COVER SHEET

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SUMMARY

Student Science Enrichment Training Program

Historically Black Colleges and Universities wing of the United States Department of Energy (DOE) provided funds to Claflin College, Orangeburg, S. C. To conduct a student Science Enrichment Training Program for a period of six weeks during 1991 summer.

Thirty participants were selected from a pool of applicants, generated by the High School Seniors and Juniors and the Freshmen class of 1990-1991 at Claflin College. The program primarily focused on high ability students, with potential for Science, Mathematics and Engineering Careers. The major objectives of the program were (I) to increase the pool of well qualified college entering minority students who will elect to go in Physical Sciences and Engineering and (II) to increase the enrollment in Chemistry and Preprofessional - Pre-Med, Pre-Dent, etc. - majors at Claflin College by including the Claflin students to participate in summer academic program.

The summer academic program consisted of Chemistry and Computer Science training. The program placed emphasis upon laboratory experience and research. Visits to Scientific and Industrial laboratories were arranged. Guest speakers which were drawn from academia, industry and several federal agencies, addressed the participants on the future role of Science in the industrial growth of United States of America. The guest speakers also acted as role models for the participants. Several videos and films, emphasizing the role of Science in human life, were also screened.

STUDENT SCIENCE ENRICHMENT TRAINING PROGRAM
PROGRESS REPORT

I. Introduction

Claflin College, a predominantly black undergraduate institution located in Orangeburg, South Carolina, has served the needs of rural communities for more than one hundred years. Claflin offers liberal arts and teacher preparation programs, and is fully accredited by the Southern Association of College and Secondary Schools.

The FTE (Full Time Enrollment) student enrollment during the first semester of 1990-91 was 910. According to the information obtained from the Office of Financial Aid, approximately 96 percent of the students received financial aid; on the average, a student was on 80 percent financial aid.

The church-related (United Methodist) school has experienced a significant expansion of its facilities in recent years. The Division of Natural Science and Mathematics is located in the James S. Thomas (JST) Science Center which was dedicated in 1976. It is a multimillion dollar modern building with good equipment and facilities.

The Division of Natural Sciences and Mathematics is composed of three departments: The Department of Biology, the Department of Chemistry,and the Department of Mathematics and Computer Science. The Department of Biology, Chemistry and Mathematics and Computer Science offer major and minor programs in their respective areas. The Department of Chemistry also offers a pre-

medical curriculum. In addition to offering a major in mathematics, computer science, a composite major in mathematics and computer and a composite major in computer and business administration, the Department of Mathematics and Computer Science also offers minors in Computer Science, Mathematics, and Physics.

II. Target Schools and Students

As is show in Table I* there is a progressive decline in the Science and Engineering Professions, chosen by the freshmen, entering colleges and universities. This is a nationwide trend and is not unique to Claflin College.

Table I*, Trends in science majors chosen by freshmen, nationwide

	PERCENTAGE OF ALL FRESHMEN	
	1977	1985
Biological Science	4.7	3.4
Physical Sciences	3.1	2.4
	1983	1984
Computer Science	8.8	6.1
	1982	1985
Engineering	12.0	10.0

Source NSF Publication NSB-86-100

Among students who complete degree programs in Sciences and Engineering, about one-half (1/2) of the B. S. Recipients, two-thirds (2/3) of M. S. Recipients and three-fourths (3/4) of Ph.D. Recipients actually entered the science work force. The

experts are already guessing, that by 1995, there will be approximately 1/2 million jobs than educated workers available for the new openings. They are also guessing, that blacks will continue to lose ground and the government will have to allow more immigrants in to make up the difference. If the present pattern of field selection continues and if employer demand does not abate, it is clear that the nation will face serious manpower supply shortage in technical fields over the next ten years.

Blacks and other minorities (Hispanics, American Indians) have dismissal record when it comes to their freshmen year. Blacks form about 10% of the nation's workforce. However, they form only 2.7 percent of the national professional manpower. One thousand blacks received Ph. D. Degrees in 1985, out of which, only 30 Ph.D. Degrees were awarded in Science, Mathematics and Engineering. Majority of 30 doctorate recipients were in the field of Biology and Health. In South Carolina, minorities (Afro-Americans) constitute 31.7 percent of the state population, but they form only 5.24 percent of the professional work force. The role of minorities in Science and Technology is very disappointing. A state, possibly, can not move speedily towards the new scientific horizons if a majority of its citizenry is incompetent to participate in the logic of decision making process relating to Science and Technology.

Today, black and other minorities constitute about twenty percent of the public high school's student bodies and by 2010, the minorities will form over one-third of the total work force. One can go on quoting statistics to prove that the minorities

are woefully under represented in the Science and Technology work force and a serous need exists to enhance their participating in these professions.

