physics text.
- 2) The repetition of experiment.
- 3) The control of velocity of a puller.
- 4) The exact measurement of maximum static frictional force and kinetic frictional force.

3. Measurement of the value of friction with the friction grapher.

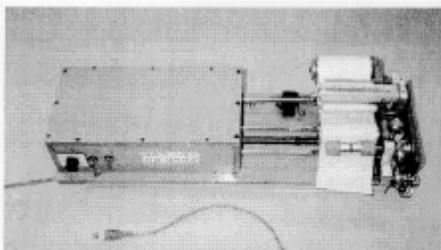
a. Connection of friction and weight of object (150g, 200g, 250g, 300g)

b. Connection of friction and bottom dimension of object (4×11cm, 6×11cm, 8×11cm, 10×

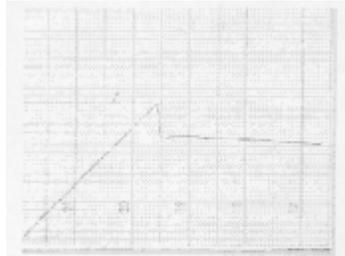


11cm, 12×11cm) 2 2 2 2 2

a design of the equipment



The equipment for drawing friction graph (friction grapher)



An example of the friction graph drawn by the equipment

2

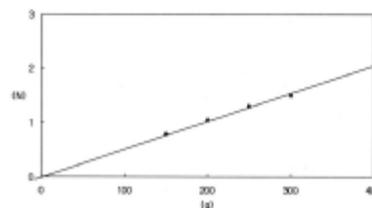
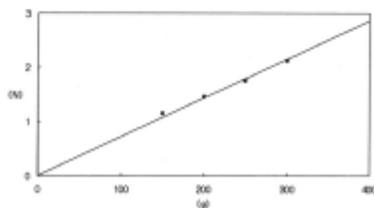
c. Connection of friction

and property of bottom surface d. Connection of friction and speed of a puller C. Data 1.

Connection of friction and weigh of object (surface: strawboard, bottom dimension: 8×11cm)



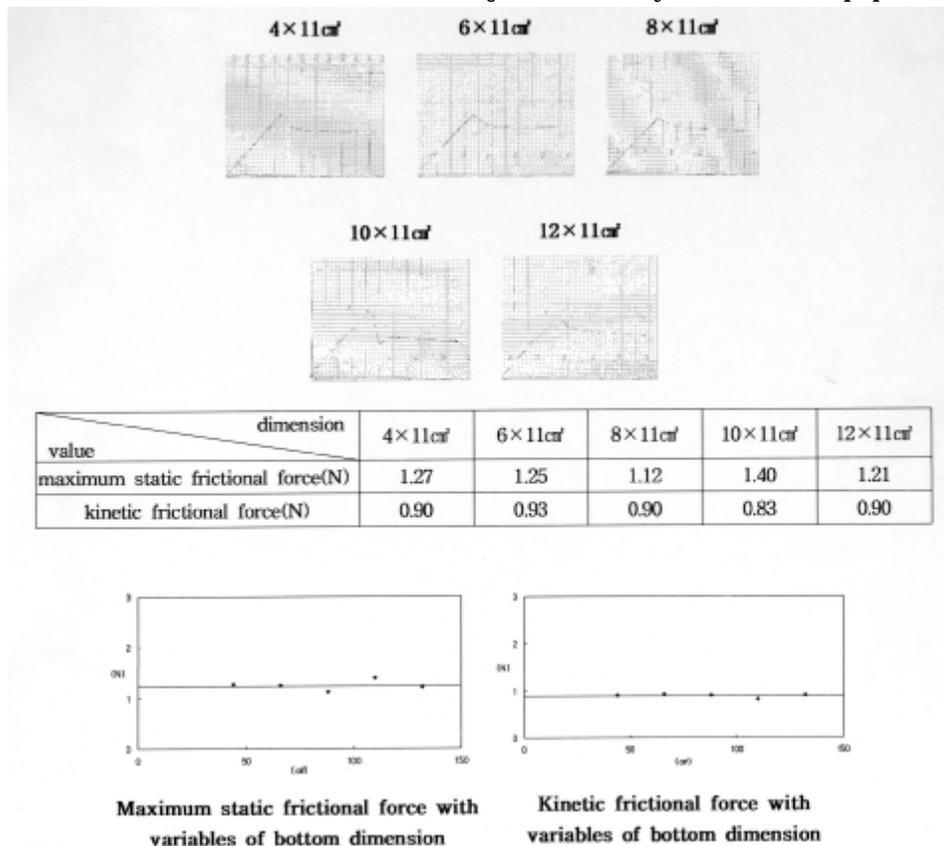
weight	150g	200g	250g	300g
value				
maximum static frictional force(N)	1.16	1.46	1.76	2.13
kinetic frictional force(N)	0.79	1.05	1.31	1.50



