4　バングラデシュ　ハイスクール調査報告

「BANGLADESH HIGH SCHOOL調査報告書」 1994. 12月

――理科教育の現状――

調査報告者　5/1K

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Ⅰ．1．はじめに

1993年7月から青年海外協力隊員として、バングラデシュに赴任した私は、理数科教師（Science Teacher）という位置付けで、チッタゴン郊外の農村地帯にある私立のHigh Schoolで同年9月から勤務することになった。

日本で高等学校の理科教師として働いていた私にとって、この新しい勤務校の環境はあまりにも貧弱に思われた。狭い教室に身を寄せ合うように座る生徒達、電気もなく、雨の日には薄暗い中で蒸し暑さに耐えながら、小さく汚れた黒板に目をこらさなければならない姿。私に要請されていたのは配属校の理科教員に対する実験指導であったが、実験室はなく、器具・薬品もほとんどないという状況であった。

はたして、バングラデシュの教育はどのような環境で行なわれているのか、教員は何を目指しているのか、生徒は満足して学校に来ているのか等々の疑問が浮かんできたので、多くの学校を見て回りたいと希望した所、幸いにも教育省のDirector –General of High & Secondary Education及び配属先校長の双

方から紹介状を得て、計50校の High School を訪問することができた。

理数科教師という職種の関係上、理科関係の項目が重点的になっている点や調査した学校がバングラデシュの平均的なHigh Schoolから偏っていないとは言い切れない点などバングラデシュの中等教育全般を論じるには問題があるが教育環境の現実の一つの姿として、お読み頂きたい。

なお、資料として BANBEIS (Bangladesh Bureau of Educational Information and Statistics) 発行の「EDUCATION SYSTEM OF BANGLADESH」、「BANGLADESH EDUCATIONAL STATISTICS, 1991」を使用した。

2．調査目的

この調査によって、

・バングラデシュの理科教育並びに理科教員の技術水準の把握。
・理科教育の実施形態（授業・実験の頻度、形態）の調査。
・実験施設、器具、薬品等の設置・充足・活用状況の確認。
・理科全般に関する教員・生徒達の認識の理解。

等が図られる。

また、副次的にバングラデシュ国内 High School JOCV の紹介がされ、活動への理解が得られる。

3．調査方法

訪問による直接聞き取り調査（アンケート用紙使用）。

および実験室の視察。

4．調査時期・調査校数

1994年1月～11月にかけて合計50校の High School (*) を調査した。

調査校名は別紙参照。

＊バングラデシュ国内の Secondary レベルの学校は約12,000校。

II．バングラデシュの教育制度

1．バングラデシュの学校システム

初等教育である Primary School は6歳次より始まり、5年間の就学期間がある。各学年はクラス (Class) と呼ばれ、Primary School は Class I ～Vに相当（第1学年～第5学年）する。

Primary School 終了後、Secondary Education（中等教育）を受けるわけであるが、一般には5年制の High School (Class VI～X、第6～第10学年) へ進学する。なお、少数ではあるが、Class VI～VIIIの Junior High School も存在する。

Primary, Secondary とも学年毎に定期試験があり、Class III以上では落第もある。

職業訓練校の中には、Class VIIIまでの終了を入学資格としている学校もあるので、Class IXへ進級せず、その方面へ進学する生徒もいる。

Class IX及びXでは人文科学と自然科学のどちらかを選択する。

Class Xが終了した所で、S. S. C. (Secondary School Certificate*) と呼ばれる公的な試験がおこなわれ、これに合格することが、College 及び多くの職業校（Vocational Institute）への入学となる。

College はまず2年制の Intermediate College があり、それが終了した時点で生徒は H. S. C. (Higher School Certificate*) と呼ばれる公的な試験を受ける。これに合格すると Degree Collete 及び University への入学資格が得られる。

これらで2年が終了すれば「Bachelor」、3年が終了すれば「Honours」の資格が得られる。更に「Bachelor」から2年間、「Honours」から1年間教育を受けると「Master」の資格が得られる。

Primary の第1学年から通算して16年間である。

なお、イスラム教徒の為の Madrasah Education と呼ばれる教育システムも存在しており、初等教育から順に、Ibteayee（5年）、Dakhil（5年）、Alim（2年）、Fazil（2年）、Kamil（2年）となって、やはり16年で「Master」に相当する資格を得ることができる。

＊S. S. C. と H. S. C.

バングラデシュの Secondary Education の終了認定試験である。

学校で学習した科目から自分のコースにより科目を選択し、1,000点満点である。各科目とも満点の33％以上の得点を取らなければ合格できない。60％以上で1st Division、45％以上で2nd Division とランク付けされる。また、75％以上は Star、全科目は80％以上は Letter と呼ばれる。

2．授業料

公立（国立、Government High School）においては、以下の様に規定されている。

Class Ⅵ――――10TK. ／月

Class Ⅶ・Ⅷ――12TK. ／月

Class Ⅸ・Ⅹ――15TK. ／月

私立においては、若干の差があるが、多くの学校では以下の様な金額に設定されている。

Class Ⅵ――――20～25TK. ／月

Class Ⅶ・Ⅷ――25～30TK. ／月

Class Ⅸ・Ⅹ――30～35TK. ／月

なお、今回の調査校中、最も高額だったのは、ダッカ市内のある女子校で、Class Ⅹの授業料が170TK/月であった。

ただし、公立・私立とも1993年度までは Class Ⅵ～Ⅷ.

1994年度は Class Ⅵ・Ⅸの女子生徒の授業料を政府が補助している。

3．High School における一般科目と標準時数

Class Ⅵ～Ⅷ

科　目	標準時数
ベンガル語　Ⅰ	6
ベンガル語　Ⅱ	4
英　　語　Ⅰ	6
英　　語　Ⅱ	4
数　　学	6
理　　科	4
社　　会	4
宗　　教	3
農業（主に男子）	3
家庭科（主に女子）	3

Class Ⅸ～Ⅹ

必修科目	標準時数
ベンガル語　Ⅰ	6
ベンガル語　Ⅱ	4
英　　語　Ⅰ	6
英　　語　Ⅱ	4
数　　学	6
理　　科	4
社　　会	4
宗　　教	4
地　　理	3
歴　　史	3
選択科目（＊）	**標準時数**
経　　済	3
政　　治	3
数　　学	3
簿　　記	3
食物栄養	3

＊2科目選択

4．教員トレーニング

バングラデシュにおいては、教員免許（License）は存在しないが、教員トレーニングを行なっている機関がある。

Primary レベルに関しては、Primary Training Institutes (P. T. I.)、Secondary レベルに関しては、Teacher's Training College (T. T. C.) が一般的である。この他に職業訓練校の教員トレーニング、短期の特定科目のトレーニング等を行なっている機関もあるが、ここでは、T. T. C. について述べる。

T. T. C. は全国に国立10校（＊）、私立1校があり、そこで、10カ月間のコースを修めると「Bachelor of Education」の資格が得られる。

このトレーニングコースには、政府からの補助があり、受講生は学費を払う必要がなく、かつ、月額

330TK.（タカ）の手当てが支給される。

このトレーニングコースの受講者の多くは現職教員であり、彼らの教育技術の向上を図っている。

科目は以下の通り。

1．必修科目
- ・教育原理
- ・教育心理学
- ・教育の歴史
- ・教育統計（評価）
- ・教育と国の発展

2．選択必修科目
High School の科目から２科目選択

3．教育実習
High School において２カ月間

しかしながら、問題点として、
- ・受講資格が「Bachelor」以上の為、大学卒以外の人間は現職教師でも受けることができない。
- ・各 T. T. C. の収容人数が少ない為、なかなか受講できない。
  (最も人気の高いダッカ T. T. C. の倍率は30倍である。)
- ・地方の T. T. C. においては設備が不十分である。

といったことが挙げられる。

(*) 国立 T. T. C. 設置都市

ダッカ、マイメイシン (2)、チッタゴン、フェニー、コミュラ、 ラジシャヒ、ジョソール、クルナ、ロンブール

III. 学校全般に関する調査結果

1．生徒数

生徒数　（人）	公立校	私立校
250以下	0	3
251～500	3	12
501～750	1	9
751～1,000	2	3
1,001～1,250	4	1
1,251～1,500	2	1
1,501以上	3	5
学校数計	15	34

＊1,501人以上の内、７校は午前・午後で生徒の入れ替わる２シフト制の学校

2．教員数

人	公立校	私立校
6～10	0	7
11～15	1	15
16～20	0	4
21～25	4	2
26～30	1	1
31～35	0	1
36～40	0	1
41～45	0	1
46～50	6	0
51～	3	2
学校数計	15	34

＊46人以上の学校の内、11校は２シフト制の学校。

3．教室数

教室数（室）	公立校	私立校
5以下	0	2
6～10	1	18
11～15	7	7
16～20	5	2
21～25	1	0
26～30	1	2
31～35	0	2
36～40	0	0
41以上	0	1
学校数計	15	34

私立の最も多いグループは６～10室である。これは各学年２組の授業編成が可能な数ある。学年や男女によりそのような編成が必要な場合がある。

4．出席率

%	公　立	私　立
50～60	0	4
61～70	1	6
71～80	5	13
81～90	7	9
91～100	2	2
学校数計	15	34

5．卒業率

%	公　立	私　立
40～50	0	3
51～60	1	2
61～70	0	5
71～80	3	5
81～90	1	8
91～100	8	6
学校数計	13	29

High School の課程を一応学習したものということで、卒業率を尋ねたが、私立は50％以下から100％近くまで幅が広い。概して、農村部ほど数字が低く、都市部に近づくにつれ高くなる。

6．教員給与

ここでは、校長を除く一般教員の平均給与（政府補助を含む）について集計した。

平均給与（TK.）	公立校	私立校
1,501～2,000	0	7
2,001～2,500	0	6
2,501～3,000	0	11
3,001～3,500	3	2
3,501～4,000	2	1

平均給与（TK.）	公立校	私立校
4,001～4,500	2	0
4,501～5,000	2	1
5,001～5,500	2	0
5,501～6,000	2	0
学校総計	13	28

私立の教員の給与は、政府の補助が70%、各勤務校から30%という規定があるが、公立に比べ、約20%程低いという結果が出た。

Ⅳ．理科教育に関する調査結果

1．理科教員数

人	公　立	私　立
2	0	4
3	1	10
4	3	8
5	1	4
6	0	1
7	1	1
8	0	1
9	1	0
10以上	5	1
学校総計	12	30

2．理科教員一人当たりの生徒数

人	公立校	私立校
41～ 80	3	1
81～120	4	7
121～160	4	9
161～200	1	4
201～240	0	4
241～280	0	3
281～320	0	1
321～360	0	1
361以上	0	1
学校総計	12	31

私立のばらつきが大きい、200人を越える状況では、教員を増員した方が良いと思われる。

なお、調査では理科教員を「Science Teacher」としたため、数学を担当する教員が入っている場合がある。また、理科教員も他の教科を担当している学校が多い。

3．教員トレーニングを受けた理科教員数及びトレーニング率

教員トレーニングを受けた理科教員数

人	公　立	私　立
0	0	1
1	0	5
2	2	8
3	1	6
4	3	6
5	0	1
6	0	1
7	1	0
8	1	1
9	0	0
10以上	4	1
学校数計	12	30

トレーニング率

%	公　立	私　立
0	0	1
1～20	0	1
21～40	0	5
41～60	3	1
61～80	2	7
81～99	1	0
100	6	15
学校数	12	30

教員トレーニングを受けていた者が意外に多かったが、それでも、公立で若干、私立では20%程がトレーニングを受けていない。

4．理科実験室数

室	公　立	私　立
0	0	8
1	3	22
2	2	3
3	7	1
4	1	1
学校総計	13	35

公立の多くが2～3室であるのに対し、私立は圧倒的に1室であり、2割強の学校には実験室がない。

5．実験回数、形態、実験時生徒人数

(1) 理科実験回数

回　数	物理分野		化学分野		生物分野	
	公	私	公	私	公	私
0	0	2	0	2	0	2
1～3	0	1	0	4	0	1
4～6	8	16	8	16	0	1
7～9	1	4	1	1	1	4
10～12	3	2	3	3	3	12
13～15	0	1	0	1	0	4
16～18	0	1	0	1	0	0
19～21	0	1	0	0	5	2
22～24	0	0	0	0	1	1
25～27	0	0	0	0	0	0
28～30	0	3	0	3	2	4

理科の教科書中にある物理6回、化学5回、生物12回という回数に沿った学校が多い。ただし、学校によっては、施設の関係上、生徒を少人数に分割し、実験と講義のグループにして、同じ実験を何回も行わざるを得ない所もある。

(2) 実験形態 (複数回答　公立11校、私立26校)

形　態	個　人	グループ毎	グループ交替	教員演示
公　立	2	5	8	4
私　立	1	12	16	6

形態は公立、私立ともグループ毎またはグループ交替という場合が多い。期間的、設備的な面から、教員演示も利用される。

(3) 実験時生徒人数

人	公　立	私　立
1～10	0	5
11～20	2	9
21～30	1	6
31～40	5	1
41～50	2	4
51～	1	1
学校総計	11	26

実験時における生徒人数は上記の通り、私立の方が人数が少なくなっている (平均20人前後) が、これは実験室 (又はそれに代わる教室) の狭さや器具の不足などから同時に多人数で出来ないという物理的条件による。

6．理科実験名

a) 物理分野

・ドライバー (及びネジ) の構造とその利点
・バネばかりの構造と重さの測定
・ノギスの構造と測定
・ニュートンの第2法則 (F=ma)
・水及び油による熱量と温度の関係 (グラフ化)
・レンズの焦点距離、拡大率の測定
・物質の密度の測定 (質量、体積の測定)
・物質の硬度の比較
・物質の電導性の確認
・電気ベルの構造
・磁力線の確認

b) 化学分野

・混合物 (砂と塩) の分離
・ナフタリンを使った融解・凝固の温度変化 (グラフ化)
・酸とアルカリの性質
・酸素の発生とその性質の確認
・水素の発生とその性質の確認
・二酸化炭素の発生とその性質の確認
・アンモニアの発生とその性質の確認
・混合物の電導性の違いの確認

・電解質の電導性の確認
・水の電気分解
・酸化と還元

c) 生物分野
・顕微鏡の構造とその使用法
・コケ植物、シダ植物の観察
・花、茎、根等の観察
・各種細胞の顕微鏡視察
・光合成による酸素の発生
・葉の蒸散作用の確認
・発芽の要因の確認
・浸透圧の確認（ジャガイモを使って）
・人体骨格構造の確認（模型利用）
・人間の眼、耳、心臓の構造の確認（模型利用）
・カエルの解剖（消化器官等、各器官の確認）
・魚の解剖（各器官の確認）

V. 問題点

バングラデシュにおいても教育の重要性は知識人のみならず一般の人々も広く認める所であるが、学校、教育制度が満足のゆくものとは言い難い。

私の行なった調査はバングラデシュの学校のごくごく一部分であるが、そこから浮かび上がってきた問題点を挙げておきたい。

1) 就学率の低さ

統計によると、Primary School 就学年齢に該当する子供の就学率は、78%である。ほぼ100%に近い日本と比べるには、色々と問題もあるだろうが、まずこの就学を上げることが必要である。政府は2000年までに就学率を95%に上げる目標を設定しているが、基本的に国民の教育に関する認識を高める啓蒙活動を進めるとともに、必要な生徒に対して充分な奨学金を支給するなど、教育政策の大幅な前進が望まれる。

2) Drop-out 率の高さ

せっかく就学した生徒もその半数以上が途中で Drop-out している。
Primary レベルで57%、Secondary レベルで61%もの生徒が学校を去っている。これでは、そもそも就学率を上げても意味がなくなってします。

現在のように、教室にただ座って大量の知識を教科書の暗記で覚え込ませ、試験の時に吐き出せるというやり方では、ついていけない生徒が多く出るのは必然である。また、仮に学校は修了しても身につかないことが多い。

実際、学校を卒業して２～３年経つと学習したことの多くを、中には文字すら忘れてしまうという人々を目にする。

知識の習得はもちろん重要だが、そこに論理的な思考が伴っていなければ最終的に身につくものではない。その場限りの暗記が学習と思われている状況を変える必要がある。

具体的に Drop-out 率を下げる為には、教授法の改善、教科内容の精選、カリキュラムの工夫とともに試験一落第制度を見直すことも必要である。

3) 教育設備環境

私の調査した High School においては、公立と私立との間の格差が大きい。大都市圏では、経営に余裕があり、設備の整った学校もたまにあるが、私立の多くは資金的苦しく、不十分な設備で授業を行なっている状況である。