The Federal Government and several national companies have fully realized that there is going to be an acute shortage of technical manpower in the near future, consequently they have decided to exert their influence in increasing the role of minorities in the field of Science, Engineering and Mathematics. Historically Black Colleges and Universities wing of the Department of Energy at the Savannah River Operation Office was able to commit funds for the residential 1991 Summer, "Student Science Enrichment Training Program" which was held at the campus of Claflin College, Orangeburg, SC.

PROJECT PROGRESS

This project accepted thirty predominantly minority (Black) students. Twenty six of these students were highs schools juniors and seniors from rural South Carolina high schools, with limited science educated programs. However, the project also provided an opportunity to the freshmen class of Claflin College. Four students from Claflin who opted to major in sciences, chose to participate in this program. All student were black and came from small or medium sized towns in South Carolina.

This was a residential project. It was very helpful that the housing aid was given to the participants in this project, as the participants were recruited from rural areas where family incomes are very low and without room and board it would have been impossible to reach this group. Indeed, in the small and medium sized

towns of South Carolina, making up for the loss of a student's summer earnings is a significant contribution by a family. It was a wise decision that the participants were compensated for room and board while they were on campus, enrolled in the summer project.

III. Major Objectives of the Project

In many of the rural high schools in South Carolina the science and computer educational opportunities are limited to simple classroom discussions with little in-depth exploration of subject matter.

Students from such schools graduate with preconceived notion about the difficult task of succeeding in science professions. In particular, the opportunities for laboratory experiences are non-existence in such schools. In recognition of the deficiencies in scientific knowledge and techniques, the following goals were adopted for this project:

A. Increase the pool of well-qualified college-entering minority students who will select to major in Physical and Engineering Sciences.

B. Develop and foster knowledge, understanding, and interest in science.

C. Offer Chemistry program which places emphasis upon laboratory experiences and some research participation.

D. Develop in minority students the belief that the Science career are exciting, challenging, and can be successfully pursued by minorities.

E. Arrange visits to scientific laboratories and other points of scientific interests for motivational purposes and generate scientific curiosity.

F. Assist students in making career choices by introducing them to a variety of information and experiences, including interaction with scientists, guests speakers and role models.

G. Motivate the participants to go back to their high schools and work hard to prepare themselves so that they will be able to pursue science careers in college.

H. Encourage and motivated participants to take national college entrance (SAT etc.) tests and have the appropriate college faculty to guide the students in that direction.

IV. Project Description

The project for Student Science Enrichment Training Program (SSETP) was planned for minorities and disadvantage students who were (1) Rising Juniors (2) Rising Seniors and (3) Freshmen Class at Claflin College (1990-91 Freshmen Class). As soon as it was realize that the project will be funded by the HBCU/DOE, the project director in consultation with the various college administrators designed and printed a brochure for the SSETP. A list of all high schools, located in the state of South Carolina, was procured from the Office of the Admissions and Records. Five copies of the brochure which also included application blanks, was mailed to the chairman, Department of Science of each high school in the state. Copies of the brochure were also distributed to every freshmen at Claflin College. To provide additional information to the public, and for Summer Science program were run in news dailies of Columbia, Orangeburg, and Spartanburg. Additionally, each freshmen orientation instructor at Claflin College was requested to talk to the students about the availability of SSETP during 1991 summer for such individuals who may be interested in science careers. The students who were identified by their teachers or guiding counselors or academic advisors, as capable of pursuing careers

in Physical Sciences and Engineering were encouraged to apply for SSETP.

In response to our approach, the project received 71 applications which were placed into following categories (a) applicants from freshmen class at Claflin College (there were four applicants) (b) applicants who expressed interest in choosing Claflin College for their undergraduate studies (there were 16 such applicants) © applicants who were ready to go into Science careers, but their choice of undergraduate studies was not Claflin (d) the applicants who were not interested in science careers. The applicants in this category (d) were not considered for acceptance into SSETP. The project director interviewed, by telephone many of the applicants to determine the firmness of their resolve and interest in Science, Engineering and Mathematics (SEM). All applicants from Claflin College were accepted into the program as they met several requirements, including one of increasing the student enrollment in the Division of Science and Mathematics and Computer Science. The applicants in the categories B and C were separately graded, based on the telephone interviews and their academic performance. Twenty six applicants out of these two categories were selected. All the selected applicants were informed through a letter. They were asked either to accept the offer by checking "Yes" or refuse the offer by checking "No". One applicant checked (No) and two of them did not care to respond. Consequently a subsidiary list of applicants who were on the waiting list was produced. The applicants in this group were made the similar offer as mentioned above. By June 10, 1991 we had thirty applicants (see enclosure 1) who committed to join the program for 1991 Summer.

The students were housed in the college dormitories. The female students, numbering about twice than the male participants, were accommodated in Asbury Hall, two per room on the ground floor. The male students were accommodated in High Rise dorm, three to a room. The project director and some other SSETP staff members were int he dorms to facilitate the moving of participants into the assigned spaces.