Maximum static

frictional force with variables of weight Kinetic frictional force with variables of weight The value of friction is in proportion to weight of object.

2. Connection of friction and bottom dimensions of object (surface: yellow-colored paper,

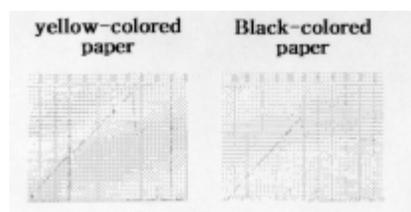


weight: 300g)

The value of friction has no concerned with bottom dimension.

2 3.

Connection of friction and property of bottom surface (weight: 300g, dimension: 8×11cm)



friction \ surface	strawboard	hard-board	gray-colored paper	yellow-colored paper	black-colored paper
maximum static frictional force(N)	2.14	1.82	2.10	1.82	1.96
kinetic frictional force(N)	1.41	1.15	1.66	1.32	1.21

The calculation of coefficient of friction with next physics formula

$$\left(\mu = \frac{F}{mg}, \mu = \text{coefficient of friction}, F = \text{friction}, m = \text{weight}, g = \text{gravitational constant} \right)$$

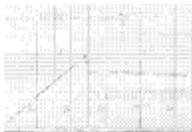
coefficient \ surface	strawboard	hard-board	gray-colored paper	yellow-colored paper	black-colored paper
coefficient of maximum static frictional force(N)	0.73	0.71	0.62	0.82	1.96
coefficient of kinetic frictional force(N)	0.48	0.39	0.56	0.45	0.41

The coefficient of friction is different at different surface.

2 4. Connection

of friction and speed of puller (surface: strawboard, weight: 200g, dimension: 8×11cm)

Speed : 1



Speed : 10



friction \ speed	1	2	3	4	5	6	7	8	9	10
kinetic frictional force(N)	1.12	1.12	1.12	1.09	1.09	1.12	1.12	1.12	1.12	1.12

The value of kinetic frictional force has no concerned with the speed of a puller.

5. The Property of friction (with friction grapher) a. The value of friction is in proportion to weight of object. b. The value of friction has no concern with bot tom dimension. c. The coefficient of friction is different ay dif ferent surface. d. The maximum static friction force is always larg er than the kinetic frictional force. e. The value of the kinetic frictional force is al ways regular. **D. Conclusion** This experimental equipment is able to mea sure the values of friction exactly. In addition it shows the basic properties of friction. Therefore, it is ex pect ed to be widely used as an experimental equip ment on friction at every level of schools. 評語 利用穩定的馬達轉動記錄紙作為時間軸，設計精巧的裝置演示由靜摩擦轉變為動摩擦的現象，演示效果良好。對於示例的圖示所表現的現象，能以彈簧的特性作正確的解釋。

Transformation of A.C. Power 南非 Parktown High School For Girls 作者: Monique Carine Howse 指導老師: S Moffat **3.Data** * Carry out Voltage, Current, Thermal and audio/ vibrations tests on loaded and unloaded transformer. * Rrcord data which was compared to the design requirements and parameters that would be used to assess the design and constructional accuracy. **4.Conclusions** * The transformer :- met the design Voltages, has good regulation, is extremely quiet in operation, is thermally stable, and has good pri ma ry/ sec ondary and earth separation. * A working transformer was constructed to my de sign out of available and low tech materials. * I achieved what I set out at do. **1.Purpose of The Research** To construct a well regulated, quiet, under-stressed transformer out of readily available materials, to run off a 12 Volt