政府は一部の私立学校に対し、定期的に援助を行なっているが、対象校を拡大する必要がある。また、教員給与の70%補助、一部女子生徒の授業料負担を行なっているが、支給が滞りがちである。私立学校の安定した経営のためにも遅滞は避けなければならない。

4) 教員の質

前述したように、Primary, Secondary それぞれのレベルの教員に対して、トレーニング機関が存在するが、充分なトレーニングが必ずしも行なわれていない。収容人員、設備等の問題もあるが、教授法についてのトレーニングが今後重要視されない限り、現在の教育システムの欠点がそのまま再生産されて、学校現場へ戻っていくことになる。トレーニング内容を検討し直し、かつ適宜改良を図れるようなシステムを導入することが必要である。

VI. まとめ ～教育分野での J. O. C. V. の活動～

これまで述べてきたようにバングラデシュの教育制度、運営に関しては、問題が多い。もちろん、全ての子供に対して完全な教育制度などというものは存在しないが、少なくとも多くの人間が指摘している問題点はただちに改善を図っていかなければならない。

この過程の中で、J. O. C. V. の隊員が効果的にその力を発揮していくことを考えた場合、望ましい活動形態として次のようなものが挙げられる。

a) 教員養成機関で、教員トレーニングを行なう。

b) District 又は Thana の教育庁 (Education Office) に勤務し、周辺現場校を巡回指導する。

a) の場合も可能なら、巡回指導を行なっても良い。

現在のバングラデシュでは、教育設備環境が全ての学校で整っているとは言えず、隊員が満足な活動を行なう為の資金的な裏付けがない場合が多い。隊員の指導する教科が、理科 (理数科)・体育・音楽等の実技教科であることを考えると、この点は時に致命的でもある。私自身の勤務校での活動や今回の調査での結果からもこの点が問題であることが判る。しかし、逆に充分な資金を持っている学校は J. O. C. V. 隊員が必要とされない。

仮に、一つの学校に配属されてしまうと、対象が極端に少人数に限定されてしまう為、効率の良い技術指導とは言い難い。加えて、バングラデシュでは、労働人口の過剰、教員資格が必要ない等の理由から、教員の数を確保できないということはないので、J. O. C. V. 隊員がマンパワー (1教員) として学校の教員不足を補うという状況ではない。

こうした観点から、上記 a) 又は b) の方法により、主に教員の質の向上の為の活動 (技術指導) を進めることが、バングラデシュの教育全体の質を高めることに効果的かつ効率的であると考えられる。

5　ソロモン諸島　中学１年生の理科学力調査

ソロモン諸島国州立セカンダリースクール理科学力調査報告　1995. 1. 8

J. O. C. V in Solomon　理数科教師

セカンダリースクールにおいて理科教育をすすめにあたって、日本とはカリキュラムや設備、器具などに大きな違いがあり当然それらの状況に適した形で進めていかなくてはならない。

その際、生徒の持つ理科の知識や学力がどの程度であるか配慮していく必要がある。多面にわたりできるだけ客観的に把握するために、テスト形式で生徒の基礎知識、学力調査を行うことは有効であると考えられる。このような目的から一昨年、理数科教師隊員により「STANDARD　EXAMINATION」が作成され、実施された。これはその第２回目（94年度の新入生対象）の結果報告である。

《実施時期、実施校》

1994年　　４月～６月

・チョイセルベイ　・シオタ　・パワー
・ボヌヌ　・アリゲゲオ　・ホニアラ

《実施対象・方法》

・各校１年生を対象とする。
　授業時間もしくは放課後の時間を利用し、隊員が１年生を担当していない場合は指導教員に協力を求めた。
・集計は実施したテスト結果をパーセントで示した。

〈テスト実施者〉

・安東　靖貴　(4/1)　ホニアラ　・関口　明美　(5/1)　ボヌヌ
・尾崎　　毅　(4/1)　パワー　・今中　弘毅　(5/1)　アリゲゲオ
・中井　一芳　(4/3)　シオタ　・土取　久美　(5/2)　チョイセルベイ
・安江徹太郎　(5/1)　シオタ

〈出題のねらいと構成〉

セカンダリースクールに入学してくる生徒のもつ基礎知識、学力を調べることをねらいとし、以下のような問題構成

A　小学校理科……小学校教師用テキスト（生徒用のものはない）から出題
　Ⅰ　用語の知識、理解
　Ⅱ　主なトピックについての理解
B　一般常識
　Ⅲ　・日常的な物理化学現象
　　・身近な動植物、自然現象　についての知識
　　・ヒトの体・健康
C　計算問題
　Ⅳ　・四則計算・分数小数計算・単位換算グラフ
※　計算問題意外はすべて選択問題とした。

《理化学学力調査結果》①　1995. 1. 8

Provincial Secondary School (Form1) in Solomon

1．小学校理科用語知識

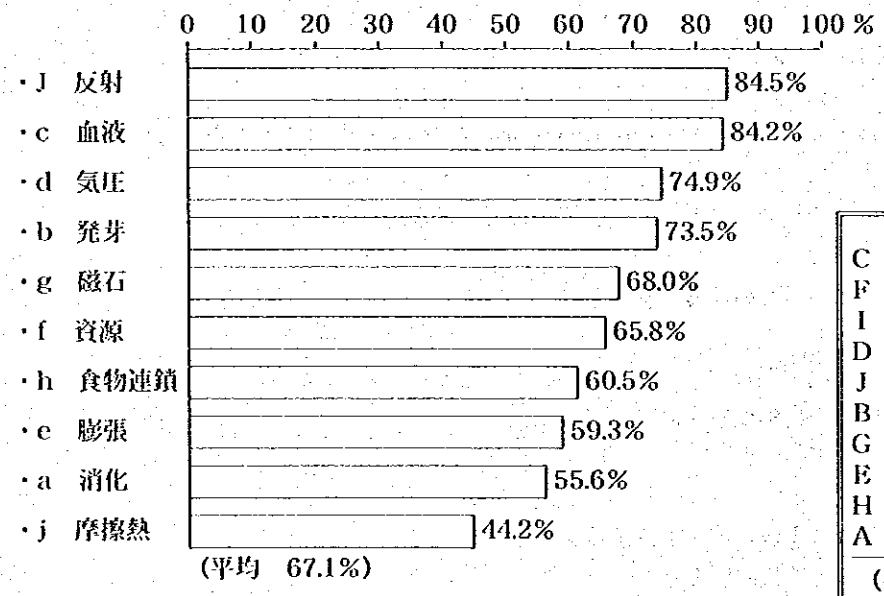
(問題)

I　Match the following words A-J with each suitable sentences 1-10.

		(和訳)	解答
A：	digestion	(消化)	3
B：	germination	(発芽)	4
C：	blood	(血液)	2
D：	airp ressure	(気圧)	6
E：	expantion	(膨張)	5
F：	conservation of natural resource	(天然資源保全)	10
G：	magnet	(磁石)	7
H：	food chains	(食物連鎖)	1
I：	heat from rubbing	(摩擦熱)	8
J：	reflection	(反射)	9

1 Some plants are eaten by animals and these animals are eaten by larger animals
2 Liquid which is going around in the body and carrying oxygen and some foods
3 Softening the food and braking down of food into smaller parts
4 Starting to grow of a seed
5 Substance become greater in size when they are heated
6 Weight of the air in the atomosphere
7 Object which attract iron.
8 When things are rubbed togehter they get hot
9 It means bouncing off of light on surfaces.
10 We shoud not waste living things : (tree, coral, etc.) and non-living things : (petrol, metals etc.)

《結果》



92年度	
C 血液	83%
F 資源	81%
I 摩擦熱	80%
D 気圧	76%
J 反射	76%
B 発芽	74%
G 磁石	65%
E 膨張	56%
H 食物連鎖	56%
A 消化	52%
(平均)	70%

《考察》

・用語は小学校の教師用テキストからのもので、選択文もテキストのものを使用している。一昨年同様に、好成績が得られている。

・「血液」「気圧」などの用語が高い正解率を示し、「消化」「膨張」「食物連鎖」などの用語が低い正解率を示している。これらは一昨年と同じ傾向である。正解率の違いについては小学校の授業での取り扱い、身近な生活との結びつき選択文の理解のしやすさなどの原因が考えられるが、平均で70%近い正

解率を示していることから、今回のテスト程度の理科用語の知識、理解については問題はないように思われる。

・「摩擦」については一昨年の調査で正解率80%だったものが、今年度は正解率が44.2%と低い値になっている。「天然資源保全」についても一昨年81%の正解率が今年度は65.8%と低くなっている。

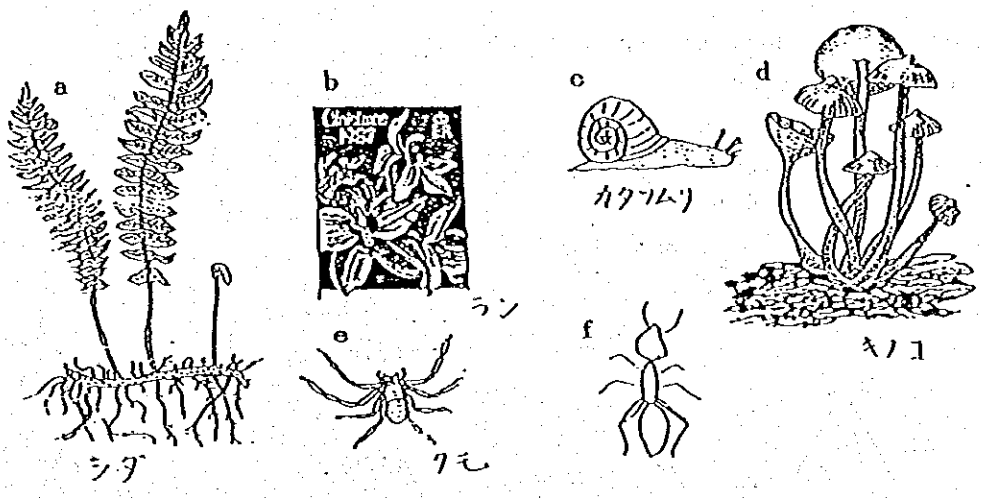
・アリゲゲオの結果は一昨年と同様に、他より明確に低くなっている。

《理科学力調査結果》②

II　小学校理科理解度（実験・観察項目）

(問題)

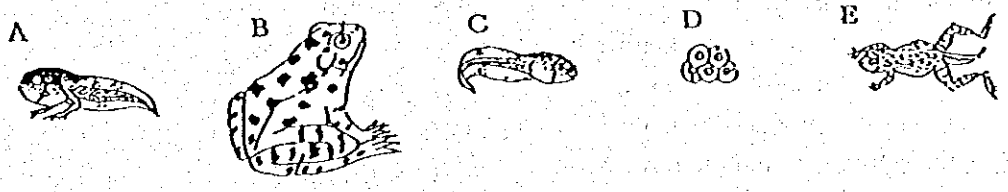
1．Choose the correct name for each figure.



fern, mushroom, orchid, spider, ant, snail, (シダ、キノコ、ラン、クモ、アリ、カタツムリ)

2．The following figurers show the different stages during the growth of a frog.
Rearrange them in order of life cycle.

解答　D→C→A→E→B



3．Next diagrams show a beam balance which can compare the two weights.
Answer the questions.

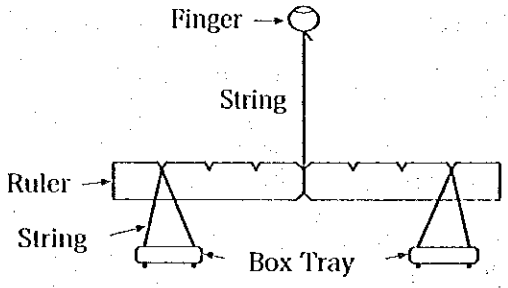
(1) When putting a cat and a dog on the beam balance, it stopped as shown. Choose the correct sentence when we compare the weights of them.

(A) The dog is heavier than the cat.

(B) The cat is heavier than the dog.

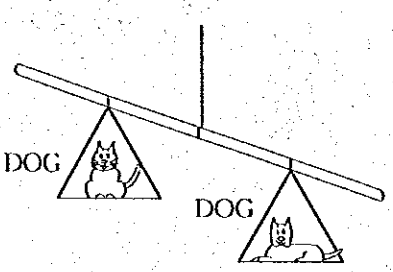
(C) They are the same weight.

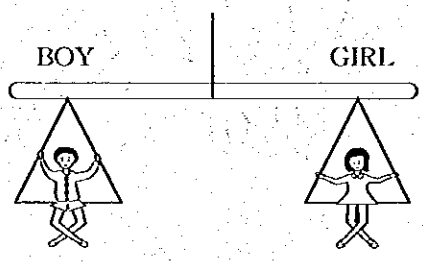
解答　A



(2) When putting a boy and a girl on it, it keeps level.
Choose the correct sentence.
(A) The boy is heavier than the girl.
(B) The girl is heavier than the boy.
(c) They are the same weight.

解答　C



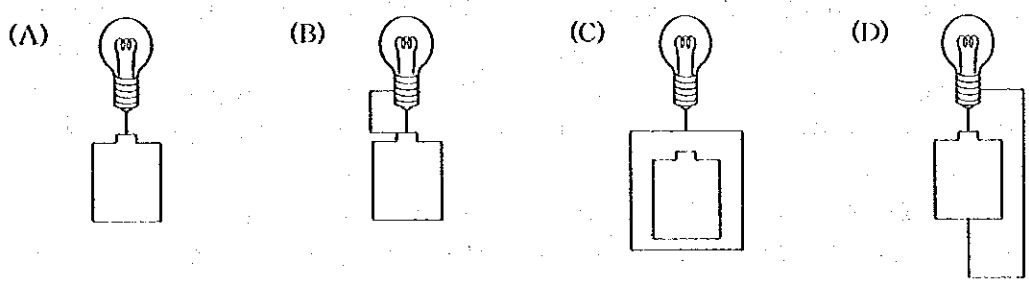


4. Answer the following questions.

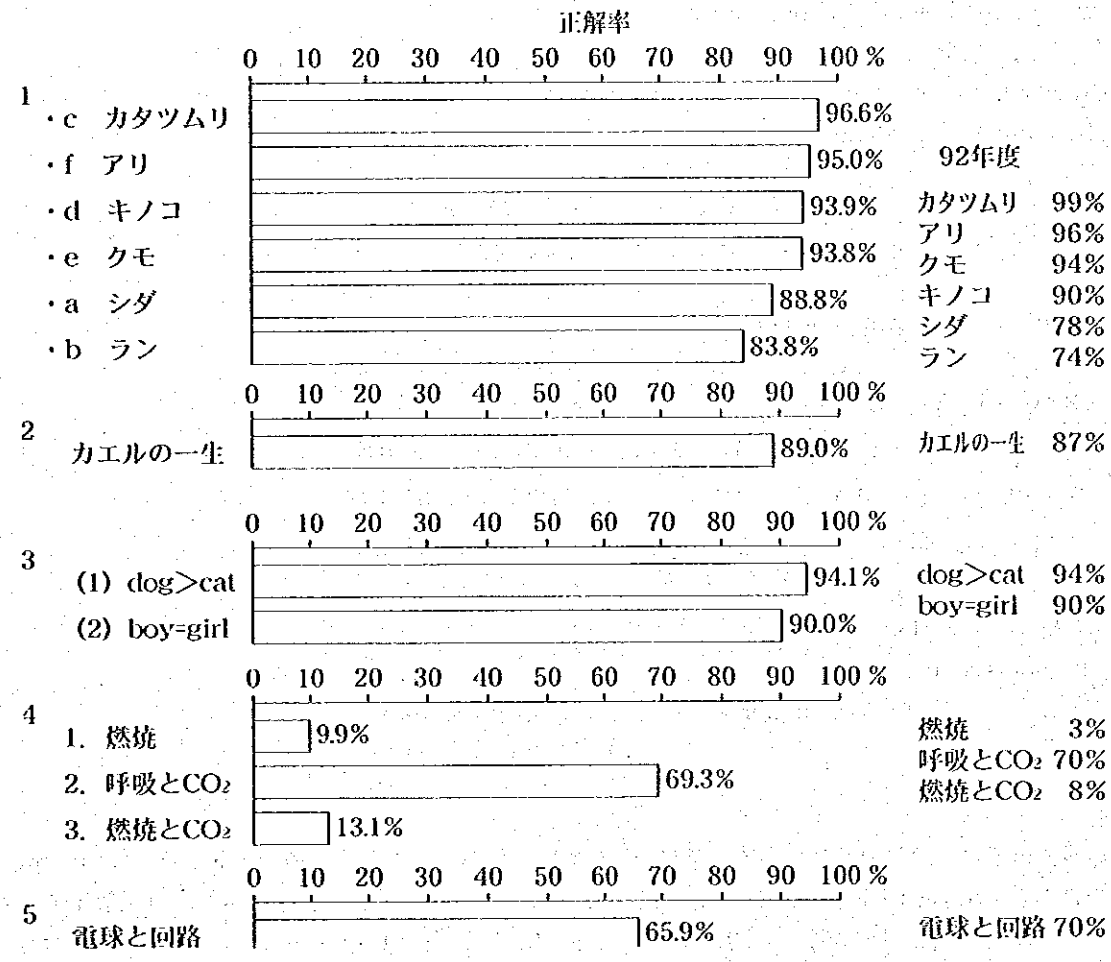
oxygen, hydrogen, carbondioxide, nitrogen, light and heat (酸素、水素、二酸化炭素、チッ素、光と熱)