The Student Science Enrichment Training Program (SSETP) ran concurrently with the college's summer school of 1991. The SSETP commenced on June 10 and ended on July 19, 1991. The students reported to the Science building on the morning of June 10, 1991. The participants were enrolled in Chemistry 121 (Gen. Chem.) and Computer Science 200 (Computer Concepts) for a total of 7 semester hours (sh). They were divided into two groups of 15 each. Consequently, there were two sections (A & B) for Chem. 121 and two sections for Computer Science course. One group of fifteen students took Computer Science and the other took Chemistry. The group rotated with each other so that each student was exposed to chemistry and computer operations and its applications in solving chemical problems. Chemistry academic programs, assisted by computer simulations and computer assisted instructions (CIA) to make learning of chemistry fun, were offered during six weeks of the program. Each student was aided to learn adequate fundamentals of computer handling and operations which were applied to the learning of Chemistry and en-hancement of computer expertise.

The students were involved in classroom instructions, laboratory activities and

research. It was conceived that the student's involvement in research and science projects stimulate the high ability students to continue their education and plan for careers in Science and Engineering. Each student was encouraged to select a topic in the fields of Science or Computer Science which involved one of the following:

A. Laboratory research requiring skills to use simple scientific tools and chemicals under laboratory conditions.

B. Literature research on any of the modern topics of scientific interest such as laser, fusion, Super conductivity,threat of aid environmental issues etc.

C. Fabricated Science project which can demonstrate Science Technology applications.

D. Computer simulation/software modifications etc.

This idea of student's involvement in research was a great success. Every student prepared material (see enclosure 2) of his or her choice and presented it to the audience which included students and faculty. These seminars were jointly chaired by a student and a faculty member. The student chairperson was given the responsibility to introduce the speaker who provided autobiographic material to the chairperson. Several students received achievement awards in chemistry, computer science and research presentations.

The caliber of material and its presentation was excellent considering the academic background of each participant. Each winner was awarded an achievement certificate and a cashier's check for $20.00 for first place, $15.00 for second place and $10.00 for third place. These awards and certificates were awarded by the President of the college at the closing banquet. The parents of the participants were invited for the banquet. The closing banquet was taped. The video tape is

available in the Office of the Director. Dr. McNealy, Vice President of the College hig-lighted the occasion by his humorous talk which brought out the role of minority scientists in keeping America ahead of competition. Each participant received a certificate for having successfully completed the SSETP. Additionally each participant received 7 Semester Hours of academic credit 4, SH in Chemistry and 3 SH in Computer Science - which is transferable to an undergraduate institution of their choice.

Instruction on the use of the library, correction of fundamental deficiencies in Mathematics and Science, discussion on career in Science, and the preparation and presentation of papers on the research projects were integral part of this project. The participants also received training in taking the SAT.

A work assignment sheet was provided. Provision was made for tutoring by undergraduate Chemistry and Computer Science student assistants, in supervised study sessions, and for generous time allotment to teachers for office conferences with students. Supervised study sessions were scheduled for the afternoon hours. Miss Brooks, a Chemistry major and Mr. Rodney James, a Computer Science major were employed as laboratory assistants. They performed tutorial services and counselling and were the constant companions for the SSETP participants.

V. Guest Speaker

Several activities such as project meetings, sessions with the guest speakers, presentation of science application videos and sound filmstrips were scheduled in the afternoon. The guest speakers were drawn from a spectrum of persons, with

good scientific as well as community service backgrounds. The speakers who participated in this program represented academia, Claflin College, South Carolina State College, Industry-Ethyl Chemical Corporation, Dupont, Business World and Governmental agencies-Department of Energy. The speakers acted as role models and assisted the participants to examine career choices in Physical and Computer Sciences, Mathematics and Engineering. Selected sound strips and videos which contributed to student's knowledge, were procured from American Chemical Society and National Science Foundation, were screened from time to time. Each such presentation was followed by open discussion in which participants as well as guest speakers took an active part. The guest speaker donated their time and energy free as a service to the community. The names of the speakers, their affiliation along with their topics are given below.

1.	Dr. Oscar Rogers, President Claflin College	"Crime in Black Society"
2.	Bert Knessel, Ph.D. Organic Chemist Ethyl Chemical Corporation Orangeburg, SC 29115	"Chemistry and You"
3.	Tony Graham, M.D. Claflin Alumnus Graham Clinic Lake City, SC 29560	"What it takes to Succeed"
4.	Vernon Middleton Vice President for Alumni Affairs	"Role of Claflin in our Community"
5.	Willie Frazier, Ph.D. Claflin Alumnus Dupont, SRP	"SRP and our Community"

Aiken, SC

6. James Arrington, Ph.D.
Zoologist, Dean
College of Science
S. C. State University
Orangeburg, SC
"Bioengineering, Gene Splicing and Human Race"

7. George Lee, Director
Admissions and Records
Claflin College
"Claflin is Good for You"

8. Frank Wright
HBCU Coordinator
DOE, SRP
Aiken, SC
"Future Role of Black Scientist's"

VI. Industrial/Academic Visits

To expose the students to science outside the program and to familiarize them with research tools in science, students were taken to a day-long field trips to scientific laboratories located at places such as the Savannah River Plant (D.O.E. Facility in Aiken) and the Medical University of South Carolina in Charleston.