A.C. supply and deliver secondary Volt ages of 4, 6 and 8 Volts at a 1 Ampere load across each secondary winding. **2.Procedures** * For ease of construction and good characteristics a Toroidal form of transformer was decided upon. The following had to be established, calculated and executed : * The total primary and secondary loads. * The core cross sectional area, turns per Volt and total amount of turns on all coils. * Establish whether available copper wire would be adequate to carry the required current. * Insulate, isolate and impregnate the transformer. **評語** 本件作品主要在設計建造安靜、穩壓又不會產生太多熱的變壓器。作者利用一般材料，適當的考慮線圈圈數，螺管截面積，負載大小，造成前述之目標，完成作品。有正確的解決問題的方法與態度。

Vexing Variability of St. John's Wort 泛太平洋地區國家參加第四十屆中小學科學展覽會二等獎 加拿大 W. J. Mouat Secondary 作者:Meredith A. Soon 指導老師: T. Homoncik trial. Using the DAC 86 assay method , the amount of sample containing 0.5 mg of hypericin was calculated and weighed. Twenty-five mL of methanol was added, and the samples were sonicated and filtered to extract the hypericin. Five mL of the sample was then diluted to 25 ml with methanol, and absorbance was measured with the UV spectrophotometer. Hypericin content was calculated and compared to the label claim. The presence of hypericin was confirmed by thin-layer chromatography using the USP assay method. Weight uniformity, content uniformity, and intra-assay variability were calculated. Precautions listed on the products were noted as consumer information. **4.Data** The potency of the ten St. John's Wort products varied between 0% to 124%. Only two of the products fell within +/-10% of the label claim. Five of the ten products contained between 80% and 120% of the labelled amount. Surprisingly, one product had 0% of the labelled hypericin content. Two products showed a wide fluctuation in unit weight. Content uniformity varied between 77-87% for individual units. The coefficient of variability assessing assay technique was acceptable at 2%. **1.Purpose** The purpose of the experiment was to determine the accuracy of the label claim of hypericin content in ten different Canadian St. John's Wort herbal products. **2.Hypothesis** If the measured hypericin content in the St. John's Wort samples was within a 10% range of labeled potency, then the product was considered within quality control expectations. **3.Procedures** Ten St. John's Wort products were obtained. Two trials with 20 units from each of the products were prepared, with three samples measured from each

5.Conclusions The potency of St. John's Wort varied from 0% to 124% between manufacturers. Only two products fell within the

10% range of the label claim. Remarkably, one of the products had no measurable standardized hypericin present. This was confirmed using thin-layer chromatography. Consumers should be aware that herbal products do not have the same quality control regulations as prescription drugs in Canada. 評語 參展作品相當生活化，主要利用UV光譜儀測量加拿大有關St.John's Wort產品中hypericin含量，雖簡單，但也提供了生活周遭相關訊息，整個參展作品也相當完整。

TEC House 泛太平洋地區國家參加第四十屆中小學科學展覽會二等獎 香港 Cheung San Wan Catholic Secondary School 作者: 陳棗烈Chan Cho Lit 鄧灝賢Tang Ho Yin 指導老師: 余浩霖Yu Ho Lam 怎樣可以隨著溫度改變而改變電流的方向呢？我們採用了恆溫器（thermostat）。此外，為了加速溫度的調節，我們安裝了風扇促進空氣的流動。它也有重量輕，結構簡單，工作安靜等優點。而且它不需要傳統的壓縮機和制冷劑（CFC），不僅安全，而且不會破壞大氣層。加上節省電力，做到能源節約，對環境的污染減到最低。珀貼爾效應即使在真空和無重的狀態下也能發揮作用。我們希望通過這著效應的廣泛應用，改善家居環境，提昇人們的生活質素，並為人們的生活帶來更多的方便，同時減少對環境的污染。1834年，法國物理學家珀貼爾（J.C.A. Peltier）發現，當有電流通過兩個不同導體組成的電路時，除了產生焦耳熱外，在不同的接觸處分別出現吸熱和放熱現象。這就是珀貼爾效應（Peltier Effect）。金屬的這兩種效應並不明顯，所以這兩種效應並未被廣泛應用，隨著在1930年代半導體的發現及半導材料的不繼改良，這效應的實用價值越來越高。電腦中央處理器（CPU）的散熱氣正式運用了珀貼爾效應。我們用珀貼爾效應設計了一個太陽能恆溫屋，此屋的特點是雙層，提高保溫的效果。我們運用太陽能作為電源，利用太陽能收集板（solar panel）收集太陽光，並以蓄電池將能量儲起。當電流通過TEC時便能產生吸熱和放熱（視乎電流的方向）的效果。當天氣冷時TEC便在屋內放熱，相反，當天氣熱的時候TEC便發揮散熱的功用，從而達至恆溫的現象。