(1) Which substance is consumed when we burn something?
Choose one substance from the box avove.　解答　oxygen
(2) Which substance is consumed when we breathe?
Choose one substance from the box avove.　解答　oxygen
(3) Which substance is produced when we burn a piece of paper?
Choose one substance from the box avove.　解答　carbon dioxide

5. The following diagram shows the wireing between an electric bulb and a battery. choose one bulb which will light.　解答　D



《結果》



《考察》

このグループの問題は小学校の復習問題である。一昨年と同じ傾向を示しており、正解率が高い。

1．一般に生徒の生き物についての知識は豊富である。

2．大部分の生徒が正解している。自然環境の中で多く目にしているものと考えられる。

3．天秤ばかりによる重さ比べである。

(1) つりあっていないもの

(2) つりあっているもの

どちらも90%以上の正解率であった。生徒の生活の中で修得した知識と問題の答えが一致することから高い正解率となった。

4．呼吸には酸素が必要だということは大部分の生徒が知っている。

燃焼と酸素、二酸化炭素の関連が極端に低い結果となっている。10%、13%という低い正解率は「光と熱」「水素」「二酸化炭素」などの誤答が多かったためである。「光と熱」については問題作成の時に意図したものであったが、「水素」については中1の理科導入段階で行う、水素ガスの爆発実験の印象が大きく影響していると思われる。ある程度の知識はあっても、それが整理されておらず、その結果理解に結びついていない。

5．高い正答率が得られた。生活の中での懐中電灯へのなじみによるものと思われる。

これらのことから定量的な物理現象の取り扱いには十分な注意が必要である。

Ⅲ．数的処理

1　Estimate the height of a coconut tree.

A. 50cm　Ⓑ 15m　C. 50m　D. 50km　　正解　34%

2　Draw a graph acoording to the following table.

The number of students of each age

age	13	14	15	16	17	18	19
number	8	7	10	9	3	0	2

3　Fill up the blanks with correct number.

	正解率	92年度
1)　$2\times6-1\times3=$ (　15　)	85.3%	63.2%
2)　$\frac{1}{2}+\frac{1}{3}=$　(　$\frac{5}{6}$　)	70.0%	46.0%
3)　$0.5-0.05=$ (　0.45　)	57.2%	64.4%
4)　$1\div3=$　($1\frac{1}{3}$, 0.3, 0.33)	17.0%	24.8%
5)　$8\times7\div2-6\div3=$ (　26　)	45.9%	40.0%
6)　1.8m = (　180　) cm	41.7%	51.2%
7)　0.5hours = (　30　) minutes	40.0%	29.6%
8)　1 liter = (　1000　) milliliter	77.3%	70.8%
平均	54.3%	48.8%

《考察》

計算能力の不足は理科の授業の中でも常に問題になっている。しかし今回のテストでは一昨年に比較して各校いくらか正解率が高くなっている。四則計算を組み合わせた問題で平均85%と高い正解率であり、分数の通分に関しても70%と高い正解率であった。小数の引き算についても57.2%の正解率であった。しかし計算能力はやはり不足しており問題となるところである。

単位の換算については40%程度の正解率であり、〔リットル〕をのぞいては、生徒にはなじんでいないようである。グラフについては集計が困難で学校間の差が大きく信頼できるデータが得られなかった。

《結論》

グラフにも示されているように、「理科用語の知識、理解」「主なトピックについての理解」については、高い正解率が示された。特に後者では75.6%と高い正解率になっている。このような形式の学習は生徒にとってなじみやすい。しかしこれらの問題では学校によってかなりの正解率の違いが示されている。

「一般常識」の内容のように理科の知識を応用して正解を求めるような問題ではやはり正解率が低くなっている。このようなことからは生徒にはなじみにくく、指導にあたっては、十分な注意が必要である。

計算に関しても、正解率は低い値になっている。小数、分数、単位などについてはていねいな扱いが必要である。「一般常識」「計算」に関しては学校によっての正解率の違いはそれほど大きくなかった。

THE SCIENCE TEACHER

MSTTP (Mobile Science Teacher Training Program) Newsletter
Published by the
Japan Oversees Cooperation Volunteers (JOCVs)
in Regional Science Teaching Center-
Ateneo de Davao University (RSTC-ADDU)

Volume 1
November 1996

Preface

"What launches the rocket?" "Why does the volcano erupt?" "Why does the *butiki* not fall down from the ceiling?" "Why is a *calamansi* sour?"

Can you answer those questions?

We are Japan Overseas Cooperation Volunteers (JOCV) sent by Japanese government. In Japan,recently more students are saying they don't like science. Do you know why? Because in Japan, the greater part of the science class in high school is spent for solving tricky problems to prepare for the entrance examinatin for colleges. Those students spend less time in experiments and observations. There is little motivation, imagination and stimulation in those science classes. Those students master a lot of techniques in solving tricky problems, but unfortunately they lose their interest and enthusiasm for science and nature.

Fellow teachers, how about your students? Do they like science? Do they enjoy your class? And do you, yourself, enjoy teaching them science?

You may have many students who find science quite difficult and uninteresting. Perhaps you may feel the same way because of the misconception that the most important thing in science is to memorize the scientific terms, laws and equations. Could it be, however, that the role of us science teachers is to guide our students so that they can comprehend and appreciate Nature. We can do this not so much through memorization or calculations, but through experiments and observations that may be tied together with the students' daily experiences and the basic concepts of science. We cannot teach science by chalk and talk alone.

We JOCV are here to serve you. We came here to share with you some simple, inexpensive, yet interesting activities that you can conduct in your classroom. We hope to work with you so that you can make more students "crazy about science".

This newsletter is compliments of our MSTTP (Mobile Science Teacher Training Program). Articles about some improvised materials, quizes, interesting activities and investigatory projects will be included. We hope this newsletter will become a means of communication between you and us. We would be delighted to receive your reactions and suggestions and we would love to publish your own insights and experiences.

GENERAL SCIENCE

In the first lecture of General Science, I took up the microscopic world entitled "Let's feel the existence of molecules!" As we can't see the atom and the molecules with our naked eyes, it is very difficult for both teachers to teach it and for students to study it. So in this lecture, I thought out that we could imagine the three states of the matter through conducting some experiments and observations using the familiar and simple materials. I think that you found it hard to understand my English. But you listened to my lecture for a long time without a rest. So I was happy and want to say again, "Thank you very much."

In this lecture, I used many pictures to explain each experiment. One teacher said to me that he needed some sentence for explanation in his class. Surely you may be afraid of the handout without the sentence for the explanation. However I think that you could remember how to make experiments that I introduced, when you see those handouts in your school again. For us simple and clear pictures are easier than long and difficult sentences to remember the experiments later. There are the detailed explanations in the textbook. In the case of everyday class, we should not only copy the textbook on the blackboard and make students read the textbook but also explain in easier expressions using pictures, charts and graphs.

For students, it must be boring to keep sitting until the end of the class. So we had better introduce some demonstrations or make the students think interestingly by giving the real thing.

Keeping above-mentioned thing in your mind, I introduced two demonstrations using the candle in this lecture.

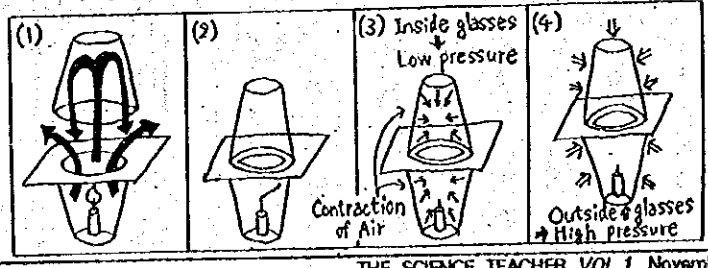
About the first demonstration using two glasses, I would ask you for the reason why the two glasses stuck together. But many of you have answered only the reason the candle in the glass went out. Of course, the reason the candle went out is the lack of oxygen in the glass. There are some reasons about the stuck glasses. One of the main reason is follows:

(1) The air in the glass is driven out by the warm air produced by the burning candle.

(2) After two glasses put together, the burning candle goes out resulting in a reduction of temperature.

(3) The air in the glass contracts because of cooling, and the pressure inside is reduced. The wet paper acts as a gasket not allowing air from outside to enter.

(4) The atmospheric pressure outside the glass is greater



than the air pressure inside the glass. So two glasses can't separate by the power of the atmospheric pressure.

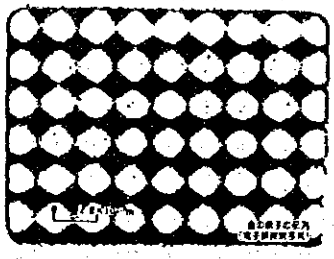
If you try to make this demonstration, you will observe that the air is sucked into the glass through the gap between the glass and the wet paper when the two glasses are pulled apart.

About the second demonstration of the candle seesaw, if you have an opportunity to observe that candle closely and carefully, you can understand the reason why the candle keeps on moving like the seesaw. Please think about it with your students. If you can't understand the reason, please ask me directly at the next lecture.

With this newsletter, I enclose your activity sheet which I collected during the last lecture. I noticed all handouts are very good. There were many observations using the five senses. I was surprised to notice that one participants tried to check the temperature of the flame with the finger. I know very much that all participants understand the importance of doing experiments and observing something for students. I want to use the information from the handouts as a reference to decide who should be my counterpart. Later on I may ask some teachers to allow me to observe their classes, and I hope that you accept my request readily.

I would like to announce now that my next topic of General Science will be "Ecosystem and Environmental pollution" from the Biology field. I want to speak mainly about soil and water. Please be looking forward the next session.

Finally I introduce a picture as an example that we can see the image of the atom in visual if we make full use of the most advanced technology. This is the picture of the solid gold atoms by the electron microscope. You can see each atom that lines up regularly. We have already taken such a clear picture. The distance between two atoms is about 0.00000028mm. In the future we may see the real action of atoms and molecules using the audio-visual aids like the videotape.



BIOLOGY -Osmosis in living organisms-

Thank you very much for your attendance at our last training program in Biology. I was very happy that I had many participants and I enjoyed myself with you very much. Through this training program, I want to introduce to you some interesting and easy activities and experiments. And also I want to share in your knowledge and experiences. I am looking forward to meeting you again at the next training program.

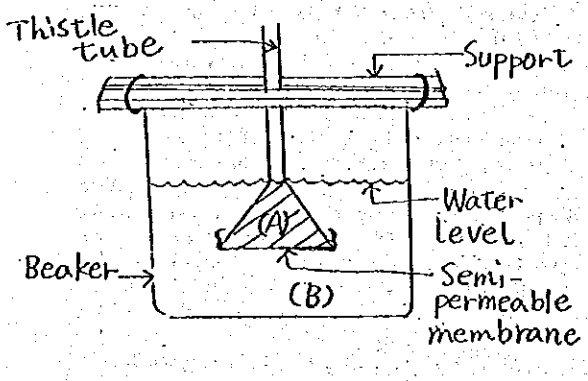
Let's review the last topic.

Do you remember the last topic? Yes, that was osmosis. We observed osmotic influence through the weight change of a potato slice. Now, let's review osmosis again.

What is osmosis?

Suppose that we prepare equipment like the illustration.

We place a 20% sugar solution in the thistle tube(A) and



place distilled water in the beaker(B). Adjust the height of the thistle tube to make the water level inside and outside the same. The bottom of the tube is covered with a semi- permeable membrane (e.g. cell membrane). What will happen?

Remember the nature of a semi-permeable membrane. It allows certain substances to pass through it but not others. Water is one substance that can penetrate the membrane. The movement of water molecules through a semi-permeable membrane is called osmosis.

In this case, sugar molecules can't pass through the membrane, so only water molecules will move through it. This is osmosis. This means that water molecules will move from a region of lower sugar concentration to a region of higher sugar concentration. What is true for sugar solutions is also true for salt solutions.

Let's go back to our original experiment and review them from the view point of osmosis.

For osmosis, we always have two solutions. When we compare their concentrations, we can use three terms: isotonic, hypertonic and hypotonic. If the concentrations are the same, the two solutions are isotonic. If the concentrations are different, the solution with higher concentration is said to be hypertonic with respect to the lower. The solution with lower concentration is said to be hypotonic with respect to the higher.

= Distilled water

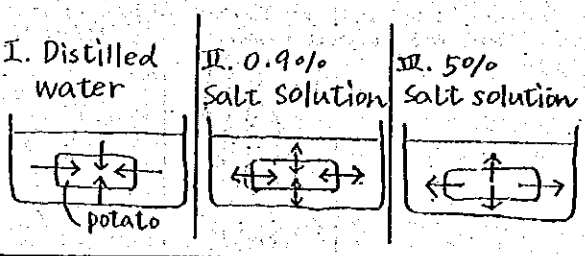
Suppose that distilled water has lower salt concentration than the inside of the potato cell. The potato slice gained the weight. So water must have moved from the outside to the inside of the potato cell. We can define that distilled water is hypotonic with respect to the inside of the potato cell.

=0.9% Salt solution

The weight of the potato slice did not change so much. The amount of water moving into and out of the potato cell must have been almost the same. So we can think this 0.9% is an isotonic solution with respect to the potato cell. By the way, a 0.9% salt solution is also isotonic with respect to human blood cell. So you can see that there is no big difference between animal and plant cells.

= 5% Salt solution

With the 5% salt solution, the potato slice lost the weight. Water must have moved from the inside to the outside of the potato cell. So this 5% solution is higher salt concentration compared to the inside of the potato cell. It is hypertonic with respect to the potato cell.



This activity is one example of ideas we can use in our classes to explain osmosis. We can find other ideas in our daily life.

If you think of good idea, please let me know. We can make good use of this newsletter, for example, an opportunity for exchanging our ideas.

Do you have problems in your classes?

We teachers have problems in our classes. Could you share with us any such problems and your own solution? For this newsletter, we welcome your suggestion and comments. Publication is guaranteed.

My profile

Finally, what about me? I want you to get to know me as soon as possible, also I want to get to know as many of you as I can.

My name is Akiko Seko. I am from Suzuka City, Mie Prefecture, Japan. It is near from Nagoya. After I graduated from my university, I became a high school teacher back home. In my high school days, I belonged to a mountain climbing club. So as a teacher, I was put in charge of the mountain climbing club. Sometimes I climbed a mountain at my free time. In my university days, I belonged to a bicycle club. In those days, I traveled all over Japan. I like traveling, and someday, I hope to travel around the world. The reason why I came to the Philippines is to make many friends and to know about the highs cool educational system here. In the future, I hope to introduce in this newsletter the ideas about Japanese high schools to have information about our teaching vocation in both our countries.

See you again....

CHEMISTRY

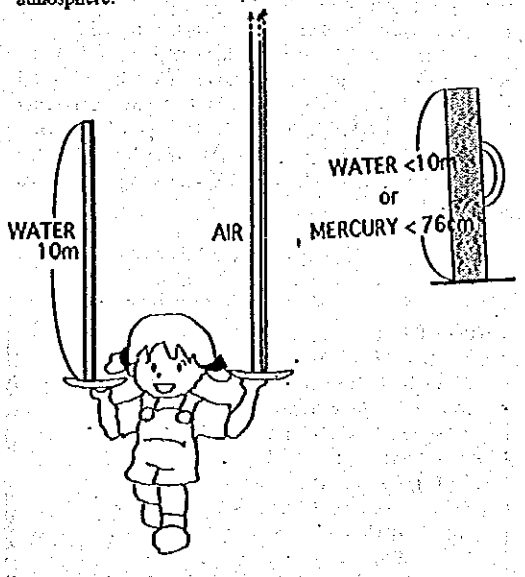
<< Last Program >> — Let's feel Atmospheric Pressure ! -

We enjoyed feeling Atmospheric Pressure in the last training, didn't we? I hope that you will introduce it to your class.