To further expose the students to different scientific settings and provide appropriate role models, a series laboratory visitations and field trips were planned. For example, students visited the University of South Carolina, Columbia, which has regional Nuclear Magnetic Resonance (NMR) facilities and recently completed an engineering center and Savannah River Ecology Laboratory which houses live alligators and many other reptiles. At SRP, students also visited laboratory facilities where research relating to the handling and disposal of radio active waste material is being conducted. The students also visited robots research center at SRP. A number of get together opportunities were made available to the students through

picnics and formal dinners. Summer program for participating students was conducted in such a way that students left the campus,a t the close of the semester, thinking that Science is fun and a rewarding field to get into. The places visited by participants along their importance are given below:

	Place	Importance
1.	Hughes Aircraft of South Carolina Orangeburg	Missile Brain
2.	Carolina Eastman Columbia/St. Matthews	Fiber material, Coke, Pepsi Plastic containers, etc.
3.	University of South Carolina Columbia, SC	Super Computer Center, Science facilities Engineering Center Campus Tour
4.	Westvaco Charleston, SC	Paper and Pulp Manufacturing faculty
5.	Medical University of South Carolina Charleston, SC	Department of Anatomy, Pathology Medicine, Biochemistry, Minority Center, Campus Tour
6.	Waste Water Treatment and Water Participation Plants Orangeburg	Recycling of Water Water Treatment
7.	Riverbank Zoo Columbia, SC	Visit to Animal Shelter Place etc.

In addition to Scientific and industrially related trips, students participated in several picnics at places such as Edisto gardens, Battery, Charleston; and Capital, Columbia. They also had BBQ at the president's resident.

The Computer Science Program was supported by a computer laboratory, housing an interactive, time sharing, mini-computer system. The Computer Laboratory is located on the first floor of the air conditioned Science Center. The college owns a Digital Equipment Corporation VAX-11/750 RA81/TU80 computer system with 2 MB of ECC MOS memory and 456 MB of disk storage. The laborATory, a "user oriented" computer facility, has 9 VT 220's and 2VT 240's (graphic) video terminals. The CRT terminal users were able to get hard copies from the LP 25 line printer.

The Chemistry Department is located on the third floor of the JST Science Center. The equipment in chemistry and the facilities in which it is housed are modern and more than sufficient for instructions at the college level (Professional B. S. in Chemistry). Claflin's Chemistry Department is particularly well positioned for this kind of project, in part, because it has received, since 1972, several research grants from the Environmental Protection Agency, the United States Department of Agriculture and U. S. Department of Energy. The Department owns or has free access to a wide variety of scientific tools and equipment.

VII. The Chemistry Program

The chemistry program was designed and implemented by Dr. H. Sabiaree. In addition to the previously mentioned general science objectives, the chemistry program had the following additional objectives.

A. Develop in students the basic knowledge and skills essential to the understanding of chemistry.

B. Develop skills of accuracy and precision in thinking, communication,

experimental observation and manipulation.

C. Develop an ability to interpret the properties and reaction of atoms and molecules in terms of structural theories.

D. Inspire in each student an interest in Chemistry as an exciting and useful discipline.

E. Guide Students to understand the elementary methods employed to conduct research in the area of Chemistry.

In addition to recitations and discussions, in a relaxed classroom environment about the theoretical aspects of chemistry, students were led to perform laboratory work which enabled them to intuitively accept various chemical principles. They were encouraged to select research topics appropriate at their levels for conducting group or individual research. The activities of the chemistry program was organized as outlined below.

First Week. Students were exposed to some physical measurements, periodic table, atoms and molecules, followed by laboratory experiments relating to the theoretical aspects of these discussions. The students were exposed to chemical literature research and encouraged to select topics of their choice for group or individual research. The role and importance of chemical discipline for man and his environment were brought to their attention. Emphasis was placed upon the job and career opportunities which exist in this field.

Second Week. The students were led into the secret of chemical bonding, formulas equations, and classes of compounds. Laboratory was designed to reinforce the theoretical experience gained by them in the classroom. The students were encouraged to discuss with the instructor the topics of their choice for research for

the final selection and approval of one of the research topics for further study.

Third Week. The students were exposed to the mole, energy, and weight relationship. The laboratory work was designed to calculate molarity, normality, equivalent weight, and prepare standard solutions of various acids, and bases. The students designed and set up experiments to meet their respective research objectives pertaining to their selected reseach projects and started collecting data or fabricating science projects.