Length Frequency Measurement 汶萊 Sayyidina Ali & Almuhtadee Billah 作者: Abdul Rahman Dr.Hj Hamit Nurul Ozliana Osman 指導老師: Kamini graph. The graphical result was plotted with the frequency of the length drawn against the weight of the fishes. One of possible applications of the result was that the weight of the certain species of fishes could be determined

by only knowing their length. Other applications may include determining the life span of fishes as well as estimating the fish reserves in order to manage a sustainable development. As a conclusion, this project has exposed the students to conservation of water resource not only for the benefit of the present generation, but more importantly. This project would be focussed on the systematic collection and definition of scientific data. The purpose of this project was to measure and determine the length frequency of fish species using the Biological Date Collection Method. The fish species include *prechiantus macarunthus*. *Prechiantus tayenus* and *Nemipterus protochantus* found in Muara, Brunei Darussalam. The procedures of this project include identifying the fish species and recognizing the differences between the three fish species such as looking at their colour and spots or certain markings at parts of their body such as the dorsal fin. The procedures also include taking length measurement of these fishes, that is, the Fork length, the Total length and then the Body Depth. The final analysis of the fishes was to determine their weight. The lengths were calibrated in centimeters and the weights in grams. The results were tabulated and plotted on a graph. This research is to study the possible correlation between the body length and the body weight of *P. macarunthus*, a commercial fish species frequently found around Muara, Brunei Darussalam (汶萊). Positive correlation was found and the data will be used for future harvesting guidance. The experimental approaches as well as the presentation of this study are of high quality.

Education: A Solution for The Bilharzia Problem water filtered through the sand and then moved via the connection tube to the empty tank. A scale model of the filter will be exhibited at the science fair. **C. Data** Organic material, other debris and Schistosoma larvae were trapped in the sand while the purified water collected in the other drum. This water was microscopically screened for the presence of larvae; no larvae were found and the water was hereafter regarded as safe for domestic use. Together with this, a video, depicting the life cycle and other characteristics of the parasite was prepared and shown to the people in the endemic areas. This was done to enhance the educational purpose of the project. **D.**

Conclusions It can thus be concluded that if safe water cannot be supplied through ordinary water networks, it can cost-effectively be purified at the homes of all those living in the endemic areas. 南非 Hoer Volksskool Potchefstroom 作者: Petrus DeWet Wolmarans 指導老師: D.J. Wolmarans **A. Purpose** The purpose of this study was to educate people in Schistosomiasis endemic areas to design an apparatus they can use to purify water for household use and by doing so, eliminate schistosome larvae from the water. **B. Procedure** The procedures used for this investigation included a thorough study of the life cycle of the Schistosoma parasite as well as the characteristics of these larvae that penetrate the skin of human beings. Using these characteristics, a water purifying apparatus was designed to get rid of Schistosoma larvae and to produce safe water that can be used for washing clothes, bodies, etc. This apparatus consists of two 200L plastic containers interconnected by a pipe. The one drum was partly filled with river sand. Water, collected from a natural habitat, was carefully transferred to this drum. The

Reuse of Treated Municipal Waste water in Urban Agriculture: A Hydroponics Study 新加坡 Temasek Junior College 作者: 許欣慧 Khaw Xin Hui 指導老師: 李麗仙 Lee Lih Sin This project was to evaluate the feasibility of using treated municipal wastewater for growing hydroponics vegetables. Two different types of wastewater effluents namely primary and secondary effluents, were used to grow Chinese cabbage and butterhead lettuce for 32 days to

determine their reuse potential. As nutrients, especially nitrogen and phosphorous, in the waste water are essential to plant growth; they would be removed while the plant grows. The resultant effluent was cleaner and thus could be reused or discharged into the rivers with minimal treatment. Growth data showed that lettuce grew to maturity whereas in Chinese cabbage it was severely inhibited. Tissue analyses also revealed that shoots contained higher levels of macro elements, while roots accumulated higher concentrations of trace elements.