Now, do you remember the second activity " Why does the water NOT fall out of the glass ?' Do you think the water doesn't fall out of the glass even if you use any size of glass? .....No. If the water pressure inside the glass is greater than atmospheric pressure outside, the water will fall out.

Then, what about the size of the glass?

At sea level, the weight of a column of water, 1 square centimeter in area and about 10 meters tall is approximately the same as the weight of a similar column of air, 1 square centimeter in area extending all the way to the top of the atmosphere.



Now water has a mass of 1 gram per cubic centimeter, so in the 10-meter column, there are 1000 cubic centimeters or 1000 grams of water,(1000 gram = 1 kilo gram).

So, if you use a drinking glass which is taller than 10 meters, the water inside will fall out!!

Mercury is 13.6 times as dense as water, so a similar column of mercury would only be 0.76 meters tall. If you use a drinking glass with full of mercury which is taller than 76 centimeters, the mercury inside will fall out!! (VERY DANGEROUS!! DON'T DO IT.)

<< Next Program >>

Next topic is " Enjoy Color !! ". This is related not only to Chemistry but also to Biology and General Science as well. See you soon!

MSTTP phase II

will be held in the division of Davao City and Davao del Norte in November and December, 1996. The scheduled dates are as follows:

Venue	Date
Davao City N.H.S.	Nov. 9 (Sat.)
Daniel R. Aguinaldo N.H.S.	Nov.16 (Sat.)
Nabuntran C.N.H.S	Nov.23 (Sat.)
Panabo N.H.S	Dec.7 (Sat.)

Another exciting, interesting, fascinating and stimulating activities will be presented to you together with the *SCIENCE CIRCUS SHOW*. You will miss 99.9% of your life if you miss it!!

The DECS memorandum will be sent to you concerning this program through the divisional office. All the science teachers in Davao City and Davao del Norte are expected to join this program in the venue which is most convenient for you.

This training is only for one whole day and the registration fee is *35 pesos lang*!! Don't miss it!! See you soon.

***** Profile *****

Name:	Mariko Suzuki
Sex:	Female
Birthday:	September 21, 1967
Address in the Philippines:	Matina, Davao City
Address in Japan:	Ibaraki Prefecture (North of Tokyo)
Hobby:	Singing, Swimming, Skiing
Subject:	High School Chemistry
Term in the Philippines:	April 9,'96 ~ April 8,'98
Technical Background:	Bachelor & Master's degree of Agriculture Worked as a Computer System Engineer for 4 years

PHYSICS -Water rocket-

Did you see our "Science Circus Show"? After that show, there were many inquiries about that rocket, asking, "How to make that rocket?", "What is that fuel inside the rocket? Alcohol? or Butane?", or "Please make one for our high school" etc...

Now, here is the real story of the "WATER ROCKET"

Level 1 -Simple Water Rocket-

Material	Empty mineral water plastic bottle(1.5 liter)	1
	Rubber stopper (fits into the mouth of the bottle)	1
	Air pump	1
	Injector pin for air pump	1

Procedure

Put a small hole in the middle of the rubber stopper and insert the pin into it. Connect them to the Air Pump. Then pour some water in the plastic bottle and put the rubber stopper into the mouth to the bottle. Ask one volunteer to hold the rubber stopper (not bottle itself) (fig. 1). Pump air into the bottle; after a few stroke the bottle should break free from the stopper (and go into orbit!). This is the simplest water rocket; it would rise up to 10 or 15 m.

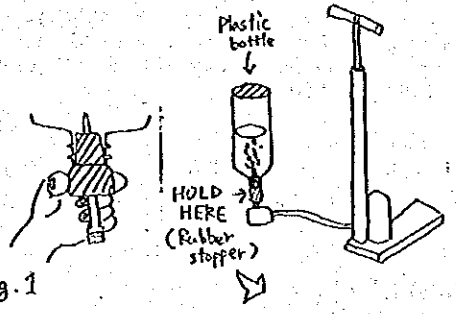


Fig. 1

Level 2 -Advanced Water Rocket-

If you try launching the simple water rocket, you may feel like launching it higher. There are some weak points in the simple water rocket, that is...

1. The flat top of the bottle causes large air pressure.
2. The rocket does not fly vertically because it does not have wings that can stabilize its orbit.

The Advanced Water Rocket is constructed to overcome these weak points.

Material	Empty mineral water plastic bottle(1.5 liter)	3
	Rubber stopper (fits into the mouth of the bottle)	1
	Air pump	1
	Injector pin for air pump	1
	Cork board or art board	1
	GI wire	30cm
	Rubber band	6
	Epoxy Glue	1
	Electrical Tape	1

Procedure

The same rubber stopper attachment can be used for launching.

Attach two PET bottles bottom to bottom with epoxy glue. Cut out the middle part of another bottle and use it to rap around the connection of the first two bottles and glue it in place. This makes it stronger and *mas pogi*.. You might wish to strengthen the connection with electrical tape. Cut out the cork board to make three fins. Attach them to the lower part of the plastic bottle with epoxy glue and after it dries, you can strengthen with GI wire or rubber band. Allow them to dry and attach completely.

We launch it in the same way but we don't need a volunteer to hold the rubber stopper because the rocket stands itself on the fins.

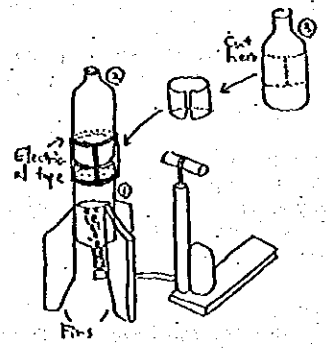


Fig. 2

Caution!

DO NOT glue the rubber stopper into the mouth of the bottle. The water cannot escape and the plastic bottle might explode!! Also DO NOT try using glass bottle.

Suggestions:

1. The tighter the rubber stopper fits into the mouth of the bottle, the higher the rocket rises.
2. By trial and error, find the amount of water which makes the rocket rise the highest.

By the way, is this water rocket just a toy for having fun? Well... No. It is fun to play with it, but there are also basic physical concept involved.

If your student asks, "Why the rocket rises higher if we put water inside it rather than just air?", can you explain?

The water rocket catches the attention of the kids, and hopefully some of the kids will really get excited. But catching attention should be followed by an explanation of the underlying physics principles, otherwise the rocket is merely a toy, not an instrument of effective teaching material.

The basic concept underlying the launching of the water rocket is Conservation of Momentum. We will see its real meaning and applications at the Mobile Science Teacher Training Program (MSTTP) Phase II. The topic of the physics in MSTTP phase II is MOMENTUM. Let's have some fun together and get more physics!! *Abangan ang sisunod na kabanata*!!

We have some slightly used model rockets, which you or your brighter students may care to examine.

THE SCIENCE TEACHER is published by the JOCVs in RSTC-ADDU during each session of the MSTTP and sent to the participants who attended and registered at the MSTTP.
We welcome contributions in the form of manuscripts and drawings and will be glad to consider them for possible publication. Contributions submitted for publication and all correspondence relating to them should be sent to: The Editor, THE SCIENCE TEACHER, RSTC-ADDU, Jacinto St., Davao City 8000.

THE SCIENCE TEACHER

MSTTP (Mobile Science Teacher Training Program) Newsletter
Published by the
Japan Overseas Cooperation Volunteers (JOCVs)
in Regional Science Teaching Center-
Ateneo de Davao University (RSTC-ADDU)

Volume 2
January 1997

Preface

Did you read our first newsletter (Volume 1) - THE SCIENCE TEACHER-? Did you enjoy it? I hope it can be useful for your classes.

Have you already tried in your classes the activities which we introduced to you in the previous training? For those who tried, did your students enjoy them? Please enjoy the science activities with your students together. And be careful about handling chemicals and tools for the activities. Please do not let the students do the activities only by themselves.

It is already December. December is called "Shiwasu" in Japan. The Chinese character (kanji) of "Shiwasu" means that teachers are very busy and always rush. Actually high school teachers are very busy in December. Of course not only the teachers are very busy but also all other people because they have to prepare for welcoming new year's day. We usually clean the whole house and write new year's cards.

How about you? Now you are very busy to prepare for welcoming Christmas day. Yes, Christmas is coming soon! How will you spend Christmas day? With whom? We guess you are looking forward to it very much. In Japan, we also celebrate Christmas. We eat special cake and exchange presents. In some regions, it snows in Christmas season and we enjoy white Christmas. It is very romantic!

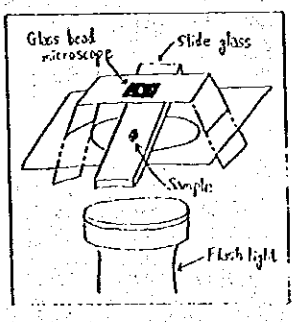
Her in the Philippines we often hear the sound of fire crackers during Christmas season. It is exciting, but it can also be very dangerous. Please don't forget our second science circus show. "Pagbantay baya sa paboto!!"

We hope you will enjoy our newsletter of Volume 2.

- GENERAL SCIENCE -

In this lecture I adopted "Ecosystem" as a common topic related to General Science and Biology. And I also gave you the topic about "Environmental Pollution" in the field of my major, the environmental chemistry. Did you enjoy it?

I think that you can discover interesting phenomena and events in the familiar scenery if you observe something carefully. Then if you have a hand lens, a magnifying glass or a microscope, you can make the experience more interesting. Though we can get the lens and the other teaching materials easily in Japan, it's more difficult in the Philippines. So I introduced you to the glass bead microscope that was devised by Leeuwenhoek - the Dutch biologist and expert for the observing with the microscope - 300 years ago. As I heard that it is difficult to adjust the focus on my first microscope, I tried to make the second microscope with the stand like the illustration. Anyway, how good or bad your microscope is depends on the degree of perfection of the lens. If you can make a really good lens, your microscope will have a magnification of more than fifty. Please try to make your microscope.



Next I will explain each experiment that we presented in the Science Circus Show.

In the activities described below the term "explosion" is used in its scientific sense, as a very rapid - almost instantaneous - chemical process.

[Combustion of Butane-Air Mixture]

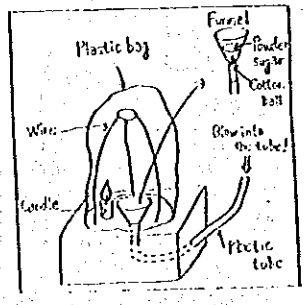
There is pressurized liquid butane in the aerosol spray can for the portable cookstove. When you take out some liquid butane from the aerosol spray can into the plastic bag, it vaporizes easily (and you will observe that the plastic bag freezes because of the high value of the heat of vaporization). Using this butane gas I made the hemispheric soap bubble on the container of the instant noodles and lighted it.

[Explosion of Alcohol-Air Mixture]

Many flammable substances can form explosive mixtures when mixed with air in certain proportions. For ethanol - the principal ingredient of denatured alcohol - and air, any mixture containing between 3.3% and 19.0% of denatured ethanol (and therefore between 96.7% and 81.0% of air) will explode when ignited. The ethanol-air mixture in the can fell into that explosive range. The mixture in an almost empty alcohol lamp may also do so; this is the reason why an explosion accident sometimes happens in the laboratory when we try to light such a lamp. To prevent such an accident, we should never use an alcohol lamp which is less than half full.

[Explosion of Sugar-Air Mixture]

Sugar is one of the substances which burn, because it consists of carbon, hydrogen and oxygen. Certain mixtures of sugar and air can also explode when ignited. To make the sugar air mixture explode we must first prepare the powdered sugar because it can then mix with the air very well. Then, using the apparatus shown in the illustration, you blow away the powdered sugar and spread it inside the plastic bag, and the heat from the burning candle will make the sugar -air mixture explode.



Please present these demonstrations in your class only after you have mastered how to perform them safely. If you have some questions, please feel free to ask us anytime.

(TOM)

- BIOLOGY -

Last time, I did not conduct a training program by myself. So this time, I will introduce you to the science activities I adopted in my classes in Japan.

In the high school where I worked as a teacher, most of the third year students get jobs after their graduation. Unfortunately, they are not interested in science classes - especially lectures. So we have adopted various materials from everyday life as subject of science experiments to make our science classes more interesting. For example, students make their own post cards and letter papers from milk cartons. Through these activities, the students can study the concept of recycle paper. I think that students begin to show more interests in science classes and begin to pay more attention to their everyday lives through this kind of activities.

In this newsletter, I will introduce you to one of those activities.

<Let's make home-made "TOFU" (bean curd)>
TOFU is one of the traditional Japanese foods. You also have TOFU here in a big supermarket. But the taste is a little bit different from Japanese TOFU. I will tell you how to make Japanese TOFU.

(Materials)
Soybean 100g, Coagulant (5%$CaSO_4$ or 5%$MgSO_4$ or 5%$MgCl_2$ solution) 10ml~30ml, Cooking oil, Blender, Beaker, Gauze or Dish towel, Bowl, Thermometer
(Procedure)
(1) Soak 100g of soybean in 400ml water (tap water) all day and night to make it soft.
(2) Drain the excess water and put the soybean into a blender. Prepare about 600ml water and add part of the water to the blender. After that, liquidize the soybean in the blender.
(3) Transfer (2) to a beaker and add the rest of the prepared 600ml water. Boil it for about 5 minutes with stirring.
Note: The bottom of the beaker might be burned during boiling time. But be careful not to stir too hard. If it boils hard and spills, add one or two drops of cooking oil.
(4) Filter (3) through a gauze (or a dish towel) and wring it well. It is very hot. So when you wring it, you sometimes need to rinse your hands with water. (The remains on the gauze is called OKARA and we cook it with soysauce in Japan.)
(5) Heat the extract to about 80°C and stop heating. Add 10ml coagulant and stir it with a stick slowly for a while and wait. Unless you can see a lot of small white pieces of solid in the beaker after a while, add a further 5~10ml coagulant and stir slowly. But add just little by little. If you add too much coagulant, the solid become liquid again and you can not make TOFU any more. To decide the right amount of coagulant is a little bit difficult. You will be able to find it by trial and error. (Maybe it is between 10ml~30ml.)
Note: If solidification is slow to happen, heat the beaker slightly.
(6) If you can see a lot of small white pieces of solid in the beaker, filter (5) through a gauze again. Wring it softly to put all pieces of solid together and make it one lump. Don't wring it too hard. It is already a real handmade TOFU. Put it into water and cool it for a while. You can make it tasty with soysauce.

Actually, the concept of this activity relates to the area of Chemistry. But I adopted this activity not only in my Chemistry class but also in my Biology class. I think we sometimes do not have to be particular about the area of science strictly. This activity is the application of the salting out theory. The extract of soybean contains protein. If we add some salts to it, coagulation will happen and the extract will be solidified. This is TOFU. After this activity, I gave my students the simple explanations about the concept.

Sometimes it might be a little difficult to relate them to the contents of textbook. But I believe that these activities can be effective for student's motivation. I believe that students can feel science more closely through these activities.

Anyway, if you have time and you can get materials, please try to make your original TOFU.

(AKIKO)

MSTTP phase III

will be held in the division of Davao City and Davao del Norte in January and February, 1997. The scheduled dates are as follows:

Venue	Date
Davao City N.H.S.	Jan. 11 (Sat.)
Daniel R. Aguinaldo N.H.S.	Jan.18 (Sat.)
Nabuntran C.N.H.S	Jan.25 (Sat.)
Panabo N.H.S	Feb.1 (Sat.)

Another exciting, interesting, fascinating and stimulating activities will be presented to you together with the *SCIENCE CIRCUS SHOW*. You will miss 99.9% of your life if you miss it!!
The DECS divisional memorandum concerning this program have been already sent to all the public High schools in division of Davao City and Davao del Norte. All the science teachers in Davao City and Davao del Norte are expected to join this program in the venue which is most convenient for you.
This Phase-III training is the final session of our MSTTP for school year 1996-1997.

The training is only for one whole day and the registration fee is *35 pesos lang*!! Don't miss it!! See you soon.

- CHEMISTRY -

Maayong hapon ! Kumsta ka ?
<< Last Program >>
-- Enjoy the color of a Natural Indicator ! --
During the training, some of you asked me some questions. I would like to answer these questions here.

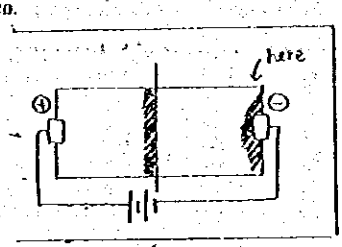
1) How do we prepare the 1M HCl solution?
Hydrochloric Acid (technical) in your lab. is already 10M (HCl 36 % solution).
To prepare the 1M HCl solution, you just mix Hydrochloric Acid (technical) with water, the volume proportion is HCl : H_2O = 1 : 9.