Fourth Week. During this week students studied acids, bases, and salts. Theoretical aspects of proton donor and its relation to pH were discussed. The laboratory work was designed to determine the acidity of lemon juice, vinegar, and acid neutralizing power of various anti-acids available in the market. The student continued to work on their projects collecting data.

Fifth Week. The students were exposed to the gas laws, and the kinetic-theory of gases. Laboratory work was designed to study the diffusion and weight relations of gases, relations of pressure temperature, and volume were explored. Students fabricated their own equipment for these experiments. The students continued to collect research data and prepared manuscripts for seminars.

Sixth Week. Final test was held Research/Science Project were written up for presentation at the seminars. Seminars were held. The Research and Science Project data were presented. Students evaluated the SSETP project.

VIII. The Computer Science Program

The Computer Science Program was designed and implemented by Mr.

Perwaiz Aslam, Director of Campus Computer Center. Upon completion of the Computer Science Program, the students were expected to analyze simple scientific/mathematical type problems, tow rite BASIC programs for solving them numerically, to enter the programs ont he computer, to correct the errors, and to execute them properly on the College computer system. The students were able to:

1. Analyze simple science/mathematics problems and to devise algorithms for solving them.
2. Express the algorithms in sequence of computer steps.
3. Code the steps in the BASIC language.
4. Enter the computer code into the computer system, edit the code, list the code, and execute the code.
5. Modify existing programs in order to meet a modified statement of the initial problem.
6. Use available software/methodology of C.S. For learning Chemical facts.
7. Application of computer for learning Chemistry.
8. Modify existing programs in order to improve them structurally, and to make them clear, faster, and efficient.
9. Use computer jargon and concepts properly.
10. Apply computer methods in fields like, sorting simulation gaming, word-processing, mathematics, economics engineering and the other science fields.

IX. Evaluation

Each student's performance was quantitatively evaluated through objectives type of testing procedures which was adopted by each participating instructor. Three

tests, including the final two hour tests, were given in each area to evaluate the learning potential of each student and his or her ability to perform in Science, Mathematics, and Engineering fields.

Each instructor also performed a qualitative analysis on each participant to evaluate his or her motivation, energy, and desire to succeed in their chosen academic field through intelligent participation and hard work. All participants were absolutely positive to select careers in Science, Engineering and Computer Science. The participants took advantage of the facilities available at Claflin College to prepare for SAT etc.

Two of four students selected in this program from the College's freshmen class decided to stay with the Department of Chemistry or Computer Science.

The data generated by each instructor is being compiled by the program director for an overall evaluation of each participant. This could not be done in the sixth week due to lack of time and coordination as instructors were busy. Each participant was awarded a certificate at the closing ceremony which was held on the last day of work at Claflin College. The parents and the college administrators joined this occasion. The final banquet was well attended and was taped for future reference.

The course outlines in Chemistry and Computer Science Programs offered, during the summer sessions at Claflin College have been supplied to participating schools, Department of Chemistry and Department of Computer Science at Claflin College, with the recommendation that each participant be awarded 4 Semester

Hour credit in Chemistry and 3 Semester Hour credit in Computer Science.

X. Follow Up

Each participant at some future date will be provided with his or her confidential rating report and analysis of his or her future goals. The Director has designed and set up a mechanism to establish contacts with the students, for monitoring his or her Science, Engineering and Computer Science careers.

Pre-College Science Engineering and Mathematics Seminar

In continuation with our efforts to motivate the high school students, the student Science Enrichment Training program in cooperation with the College administration, held one day Pre-College Engineering Science and Mathematics Seminar as a part of College day for high schools. The seminaries was held on December 3, 1991 which was also a homecoming for Claflin College. Claflin was having a homecoming basketball game. The college's Pantherettes (lady basketball team) ended their season with a number two spot in the NATION. Several activities were scheduled for the visitors. However; the major theme was to bring to the attention of visitors what Claflin could do for them in the field of undergraduate science and computer studies. The visitors were Claflin guests and were allowed free to get in the basketball game. All the visitors were introduced during the half time.

Monitoring of student progress will continue through out his or her college life to collect data to evaluate the degree of success of the project. The monitoring of students progress and his ultimate success will continue beyond the project period

of summer 1991.

XI. Organization and Management

The project was initiated on June 10, 1991 to coincide with the College Summer School 1991. Its duration was six weeks. Dr. S. S. Sandhu carried the primary responsibility for the operation of the project. A SSETP Advisory Committee consisting of Dr. Sablree, Mr. Aslam, Ms. Brooks and Mr. James was established. Dr. Sandhu served as a chairman of this committee. Selection of participants was done by the SSETP faculty and staff.

The project instructors had a few days, prior to starting date, for the preparation of instructional materials for finalizing their plan of action for class, laboratory, research, and program activities.

The College General Fee allowed the participants to become involved in the athletic and social recreational programs, organized by the College. Nevertheless, two laboratory assistants were employed to serve (1) as coordinators of recreational programs (2) to coordinate the tutoring in supervised environment and (3) to help in Chemistry and Computer laboratories. The Project Director's responsibilities also included the organization of student activities and visitation by the guest speakers.