2) What does the pH mean literally?
It means the "power" (potenz in German) of Hydrogen.

3) In the activity of "Movement of Ions", why is the color at the negative electrode changing to green after passing the current?
Some of you could observe the color change at the negative electrode after passing the current in the activity of " Moving ions ". Why did it happen?
As you know, the added salt(NaCl) helps more current to pass on the indicator paper. Because of this, water(H_2O) is electrolyzed into H^+ and OH^- at each electrode. The electrons on the surface of the negative electrode neutralize the positive charges on the hydrogen ions(H^+).

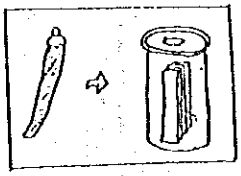
H_2O ——> $H^+ + OH^-$
$2H^+ + 2e^-$ ——> H_2(gas)
Leaving excess OH^- ions

As a result, the part around the negative electrode is becoming alkaline and the color of the indicator paper is changing to green.



4) What is the procedure of making the indicator papers using eggplants?
Some of you said to me, "Grape juice is very expensive. Are there other materials for the indicator papers?" Now I will introduce how to make the indicator papers using the eggplants.
1. Remove the tail end of an eggplant. Peel off the outer skip (purple part) and cut into small pieces. Place in a 100ml beaker.
2. Add about 30ml water and boil it for 3~5 minutes.

3. As soon as possible, pour the extract solution into another beaker. Immediately add a small amount of Alum (about the size of a match head). Dissolve it very well.
4. Lay out a filter paper (or toilet paper or white paper napkin etc.) over the mouth of a beaker. Carefully pour, in small portions, the liquid indicator over the entire area of the filter paper.
5. Air dry for about 5 minutes. There is no need to dry the paper completely at this point. Repeat the process a few times.
6. Air dry the paper further. If possible, avoid touching the paper with your bare hands. Use tweezers. When completely dry, cut the paper into small square pieces and keep in a covered bottle. This is your pH indicator paper. It can be kept in the covered bottle for a few months.



This paper is light blue. The color change is:

strong acid	: red
weak acid	: light red
pH 5~7	: blue
weak base	: green
strong base	: yellow

We can use it in the activity of "Movement of Ions". Then you can use the acid solution instead of NaOH solution.

<< Next Program >>
Now, Christmas is coming soon. The many beautiful miniature bulbs in front of the City Hall let me happy and enjoyable. It's the first time for me to spend Christmas here and I'm looking forward to it very much. Now I'm thinking about the next topic.

"Let's play with the electricity !!"

Some of you might say that your students dislike electro-chemistry. But the electricity is very interesting and has a big power. If you have some time before the next program, please review this topic.

Well, see you soon. And

Malipayong Pasko !
Malipayong Bag-ong Tuig !
(MARIKO)

- PHYSICS -

Let's think about this problem. A man dives from a platform into water (Fig. 1). If we take the level of the water as a reference height, the man has some gravitational potential energy, say 10000 Joules before he starts diving (a). How much is his kinetic energy? Since he is not moving, his kinetic energy is zero. When he jumps from the platform and is falling down, his potential energy decreases because he is going down. What about his kinetic energy? Since he falls faster and faster with time (accelerating downwards), his kinetic energy increases. And the increment of his kinetic energy is exactly the same with the reduction of his potential energy (if air friction can be neglected). This is what we call CONSERVATION OF MECHANICAL ENERGY.

For example, when he reaches one-half of his initial height, his gravitational potential energy becomes 5000 J and kinetic energy is 5000J (b). When he is one-fourth of his initial height, his potential energy is 2500 J and kinetic energy 7500 J (c). When he is just about to hit the water, his potential energy is 0 J and kinetic energy is 10000 J (d). Then what will be the value of his potential and kinetic energy shortly after he enters into the water?

When he is in the same height with the water level, his potential energy is zero. And since he is forced to stop by the water resistance, his kinetic energy is also zero when he comes to stop. Both potential and kinetic energy are zero. Where did the energy go? Was the energy lost? Or was it merely transformed into another kind of energy? If so, what kind of energy would it be?

We have discussed a similar problem briefly in the last session (MSTTP phase II). I felt that it will be a good exercise to grasp an important concept, HEAT, to discuss this problem a bit more in detail.

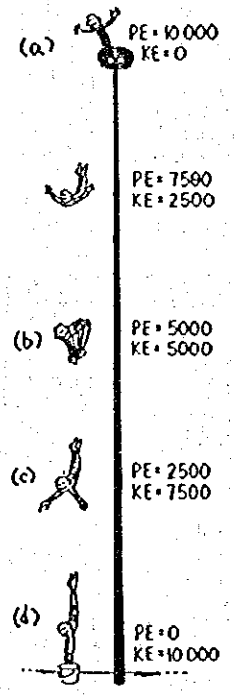


FIG. 1

The answer is, you know, HEAT. The mechanical energy is transformed into HEAT ENERGY. It means the temperature of both the water and the man have increased. Although the increment of temperature is too small to be observed, but they are a bit warmer compared with before. In many cases, if there seems to be a loss of mechanical energy, there will be a gain of heat energy. Then how can the **mechanical energy (potential or kinetic or both) be transformed into heat energy?**

Let's put it this way. Water at 80 °C and water at 20 °C are different in their temperature. Water is made from the water molecules (H_2O). Then what does "the difference in temperature" mean from a molecular point of view? What is the difference between water molecules at 20 °C and water molecules at 80 °C ? Roughly speaking, these molecules differ in how vigorously they move, in other word, they differ in average kinetic energy.

For any substances, gas (air, oxygen, nitrogen, water vapor, etc.), liquid (water, alcohol, mercury, etc.), solid (metal, paper, plastic, clay, ice, etc.), all the atoms or molecules are moving inside the material. Simply speaking, as the temperature rises, the molecules move faster and faster. The water molecules at 80 °C move much more vigorously than those at 20 °C (see Fig. 2). The temperature is a measure of how fast those molecules are moving inside the material. Every moving body

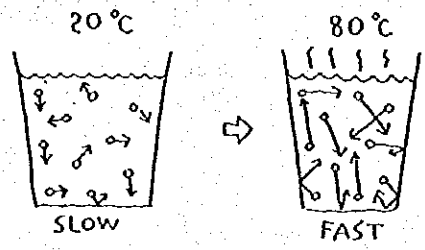


FIG. 2

has kinetic energy, so moving water molecules have kinetic energy. We can say the water molecules at 80 °C have more kinetic energy than those of 20 °C in average. **Then how the mechanical energy (kinetic energy of the diver, in a previous example) is used to raise up the temperature?**

When the diver hits the water, the water molecules are forced to move faster because of the force applied by the man (Fig. 3). The vigorous motion of molecules means their temperature is increased. This motion is spread around by the collision of the molecules nearby. Thus the mechanical work of the diver is transformed into the HEAT energy of the water.

When you rub a piece of wood with a sandpaper, you will notice both of them become warmer. The motion of your hands forces the molecules of the wood and the sandpaper move vigorously and their temperature increases. The mechanical

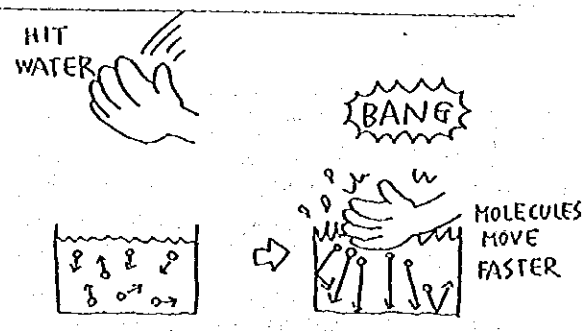


FIG. 3

energy of your hand is transformed to the heat energy of the wood and the sandpaper.

A shooting star shines because it burns when it comes into the earth's atmosphere. It's temperature is raised because the molecules (or atoms) of the shooting star (basically it is just a small rock drifting around the earth) are forced to vibrate faster and faster because of the continuous collision with the air molecules in atmosphere. Some of the kinetic energy of the shooting star is transformed to the heat energy. If we had no atmosphere (air) in our earth, the shooting stars would have nothing to collide with and would not burn. They would just hit the ground and make a big crater. Thanks to the atmosphere, almost all the shooting star just burn down before they reach the ground and you don't need to watch the sky to avoid meteors falling onto our head. Can you tell why there are a lot of craters on the surface of the moon?

Anyway, that is how the mechanical energy is transformed into heat energy. There is a loss of mechanical energy in almost all the phenomena and that loss is usually just transformed into heat energy. Then would it be possible to transform heat energy into mechanical energy?

The answer is YES as you know the engines are doing it in our Jeeps and Buses. We may discuss it in some other time.

(TAKA)

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MAGNETIZER

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(Pls. inquire TAKA)

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THE SCIENCE TEACHER

MSTTP (Mobile Science Teacher Training Program) Newsletter
Published by the
Japan Overseas Cooperation Volunteers (JOCVs) in
Ateneo de Davao University-
Regional Science Teaching Center(ADDU-RSTC)

Volume 3
March 1997

Preface

"Time flies!". You can really feel the meaning of this saying, can't you? Almost three months have passed from our last newsletter. And more than six months have passed from our first training program in Davao City National High School on September 21, 1996. We have already finished our Mobile Science Teacher Training Program of this school year last February 1. We are very happy that we had many participants in every training and that we met many science teachers through this training program. We really hope that the teachers will try the science activities which we introduced and that the activities will help your classes to get your students' attention. We will try to make our future training better. Please join us again next school year.

We told you in our last newsletter that it snows in some regions of Japan during Christmas season. This month, March, is the end of winter and this time it is still cold in Japan. In the regions with heavy snow, people are very busy removing snow from the roofs and porches of their houses in the morning. There is also much snow on the roads and it is very dangerous especially for cars. In some places, bulldozers are used to remove snow from the roads to avoid traffic accidents. They also use calcium chloride to prevent snow freezing on bridges. It is actually an application of chemical theory; freezing point depression. In this example, we apply scientific principles to improve our lives more and more. We can find many examples of application of scientific theory in our living condition. If you introduce those examples and explain them well in your class, your students will feel science much closer to them.

We are still trying to find out a better way to remove snow from the public places at lower cost. Science gives us great possibilities to make our lives better. The duty of the teachers is to raise many good scientists of the future. What a challenging work the teacher has! "Be proud you are a teacher! The future depends on you!"

We hope you will enjoy our Newsletter, Volume 3 .

- GENERAL SCIENCE -

This time I will write about myself.

As I mentioned in the previous seminar, my real major is Environmental Chemistry. In the university I monitored and analyzed some artificial toxic chemicals in the environment. Mankind has developed technology and has a convenient life. On the other hand mankind has been worrying about many problems caused by some toxic chemicals which are spread in the environment through mankind's activity. I want the school children to know about the serious situation of our environment, that's why I became a teacher.

In order to become a teacher of a public high school in Japan, it is necessary to get a teaching certificate at the university and pass the employment examination conducted by each Metropolitan and Prefectural Government. I took the employment examination in Hokkaido, because Hokkaido is one of the prefectures which has remained the most beautiful nature in Japan.

The school where I was employed was an agricultural high school located in a small city where the temperature difference was 70 degrees between summer (35°C) and wintertime (-35°C). At that school there were two big dormitories where all first grade students and half of other grade students stayed. Most of the students couldn't go home except during the long vacation. So the teachers lived with students for most of the year. As my house was inside the school site, I spent all day long with students.

I left home for work at 8 a.m. and spent a time in the school until 3:30 p.m. After that I transferred to the dormitory and took care of the students' activities(meal, study, cleaning and so on.) until 10 p.m. When all students were on bed, I returned to the school to prepare for the next day's class and to do other paper work. I usually went to bed after midnight.

As there are few public schools with dormitories in Japan, my conditions was exceptional. However in Japan, it's a fact that most of science teachers are too busy to have enough time to prepare for their class including class activities and demonstrations. So in the Philip-

pines, it was very interesting for me to think of new teaching materials using some familiar things every day. Also it was my pleasure to feel the interest and curiosity of teachers in our seminar and Science Circus Show. At the same time my hope to get back to my former position has been swelling gradually. Of course, in order to become a high school teacher again, I have to take the employment examination once more. Also thinking of my marriage planned in the near future, I have to get a job as soon as possible.

I regret to say that I decided to shorten my term and go back to Japan. During one year I met many teachers and studied many things in the Philippines. Thank you very much for your kindness. Though "Doctor Tom" goes back to Japan (and may go to Africa), MSTTP by JOCV will be continuing in the next school year. Please enjoy the next MSTTP!

"O sige, mouli na ko sa Japan. Babay sa tanan!"

(TOM)

- BIOLOGY -

Thank you very much for your attendance in the last Biology training. Unfortunately, I could not conduct my seminar in Nabunturan because I was sick. It was very sad. But I believe I can be in Nabunturan next school year.

Last seminar, we used microscopes in doing our observations. Some of you may not have microscopes. Some of you may not be able to try the last activities immediately. But I hope you will have microscopes in near future and you will be able to try the last activities. Please keep on working to get microscopes. Needless to say, a microscope is a very basic and excellent piece of equipment for Biology classes. It can show us the microscopic world and widen our world. Even if you get only a few and it is not enough for all the students, please use the microscope to show this wonderful world to your students in your class by taking turn. Some of your students will become more interested in Biology if they are the real specimen.

<Let's review each activity of the last topic!>

(A)Preparation of protozoan slides.

This preparation is actually very simple and easy. You can try rice straw instead of grasses. You will find mainly paramecium if you use rice straw. You can try also many kinds of inoculums (e.g. paddy field). If you get big protozoans like paramecium, try to stain them to get clearer features of organelles. You may be able to observe the movement of cilia.

(B)Preparation of botanical slides.

This preparation is appropriate to observe the differences between monocot plants and dicot plants. We can find the big differences especially in transport system tissues. Stem is the best part to check the differences. To get good sections which are thin enough without the hand microtome, you need to practice to improve your skills. You should use a new and a very sharp blade. If you get the thin sections, you can observe the vascular bundle and identify the tissues without stains.

(C)Preparation of mitosis slides.

Were you able to make good mitosis slides? Some of you could get the good semi-permanent slides. Actually it may be a little difficult for you to prepare Hoyer's mounting medium which we used to prepare semi-permanent slides. If you can make good temporary slides, seal the edge of the cover slip with colorless nail polish. You can keep it for weeks. I will give you some advice about the procedure.

(1)Before you stain the root tip, make sure that it is less than 1cm long.

(2)The cell should be flattened enough to be one layer. Make sure that the root tip is chopped enough in a drop of stain.

(3)When you press the glass slide with your thumb, do not move the cover slip. If you move it, some cells might be broken and will overlap and you cannot observe the cells.

<Is your microscope clean?>

A microscope is a delicate and expensive instrument. It should be well maintained. Especially the lens, its condition should always be the best. I will introduce you to one way of lens cleaning.

(A)Preparing lens cleaning solution.

Materials:

Ethanol, Chloroform or ether, Amber storing bottles, 200 ml beaker, Stirring rod, Gum or adhesive label, Graduated cylinder

(Procedure)

1.Mix ethanol and chloroform in 1:1 proportion in a beaker.

2.Store in bottles and keep in a chemical cabinet.

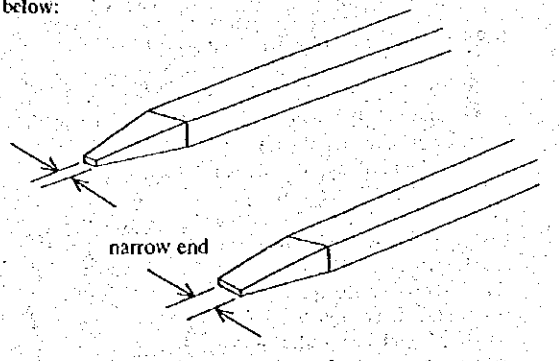
(B)Cleaning of eyepiece and objective lenses.

Materials:

Chopsticks, Cutter/knife, Lens paper(available in photo shops), Lens cleaning solution

(Procedure)

1.Taper both ends of the chopstick with a cutter as shown below:



2.Wrap the narrow end of the chopstick with lens paper.

3.Wet the lens paper with the lens cleaning solution.

4.Wipe the outer and inner surfaces of the upper eyepiece lens from the center to the side in a circular motion.

5.Change the lens paper if it is already dirty.

6.Using the wide end of the chopstick, do steps 2-4 to clean the lower eyepiece lens.

7.Do the same with the objective lenses using the narrow end of the chopstick.

Try to keep your microscopes always clean.

Our training program of this school year is already finished. Please participate again next school year. See you next school year!

(AKIKO)

- CHEMISTRY -

Maayong hapon ! Kumsta ka ?

During the past ten seminars, I really enjoyed talking with you and your enthusiastic attitudes encouraged me. I will be very happy if I hear that you show our activities to your students. I will be even happier if you let your students do the activities.

Some of you asked me some questions during the training. Now I would like to answer these questions here and add some explanations.

1) Is the "Blue Vitriol" same as copper sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$) in the activity of "A copper Coin from Blue Water"?

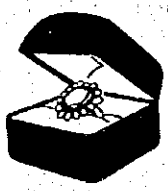
Yes. They are same. So, you can use it in the activity.

2) How is the gold plating done?

I'm sorry that I can not find out it exactly. But I found some explanation with reference to the gold plating in the textbook. I quote them.

"Gold Plating Nonconductive Materials"

Metals are the usual materials that are electroplated for protection and decoration. Today, you see in the market gold plated orchids, leaves, shells, child shoes and other nonconductive objects. How is this done?



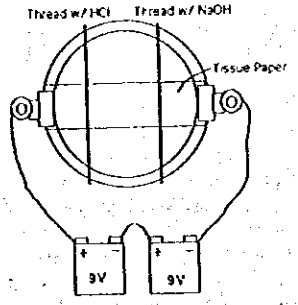
The nonconductive material to be plated is first cleaned with a grease remover. The semi-dried object is then brushed with a conductive paint. There are several kinds in the market - silver, copper, brass, filler ions or black supplementary filler. The choice of the paint is based on price, chemical reactivity and applicability. Silver-based paint is the best paint for plastics, wood, rubber and wax products, but it is also the most expensive. Copper-based paint is used in shells and starfishes. Brass-based paint has a mixture of silver and copper. It works well with flowers, leaves and similar objects. Filler ions are good on paper. Black supplementary filler is the cheapest among conductive paints. It can be used on rubber, wood, leaves and insects.

After drying the conductive paint, the object is dipped in silver solution. The silver-coated object is then electroplated in series with copper, nickel and then gold. To protect the gold finish, varnish is applied on the gold plate.

Think about these. Why are leaves, flowers and seashells not electroplated directly? Why are conductive paints necessary for this kind of activity?

— pp.239, SCIENCE AND TECHNOLOGY FOR A BETTER LIFE 3 "Chemistry" —

3) Able to use tissue paper in the activity of " Movement of Ions"



Did you remember the activity of " Movement of Ions" in the second seminar? I got a good advice from UP-ISMED. We can use the folded tissue paper (fold tissue paper few times and cut the folded paper to the size of a slideglass) instead of the filter paper. And we can use HCl solution as well as NaOH solution on the eggplant indicator paper because paper color is blue and changes to pink with HCl solution.

4) An apology for the activity of "Buffer Solution"

I would like to apologize for the activity on "Buffer Solution" in the second seminar. We used grape juice indicator paper in the activity. But I noticed that the color of the indicator paper sometimes didn't show proper color so that we could not get the clear concept. If your school has universal pH paper, please use it instead of the grape juice indicator paper in this activity.

If you have some questions, please come or send to RSTC. I'm very happy to share the knowledge with you.
See you next semester !!!

(MARIKO)

- PHYSICS-

In the Science Circus Show vol. 3, several activities concerning "buoyancy force" were introduced. Do you remember the "gift" sent by Dr. TOM? The one went up and down as MARIKO spelled "*Mga duha, hanghud pito, katulo lang*"? It was the improvised material, "CARTESIAN DIVER" This time I would like to explain how to make CARTESIAN DIVER.

-material-

1.5 or 2 liter plastic bottle.	1
A piece of drinking straw (7cm long)	1
Electrical or Scotch tape	a little
Paperclips	2 - 4

The Cartesian diver consists of two parts; a vessel and a DIVER. Basically, any kind of plastic bottle will do as a vessel. We used 1.5 liter mineral water plastic bottle. But the bottle should yield to pressure you apply. It is not appropriate to use the bottle that is too hard to compress.

The diver is made by a material that contains air inside and some weight. In our science circus show, we used a piece of straw cut into 7cm long and three small paperclips. The straw is bent at the middle and fixed its shape by electrical tape (Fig. 1). Three paperclips are attached at the ends of the straw (Fig. 2). The length of the straw and the number or the size of the paperclips can be adjusted depending on how it works.

Now let us try to use the Cartesian diver.

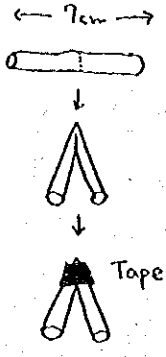


Fig. 1

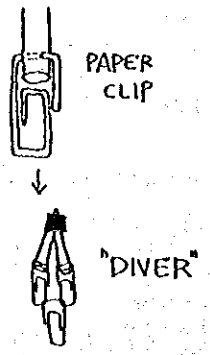


Fig. 2

(1) Fill up the vessel with water.

(2) Put the diver in the vessel carefully. This should be done so the air inside the diver does not go out. The diver should float on the water. (If the diver sinks here, try to decrease the number or size of the paperclips or make another diver with a longer piece of straw.)

(3) Cover the vessel with the cap. There should be no big air gap at the top of the bottle.

(4) Press the vessel tightly and the diver will sink. (If the diver does not sink here, try to increase the number or size of the paperclips or make another diver with a shorter straw.)

(5) Release your hand and the diver will rise up.

Did the diver go up and down? Whether it works or not depends on the balance of the amount of air inside the diver and the weight. The diver should just float. There should be just enough amount of air inside the diver to make a little bit bigger buoyancy force than the weight. OK, let us look into the mechanism of the Cartesian diver.

The diver rises if the buoyancy force is bigger than its weight. Remember the buoyancy force is the same as the weight of water displaced by the object (Archimedes' principle). What will happen if you apply pressure on the vessel? The pressure is transmitted to the diver and compresses the air inside to make the volume of the water displaced smaller. If the volume becomes smaller, its weight also smaller and the buoyancy force also becomes smaller. When the buoyancy force is lesser than the weight, the diver sinks. The rising and sinking of the diver is determined by the balance of the buoyancy force and the weight.

(TAKA)

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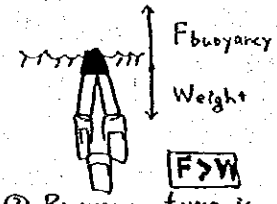
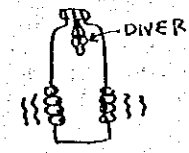
MECHANISM OF CARTESIAN DIVER

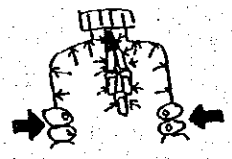
① There is air inside the straw



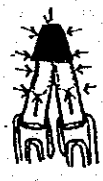
② Buoyancy force is bigger than weight. It floats.



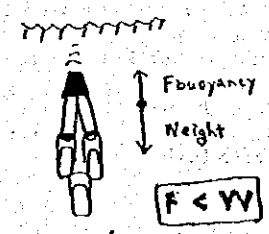
③ Apply pressure on the bottle.



④ Applied pressure is transmitted in water in all direction.



⑤ Pressure compresses air inside the straw

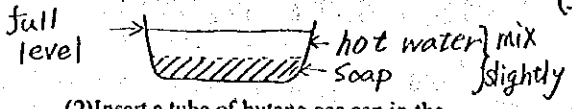


⑥ Buoyancy force becomes smaller than weight It sinks

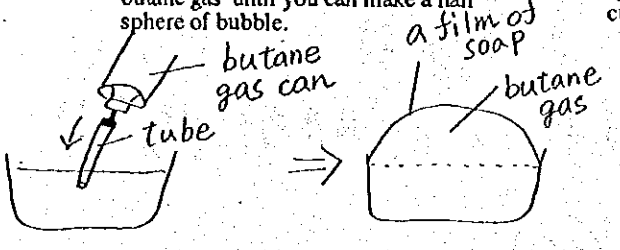
Science Circus Show vol.2 "Explosion"

<Activity #1.> Burn a soap bubble of butane gas.

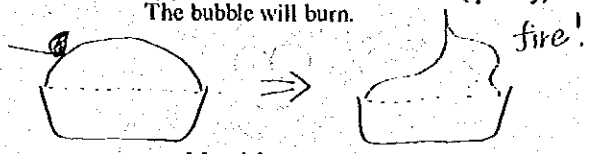
(1)Put 1 pack of liquid soap in a container and add hot water to fill the container.



(2)Insert a tube of butane gas can in the solution (just under the surface) and put butane gas until you can make a half sphere of bubble.



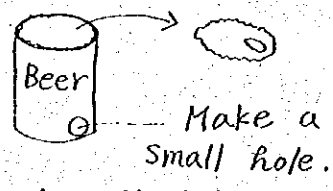
(3)Fire the bubble with a match (quickly). The bubble will burn.



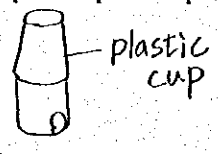
<<Materials>>
Container - e.g. the cup from "instant noodle", Plastic tube - Hard Ware shop, Needle of air pump - sports shop

<Activity #2.> Burn alcohol.

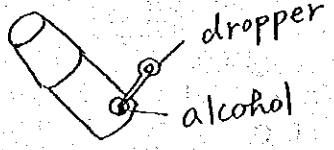
(1)Prepare an alminium can (Beer, Cali...). Remove the top cover of the can with a can opener.



(2)Cover the top with a plastic cup tightly.

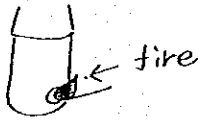


(3)Put a few drops of alcohol (denatured alcohol) through the hole with a dropper.

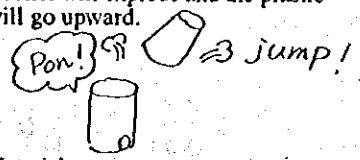


(4)Spin the can several times.

(5)Set fire through the hole.



(6)Alcohol will explode and the plastic cup will go upward.



<<Materials>>
You can get everything easily.

<<Concept>>
Alcohol will explode if its vapour is mixed well with oxygen. If you put a little alcohol in an alcohol lamp, it is very dangerous because the space above the liquid alcohol will contain alcohol vapour and air (oxygen). Make sure that the lamp is filled with alcohol.

<<Note>>
If you connect a plastic cup with a can too tightly, the plastic cup may not go upward. Try to find the moderate level of tightness.

<Activity #3.> Burn sugar.

The apparatus for this activity has already been introduced and explained in our 2nd Newsletter. Please read the explanation again.

To make the sugar-air mixture explode, we must first prepare the powdered sugar because it can then mix with the air very well. Then, using the apparatus shown in the illustration, you blow away the powdered sugar and spread it inside the plastic bag, and the heat from the burning candle will make the sugar-air mixture explode.

I hope the explanation is clear and you will try these activities!

By Akiko.

7　ホンジュラス　小学校教師のための理科実験ノートと指導案

－前任者の実験ノートを指導案化して提供－

小学校教師のための実験ノートと指導案

(1) 実験ノート　5/1　理科教師

ホンジュラス　5/1

T. G.

La quema y el aire 4 ---
el aire mágico (Bióxido de carbono)

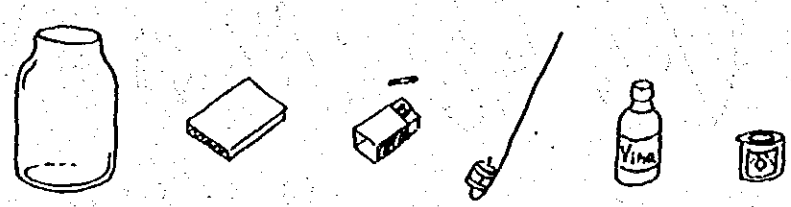
¿Cómo es el bióxido de carbono?

Al quemar papel, madera, alcohol o gasolina, se produce una clase de gas, esto es el bióxido de carbono.
Y al echar vinagre en bicarbonato de sodio, tambien se produce el bióxido de carbono. Y las burbujas de fresco son del bióxido de carbono.
El bióxido de carbono es el aire que no tiene olor ni color. Y él casi no existe en el aire que nos rodea. El bióxido de carbono no sirve para quemar algo, por eso dentro del puro bióxido de carbono se apaga el fuego.

Experimento(El fuego dentro del bióxido de carbono)

* materiales necesarios

Bote grande (de mayonesa)
Cartón ondulado pequeño
Candela con alambre usada en el experimento anterior.
Fósforo
Vinagre
Bicarbonato de sodio. (por ejemplo: "ROYAL")



* Pregunta

1. ¿Qué ocurrió?

2. ¿Por qué se apaga la candela?

Comentario

Se observará que se apaga la candela al introducirla en el bote lleno del bióxido de carbono.
Este resultado quiere decir que el bióxido de carbono no sirve para la quema.

Experimento(La fotosíntesis y la luz solar)

* Materiales necesarios

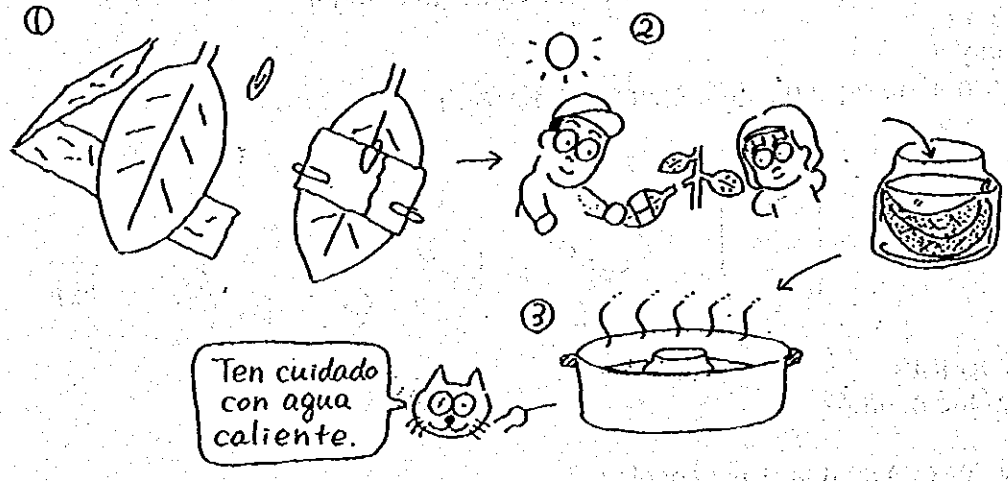
Bote pequeño
Olla grande
Alcohol
Agua caliente
Solución de yodo (Indicador de almidón)
Papel aluminio
Unos clips
plato pequeño

* Procedimiento

1. Cubrir una hoja con papel aluminio de madrugada o por la noche anterior y sujetarlo con unos clips para que no se caiga.

2. Por la mediodía o la tarde, quitar la hoja cubierta y quitar el papel aluminio y meterla en el bote que contiene alcohol.

3. Introducir el bote en el agua caliente para calentar el alcohol. En este proceso, se extrae pigmento verde de la hoja.



Respiración ---
El oxígeno y el bióxido de carbono

El hombre siempre respira.

Cuando respiramos, ¿expulsamos el mismo aire que aspiramos?

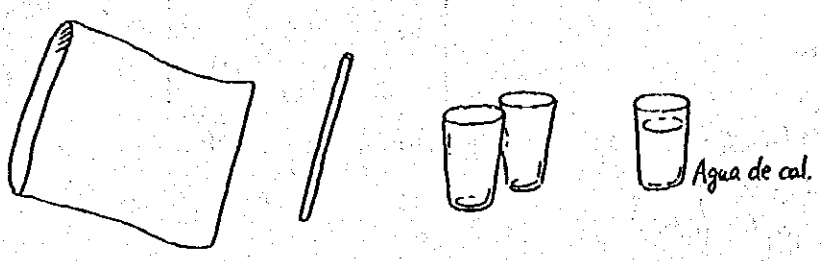
Vamos a averiguar si hay diferencia entre el aire que se aspira y el aire que se expulsa?

Experimento(¿Qué diferencia hay entre el aire aspirado y el aire expulsado?)

* Materiales necesarios

Bolsa plástica
Pajilla
2 vasos
Agua de cal (Indicador de Bióxido de carbono: El se nubla en color blanco cuando se mezcla con el bióxido de carbono.)