The formal evaluation of the project programs was done first by students on end-of-semester evaluation forms. Secondly, by student laboratory assistants and finally, during the final week, the project instructors participated in the evaluation of project activities. The instructors met to share the experiences and evaluate the project form their prospective. The Project Director is presently in the processes of

consolidating this information.

XII. Project Director

Dr. Shingara S. Sandhu, Project Director

Dr. Sandhu was [redacted] He received his M. S. In Chemistry from Punjab University, Chandigarhin 1954, and his Ph. D. In Environmental Chemistry from Utah State University 1970.

His post-doctoral studies and training include: Environmental application of GC mass spectrometry; water resources training; Nuclear Magnetic Resonance Spectroscopy; speciation of metal ions in Aquatic System and Sluice; computer application in undergraduate chemistry programs; environmental assessment programs; Thermodynamics of Water and Heat Fluxes, and instrumental application in Chemistry. His research has related to Recondite Toxicity of Arsenic Species, Kinetics of Degradation and Transport of Pollutants in Human Environment, Methods Development for Total Arsenic and Arsenic Speciation in Biological and Aquatic Systems. His research has been in the Environmental Analytical and Environmental Physical Chemistry.

Dr. Sandhu has taught College Chemistry, including Physical Chemistry and Instrumental methods of Chemical Analysis, since 1955. At present, in addition to teaching, he is principal investigator for the project funded by Department of Energy. He has over 40 publications. He is a member of American Chemical Society and its Environmental Divisions.

XIII. Benefit of SSETP

A. Motivational:

Upon completion of this program all of the participants were motivated to enroll in high school science and mathematics courses, and hopefully will work hard to prepare themselves for college entrance. All participants were eager, to pursue careers in Science, Engineering, Computer and Mathematics as he or she goes to the college of their choice. Claflin students who chose to participate in this program, were urged to continue their career in Chemistry and Computer Science. Indeed, during the Fall Semester of 1991, the Project Director will try to invite school principals or their designees to estimate the general effect of the project on the participants, and their subsequent classrooms performance:

B. Claflin College as Beneficiary

Availability of funds for summer academic programs in Chemistry were great attraction and inducement for 1990-1991 freshmen class at Claflin College to opt for Chemistry career. Minority teens, especially of rural areas, have a very difficulty time in getting rewarding summer jobs. The college, having received funding through this project, contributed richly to the professional growth of the student throughout his or her stay in the college. The added attraction of academic summer program in Chemistry along with the growing demand for Science and Engineering professional probably will contribute towards increased enrollment in the Department of Chemistry at Claflin College. Two students our of four who participated in SSETP from Claflin College changed their major to Chemistry. It is a

good beginning.

C. Academic Head Start:

The participants had a head start over the general high school population who intend to go to college. They have also favorable and promising start. Not only they earned 7 Semester Hours of credit, 4 SH in Chemistry and 3 SH in Computer Science to carry to the college of their choice they also had an early taste of college life; the freedom and the responsibilities that follow such activities. They were able to see first hand the Chemists, the Computer Scientists, Physicists and Physicians in action. They saw the role of Chemistry in Human Life.

STUDENT SCIENCE ENRICHMENT TRAINING PROGRAM
INFORMATION DISSEMINATION

SSETP Brochure was published. It provided information to the potential participants about the requirement for entering the SSETP program and their obligations. The brochures were mailed tot he Science Teacher of every high school in the State of South Carolina which was followed by telephone calls to some schools, which are located in rural areas away from cosmopolitan cities. Every students of the freshmen class of 1990-91 at Claflin College was provided with SSETP brochure. Additional, every orientation teacher of the freshman class was requested to spend sometime in his or her class to provide information to the students about the SSETP. Sever ads in daily news were taken to provide information to participant population.

A few days prior to the initiation of the SSETP at Claflin College the Director of the Program was invited by the Jones Inter Cable TV, Orangeburg, SC for in depth discussion of the requirements and future impact of SSETP on Science and Engineering fields. The tape of this recording is available in the office of the Project Director. The taped program was screened for the TV viewing audience in South Carolina.

A reporter from Times and Democrat, a popular local daily news paper; visited the college for an interview with the Director and to observe the SSETP students in operation. The reporter wrote an article which not only was complimentary to the program but also provided an in depth analysis of the

program. The interviews with the various news media were arranged by the college Public Relation office, Mrs. Lemon. A representative of Quicky Radio Station, St. Matthews, also visited the college to observe the SSETP participants in action. The Times and Democrat reporter also participated in the closing day ceremonies of the SSETP which was high lighted by a banquet, award of certificates and achievement awards. The Jones Inter Cable TV invited the students and the Project director for an interview on July 25, 1988. The taped interview was screened for the viewing audience in South Carolina. A copy of the taped interview is kept in the Office of the Director, the final day banquet and the award ceremonies were taped for future reference.