Ver la página de "La quema y el aire 3"



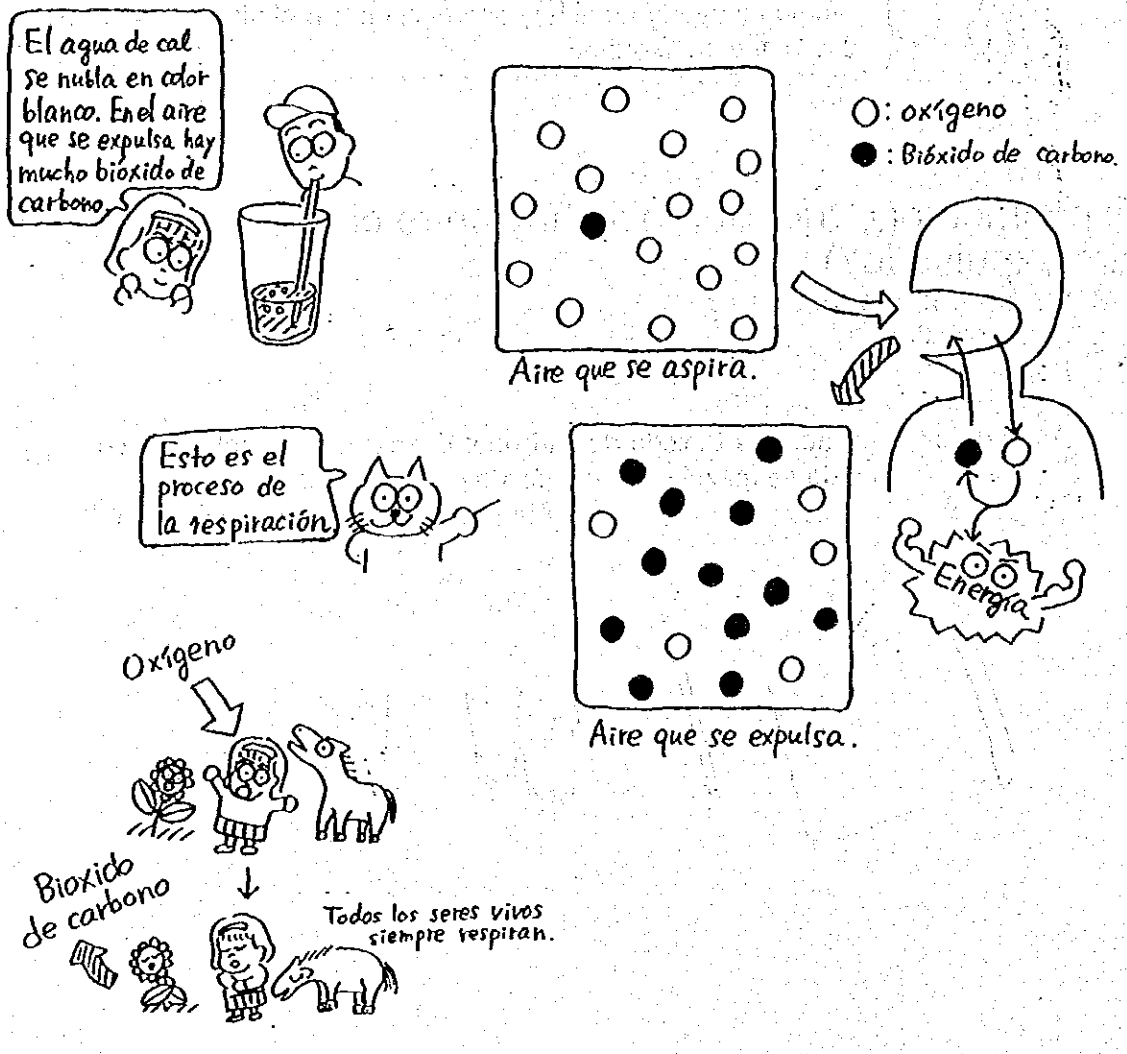
Comentario

El agua de cal en la que pasó el aire que se expulsa se nublará. Este cambio de color quiere decir que el aire que se expulsa contiene mucho bióxido de carbono. En cambio, el agua de cal del otro recipiente no se nublará. Porque el aire nos rodea no contiene mucho bióxido de carbono

Los seres vivos absorben el gas llamado "oxígeno" que es una parte del aire y expulsa el gas llamado "bióxido de carbono" que se produce y no se necesita en el proceso de la respiración.

El oxígeno absorbido es aprovechado en el cuerpo para producir energía que se necesita para los seres vivos.

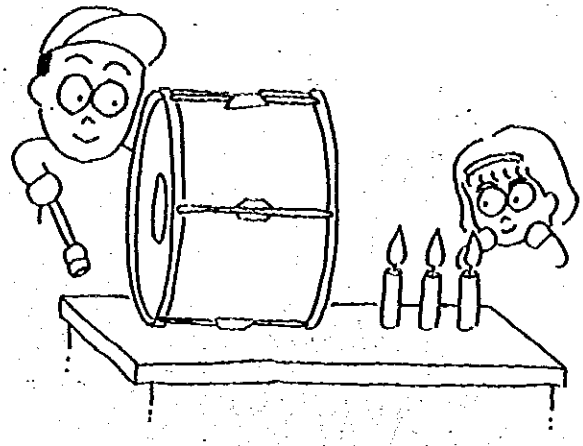
Al hacer ejercicio, aumenta el numero de respiros. Esto se debe a que se necesita más energía para realizar ejercicio, por eso se consume más oxígeno.



* Procedimiento

1. Poner un tambor y 3 candelas como la ilustración, luego encender las candelas.

2. Tocar el tambor fuertemente y suavemente.



* Pregunta

1. ¿Qué diferencia se observó en las llamas de las candelas?
   ¿Hay alguna diferencia entre las candelas que están cerca o lejos del tambor?

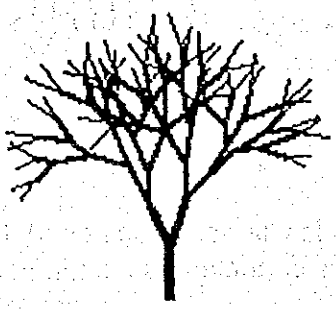
2. ¿Hay alguna diferencia en las llamas de las candelas según el grado de fuerza al tocar el tambor?

3. ¿Por qué hay diferencia en las llamas de las candelas, según el grado de fuerza al tocar el tambor?

(2) 指導案　6/1　理科教師

理科グループ資料1
「指導案：空気の性質」

96 Física-2



GROUP EINSCHTEIN

Plan de clase

tema: Las características del aire

subtitulo: La expansión del aire

ホンジュラス　6/1
S. H.

Plan de clase

tema: Las características del aire

subtítulo: La expansión del aire

<<< Lección 1 >>>

Profesor: Vamos a aprender sobre las características del aire. ¿Qué característica del aire conocen ustedes?

Alumno:
1. El aire es transparente.
2. El aire es ligero.
3. El aire es invisible.
4. El aire se permite quemarse un objeto.
5. El aire no tiene color.

P: Exacto. El aire tiene unas características, vamos a aprender una de estas. Cuando el aire se calienta, su volumen aumenta.

P: ¿Conocen ustedes este fenómeno?

A: No.

P: Bueno. Desde ahora vamos a comprobar este fenómeno usando un bote de refresco y un jabón. ¿Está bien?

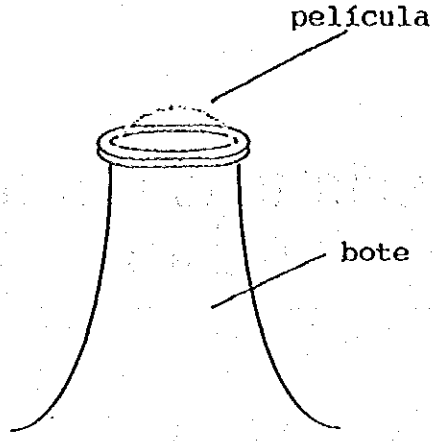
A: Sí.

<<< Experimento 1 >>>

P: Primero yo voy a explicarles el procedimiento de este experimento.

1. Disuelvan jabón en agua.

2. Preparen un bote de refresco. Introduzcan la boca del bote en agua con jabón y hagan una película de jabón.



3. Comprueben la presencia de la película y calienten el bote con las manos.

4. Observen bien el estado de la película. En este momento ustedes no deben mover el bote.

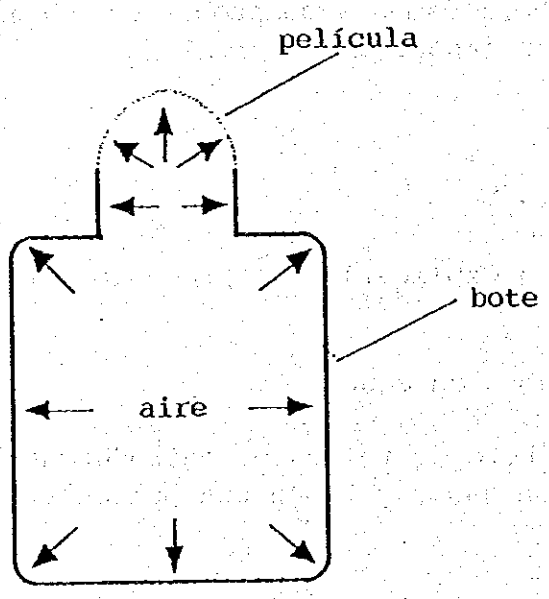
<<< Lección 2 >>>

P: ¿Qué observaron ustedes?

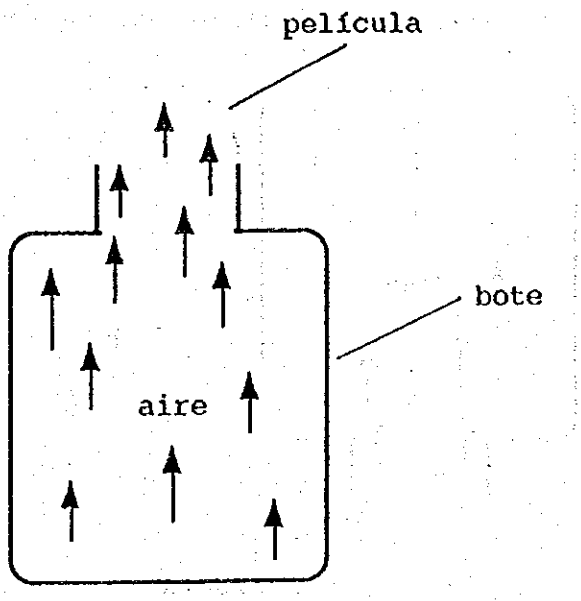
A: La película se hizo más grande.

P: Exacto. ¿Por qué la película se hizo más grande?

A: 1. Porque cuando se calienta el aire, su volumen aumenta.



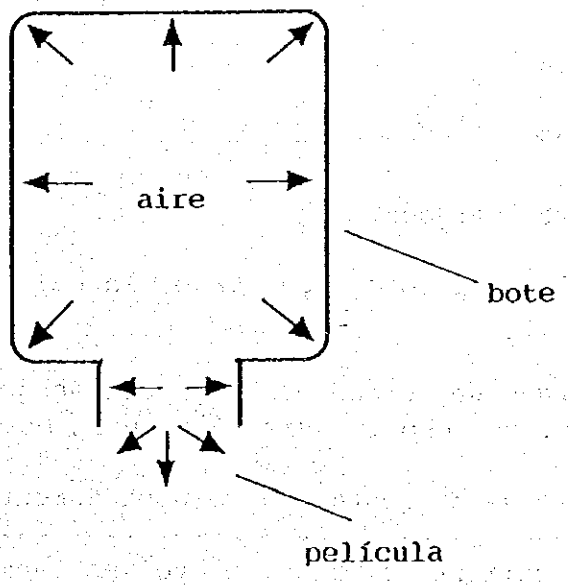
2. Porque cuando el aire se calienta, éste se pone ligero. Por eso sus partículas tienden a subir.



P: Ahora ustedes dijeron dos opiniones. ¿Cuál opinión es la correcta?

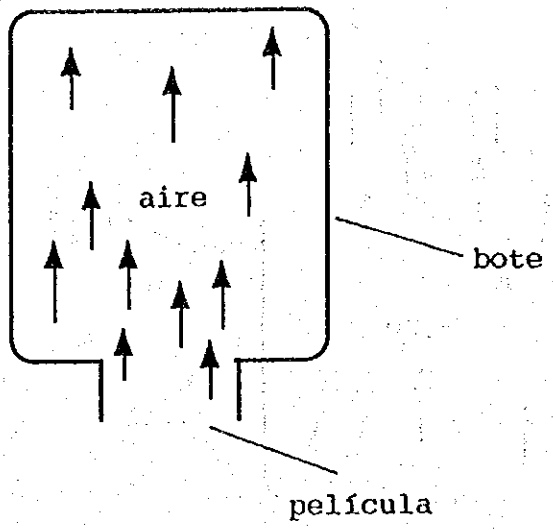
A: 1. La primera opinión es correcta.
2. La segunda opinión es correcta.

P: Bueno, si es correcta la primera opinión, cuando se coloca el bote boca abajo, la película se hace más grande también, ¿es verdad?



A: Sí.

P: Pero también es correcta la segunda opinión, cuando se coloca el bote boca abajo la película no se hace más grande.



<<< Experimento 2 >>>

P: Desde ahora vamos a comprobar esta situación experimentalmente. En esta ocasión calienten el bote boca abajo. ¿Están listos?

A: Sí.

P: Vamos a empezar.

<<< Lección 3 >>>

P: ¿Qué observaron ustedes?

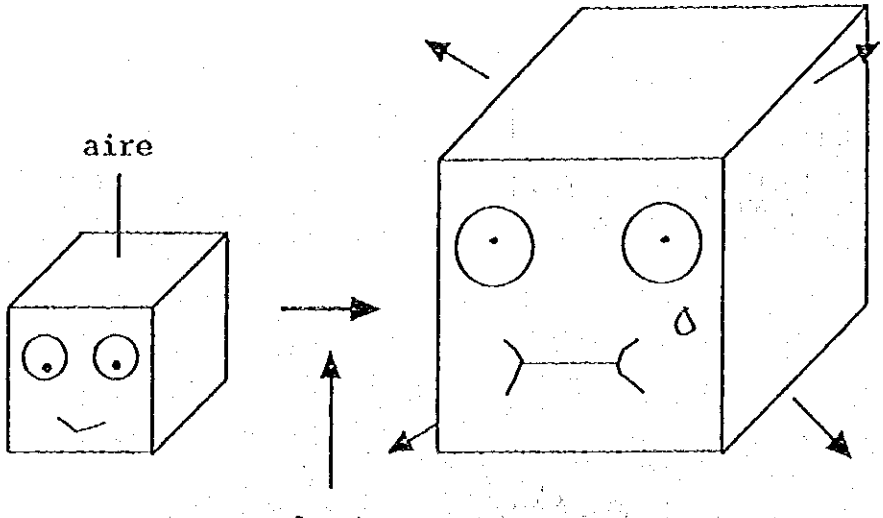
A: Cuando se coloca el bote boca abajo, la película se hizo más grande también.

P: Entonces, aunque se colocó el bote boca abajo, la película se hizo más grande. Por eso la primera opinión es la correcta.

P: Cuando el aire se calienta, su volumen aumenta.

---

1. Cuándo se calienta el aire, el volumen aumenta.



P: Yo voy a ordenar algunas cosas que ustedes aprendieron hoy.

---

1. Cuando se calienta el aire, el volumen aumenta.
2. Cuando aumenta el volumen del aire, el aire se extiende por todas direcciones.

理科グループ資料2
「指導案：燃焼と空気１」

96 Química-2

Plan de clase

tema: La combustión y el aire 1

subtitulo: Lo necesario para quemar

Plan de clase

tema: La combustión y el aire 1

subtítulo: Lo necesario para quemar

<<< Lección 1 >>>

Profesor: Para quemar, ¿qué se necesita?

Alumno:
1. Un papel.
2. Una madera.
3. Una leña.
4. Una gasolina.
5. Un gas.
6. Un fósforo.

P: Exacto. Para quemar se necesita una cosa que se pueda quemar. Pero sola esta cosa no permite quemarse, ¿es verdad?

A: Sí.

P: Entonces, ¿qué otra cosa se necesita para quemar un objeto?

un objeto	+	?	→	quemar

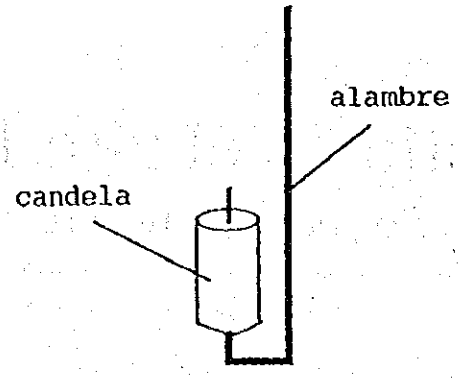
A: **********.

P: A decir verdad, esta cosa es invisible. Por eso desde ahora vamos a comprobar la existencia de ésta.

<<< Experimento >>>

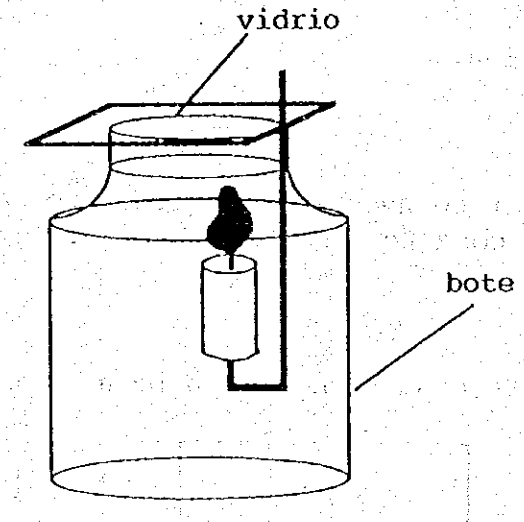
P: Primero yo voy a explicarles el procedimiento de este experimento.

1. Coloquen una candela en un punto del alambre.

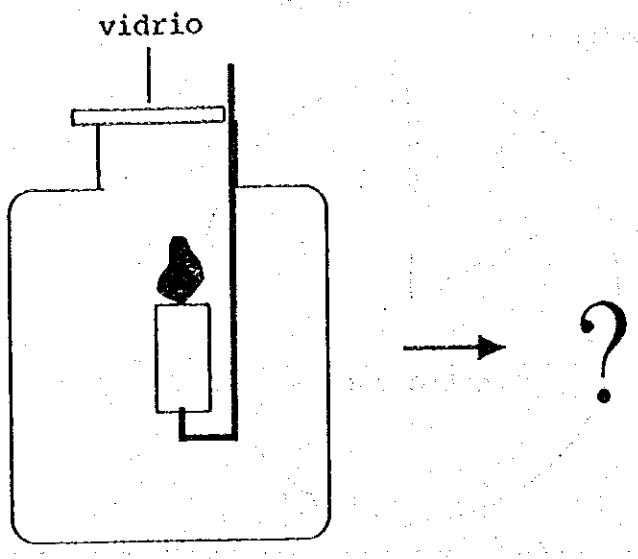


2. Enciendan la candela.

3. Introdúzcanla en un bote y tápenlo con un vidrio.



4. Observen bien lo que ocurre con la llama en el bote.



<<< Lección 2 >>>

P: ¿Qué observaron ustedes?

A: Se apagó una llama.

P: Exacto. ¿Por qué se apagó una llama?

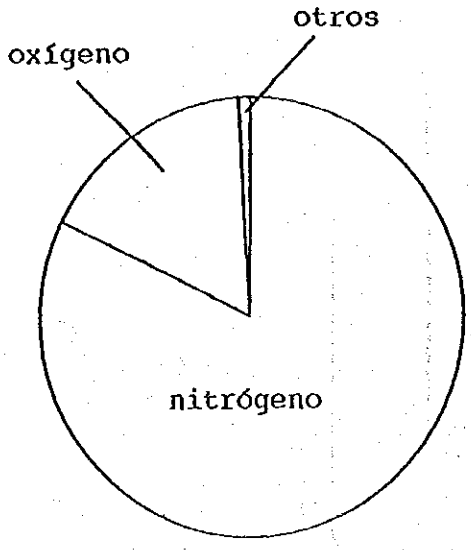
A: 1. En el bote no hay aire.
2. No había aire en el bote.

P: Así es. Yo voy a explicarles esta situación.

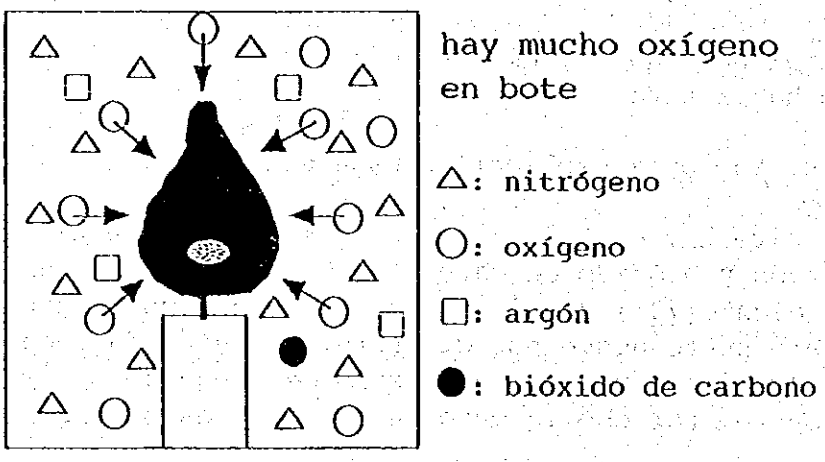
P: En el aire hay muchas clases de gas. Éstos son nitrógeno, oxígeno, argón y bióxido de carbono, etc.. En el aire hay setenta y ocho por ciento(78%) de nitrógeno, veintiuno por ciento(21%) de oxígeno, cero punto nueve por ciento(0.9%) de argón y cero punto cero tres por ciento(0.03%) de bióxido de carbono aproximadamente. Por eso la mayoría del aire es nitrógeno y oxígeno.

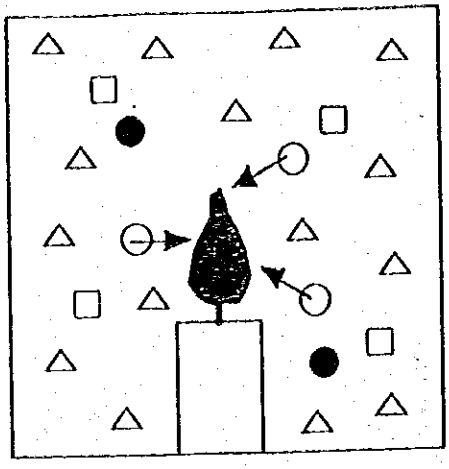
---

1. En el aire hay nitrógeno, oxígeno, argón y bióxido de carbono principalmente.
2. Hay setenta y ocho por ciento(78%) de nitrógeno en el aire.
3. Hay veintiuno por ciento(21%) de oxígeno en el aire.



P.: Para quemarse candela necesita oxígeno. Cuando no se tapa bote con un cartón se cambia el aire dentro de un bote continuamente, por eso no se apaga la llama. Pero cuando se tapa un bote con un cartón no se cambia el aire dentro de bote, por eso se apaga la llama.





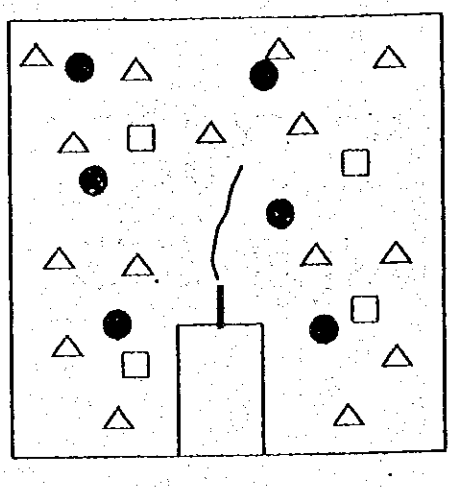
no hay mucho oxígeno en bote

△: nitrógeno

○: oxígeno

□: argón

●: bióxido de carbono



no hay oxígeno en bote

△: nitrógeno

○: oxígeno

□: argón

●: bióxido de carbono

P: Yo voy a ordenar unas cosas que ustedes aprendieron hoy.

---

1. Para quemar se necesita un objeto que se pueda quemar.
2. En el aire hay nitrógeno, oxígeno, argón y bióxido de carbono.
3. Se necesita la presencia de oxígeno para quemar.

理科グループ資料3
「指導案：燃焼と空気2」

96 Química-2

GROUP EINSCHTEIN

Plan de clase

tema: La combustión y el aire 2

subtitulo: El oxígeno

Plan de clase

tema: La combustión y el aire 2

subtítulo: El oxígeno

<<< Lección 1 >>>

Profesor: ¿Qué clase de gas hay en el aire?

Alumno:
1. Nitrógeno.
2. Oxígeno.
3. Argón.
4. Bióxido de carbono.

P: Exacto. En el aire hay nitrógeno, oxígeno, argón y bióxido de carbono.

---

1. En el aire hay nitrógeno, oxígeno, argón y bióxido de carbono.

P: Entonces, ¿cuál es el gas que se necesita para quemar?

A: Se necesita oxígeno para quemar un objeto.

P: Exacto. Para quemar se necesita oxígeno.

---

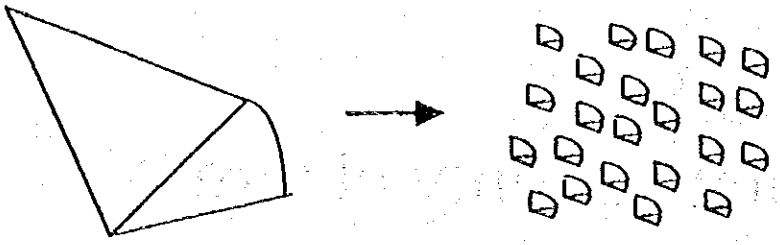
1. Para quemar se necesita oxígeno.

P: Bueno, vamos a comprobar esta situación a través de un experimento.

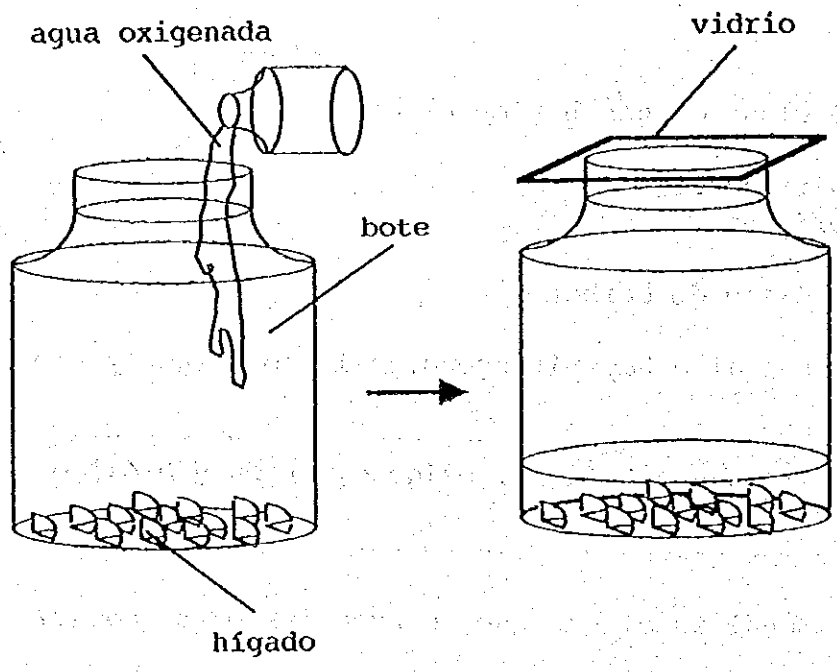
<<< Experimento >>>

P: Primero yo voy a explicarles el procedimiento de este experimento.

1. Corten un pedazo de hígado de res con un cuchillo en varios trozos lo más pequeño posible y echenlos en un bote.



2. Echen agua oxigenada en el bote y tápenlo con un vidrio.

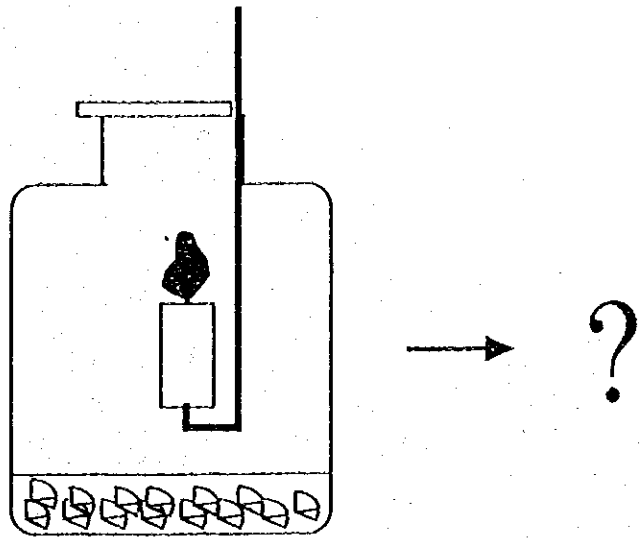


3. Coloquen una candela en un punto del alambre.

4. Después de terminar de producirse las burbujas enciendan la candela.

5. Introdúzcanla en el bote y tápenlo con el vidrio.

6. Observen bien lo que ocurre con la llama en el bote.



<<< Lección 2 >>>

P: ¿Qué observaron ustedes?

A: 1. La llama se vuelve más brillante.
2. Dura por más tiempo la llama.
3. La llama aumenta de tamaño.

P: Exacto. Ustedes observaron bien.

P: Yo voy a explicarles que fue lo que ocurrió.

P: Cuando ustedes echan agua oxigenada en el bote, el agua oxigenada reacciona con el hígado y se produce oxígeno en el bote. Por eso después de unos minutos, está lleno de oxígeno el bote.

P: En presencia de mucho oxígeno la llama aumenta de tamaño más que en el aire. Yo voy a resumir algunas cosas que ustedes aprendieron hoy.

---

1. El agua oxigenada reacciona con el hígado, y se produce oxígeno.
2. En presencia de mucho oxígeno la llama brilla más.

＜付表＞理・数系教師隊員の国別、年次別派遣実績

	マレイシア	フィリピン	ネパール	スリランカ	モルディブ	バングラデシュ	ブータン	中国	タイ		タンザニア	ケニア	マラウイ	ガーナ	ザンビア	リベリア	ニジュール	ジンバブエ	エティオピア		ホンジュラス	パラグアイ	ペルー	コロンビア	ボリビア	パナマ	ジャマイカ	エクアドル	ニカラグア	セントルシア	グァテマラ	エルサルヴァドル		サモア	トレガ	ソロモン	ミクロネシア	マーシャル諸島	PNG	ヴァヌアツ	フィジー		ポーランド	ブルガリア			
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87		2	7									①13		6	③3	4	1				1	2														①3											
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89		[2]	4									22		①2[2]	②7[4]	①5					[1]	[1]														①3											
90			7	1							3	9		②8[6]	5	2					②[3]	1[2]		2	[1]											2	[2]										
91		[2]	5		1						3	7		①4[4]	③4[2]							[1]	[1]			[2]										2	1[2]	1	①							
92			①1								8	3	1	1[5]	8[1]						①[1]	1[1]			[1]		①[1]								①	1	1[1]			3	2					
93			③1				1	1	1		12	7		②14[2]	②7[1]				②[2]		①[1]	[1]			①		[1]										4	1		①						
94		3	②3		1			2		1	8	8	2	16[1]	③5[2]					①		①4[2]		1	①[1]	1	1									1	5	②2	①	3				①		
95		7[1]					1				8	14	3	9	③14[1]						①1[3]	[1]			1	[1]			[1]				①		②			3	1			1			①		
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97		5	①3[2]				1				9	13	3	12	①12						①[1]	[1]				[1]		1		3			[1]						3						
98		7	6	2			1				6	10	2	8	5						①					[1]	[1]		1	1	1	②		1		3[4]	1	①1[2]	1		1					
計	㊎			⑦								①		⑧	⑲	②		②	①		⑨	①			①	①	①					③		③	②		②	③	①			①	①			
	理数	5	51	81	3	2	6	3	1	1	89	272	108	181	90	43	3	0			14	11	3	2	2	0	1	2	1	5	1	0		11	19	11	8	2	13	3	1		0	0			
	理	0	[5]	[7]	0	0	0	0	0	0	0	0	0	[23]	[13]	[2]	0	[2]			[13]	[10]	[1]	[1]	[2]	[8]	[4]	0	[1]	0	[1]	[1]		0	0	[16]	0	[3]	0	0	0		0	0			
総数		5	56	95	3	2	6	3	1	1	89	273	108	214	122	47	3	4	1		36	22	4	3	5	9	6	2	2	5	2	4		14	21	27	10	8	14	3	1		1	1			

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