PROPOSED SCHEDULE OF ACTIVITIES

FY 1992-93

Description of the project activities was detailed in the original project proposal which was submitted to the Department of Energy in the Spring of 1991. Major activities for Fall of 1991 related to the follow up studies of the academic achievements of the participants. The Director has established a mechanism to contact the students and their academic counselors. A report on the quantitative and qualitative evaluation of his or her motivation, energy and desire to succeed in their chosen academic field will be mailed to each SSETP graduate in due course of time. The director will continue to maintain close ties and contracts with the SSETP graduates through telephone calls and other contacts. He will coordinate his activities through respective academic counselors who will help the students to

make career choices.

The brochure providing information to the potential participants has been published for 1992 summer program. Five copies of the brochure have been provided to the office of the Academic Counselor of each high school. The counselors along with the science teachers have been urged to identify such students who have potential to go into Science and Engineering fields and have such students to apply for the SSETP program during 1992 summer to be held at the campus. The 1991-92 freshmen class at Claflin College has been provided with the copies of the SSETP brochure. The attempt will be made to mail a copy of the brochure to the parents of the freshman class of 1991-92. The parental help will be solicited to see if the students can be urged to select careers in Science, Engineering and Mathematics. It is also desired to provide copies of the brochure to the SSETP participants of 1991 summer, for them to identify students in their schools who may be interested in participating in SSETP.

A merit list of applicants based on the information supplied by the potential participants will be prepared by the Director. The top 30 applicants will be offered sports in the SSETP, for them either to accept or reject the offer by April 29, 1992. A subsequent list of candidates will be prepared and additional potential participants will be contacted in case a need arises.

The project will be initiated June 9, 1992 to coincide with the College Summer School of 1992. Its duration will be six weeks. Dr. H. Sablree and Mr. P. Aslam will serve as Chemistry and Computer Science instructors respectively. One student will

be hired as laboratory assistant and tutor and to manage the out of class activities, such as local trips, picnics, visitations to various points of interests within the State of South Carolina. Introduction and class registration for courses will be done on the first day of school. The abbreviated curriculum vita for each of the project instructors appears under the progress reports of SSETP for the year 1991-92. The SSETP will run through July 19, 1992.

The activities listed in the original project were found appropriate and rewarding for the target audience and will be repeated for 1992 SSETP, with one exception that we would like to invite the SSETP Alumni for the final banquet which will be held on the last day of 1992 summer. Each SSETP Alumnus who will come to participate in the banquet to be held at Claflin College campus must be compensated for travel cost. The project must also provide lunch to the alumni at the banquet.

It is also conceived desirable and beneficial for future contacts to invite the High School Principals or their designees to attend the 1992 closing Banquet. We would like to have the schools get deeply involved in the future of Science in the United States of America. The school representative who will decide to come must be compensated for travel and lunch.

STUDENT SCIENCE ENRICHMENT TRAINING PROGRAM ROSTER OF PARTICIPANTS 1991 SUMMER

	NAME	AFFILIATION
1.	Tanya Benson	Newberry High, Newberry, SC
2.	Michael Williams	Mid Carolina High, Prosperity, SC
3.	Terrance Brown	Kingstree Senior High, Kingstree, SC
4.	Gary Cain	Malboro High, Bennettsville, SC
5.	MaRenins Collins	Blackville-Hilda High, Blackville, SC
6.	Tyoka Davis	Southside High, Greenville, SC
7.	Tycie Edwards	Hartsville Senior High, Hartsville, SC
8.	Tamisha Elmore	Blackville-Hilda High, Blackville, SC
9.	Rabiah Fraser	Middleton High, Charleston, SC
10.	LaDawn Frasier	St. John's High, John's Island, SC
11.	Angela Gilbert	Seneca High, Seneca, SC
12.	Nakpangi Hampton	Seneca High, Seneca, SC
13.	Patrick Jones	Marion High, Marion, SC
14.	Tinisha Ladson	Middleton High, Charleston, SC
15.	Katrina Linning	Summerville High, Summerville, SC
16.	Sharon Maynor	Bamberg-Ehrhardt High, Bamberg, SC
17.	Areshia McFarlin	Northside High, Atlanta, GA
18.	James Moss	St. Andrews High, Charleston, SC
19.	Boyd Owens	Palmetto High, Williamston, SC
20.	Walter Robinson	Blackville-Hilda High, Blackville, SC
21.	Nicole Sawyer	Mayo High, Darlington, SC
22.	Nikki Saywer	Mayo High, Darlington, SC
23.	Chrystal Simmons	Summerville High, Summeville, SC
24.	Kesha Stewart	Berkeley High
25.	Stephanie Tyler	Wagener-Sally High
26.	Hazel Washington	South Florence High, Florence, SC
27.	Dwayne White	Holly Hill-Roberts High, Holly Hill, SC
28.	Jennifer Williams	Cheraw High, Cheraw, SC
29.	Vonita Williams	Wagener-Sally High, Wagener, SC
30.	Keyonia Young	Mid Carolina High, Prosperity, SC

1991 SUMMER

SEMINAR

STUDENT SCIENCE ENRICHMENT TRAINING PROGRAM

SPONSORED BY

UNITED STATES DEPARTMENT OF ENERGY (HBCU)

SAVANNAH RIVER OPERATION OFFICE AIKEN, SC

CONDUCTED BY

CLAFLIN COLLEGE ORANGEBURG, SC 29115

ABSTRACT OF PAPERS

Benson, Tanya, and Williams, Michael, Newberry High and Mid-Carolina High, Global Caution

The earth is fast changing, and the there is a great need for global help. The earth, its ozone layer, and its environment are being poisoned and polluted. In our research part of our project we will discuss problems, solutions, and laws to help make the earth a better place to live. The people have to ban together to help make this happen, because if we don't who will.

In the experimental part of our project we will be creating an experimental system to investigate the effects of detergent as a pollutant, list characteristics of eutrophication, and relate the effect of detergent pollutants to the organisms in the environment. This is to show that in recent years disposal of waste products has been the most damaging problem in recent years for the human populations. Another important purpose is to determine the effects of the detergent to see if we can work to make it better.

3

Brown, Terrance, Kingstree Senior High, Kingstree, SC
Which Soil Holds the Most Water

My project is which soil is able to hold the most water. In order to find this you will need to perform a experiment. I wanted to know this so I decided to put my ideas into a experiment.

4

Cain, Gary, Marlboro High, Bennetsville, SC
Supersaturation

The Purpose of this project is to see how things can become supersatured. In this experiment superation of a solution was the objective. In a solution after superation, if cooled, it forms crystals.

5

Collins, MaRenins, Blackville-Hilda High, Blackville, SC
Conservation of Matter

My Project's title is conservation of matter. The project basiced on the law that states the you can't destroy matter, but you can only change it.

I am going to research the conservation of matter law into greater detail through a research paper. The project will also define matter. My project's main focuse will be on conservation of matter.

My experiment will hopefully prove that you can't destroy matter.

6

Davis, Tyoka, Southside High, Greenville, SC
The Acidification of Soap

The sodium and potassium soaps are soluable in water and are used as cleansing agents. The calcium, magnesium and ferric salts are insoluable in water and are not useful in soaps. These insoluable metal salts precipitate as a scum when ordinary soaps is used in hard water. Syndets (synthetic detergents) do not form insoluable salts with the metallic ions normally present in water. Acidification of a solution in a soap will cause the fatty acid to precipitate.

7

Edwards, Tycie, Hartsville Senior High, Hartsville, SC
Sickle-Cell Anemia

My paper is about Sickle-Cell also called Sickle-Cell Anemia. It is a hereditary disorder characterized by malfunctioning red blood cells which forms it in the shape of a sickle. The Sickle-Cell Disease is most common among black persons although it also is common among Mediterranean and other groups in the world.

Most carriers of the disease have the symptoms but are not to sure. Sickle-Cell symptoms are shortness of breath, pain in the bones, muscles and abdomen. This disease is very fatal.

8

Elmore, Tamisha, Blackville-Hilda High, Blackville, SC
All About Volcanoes

My presentation will be taken from the filed of Environmental Chemistry. The presentation that I am working is intended to show how, where and why volcanoes erupt. In my presentation I will display two volcanoes. The first volcano will demonstrate how the lava looks and flows it will contain Vinegar, NaCO3, and red food coloring. The second volcano will display how it sound and how it actually comes out and it will contain Ethyl Alcohol, and aluminum Decarbonate. I will display a poster of how the inside of a volcano looks and it will show the name of certain parts. I will also have another poster that will show the names of some volcanoes in North America. I will end my play in doing a skit. In doing this I hope it will help the group understand what really goes on inside a volcano.

9

Fraser, Rabiah, Middleton High, Charleston, SC
Ionization Energy Election Affinity, and Electronegativity.

In my research paper, I will be discussing the subjects of Ionization Energy. Electron Affinity and Electronegativity. I will be discussing the subject of ionization energy in several ways. I will discuss the filling or orbitals by ionization energy as well as the many different trends in the orbital energies.. I will also discuss in my paper the electron affinity of and atom. I will discuss the formula used in determining the electron affinity of an atom. I will discuss the different fundamentals that are assumed in electron affinities as well. Finally I will discuss the electronegativity of and atom (which

is my favorite subject of the paper). I will discuss the basic concepts of electronegativity and how it is useful and almost indispensable. I will discuss the different ideas that surround electronegativity as well as the atomic and orbital electronegativity of and atom. I will attempt to discuss the Linus Pauling electronegativity scale by expressing in electron volts the difference between the energies of a single bond in dissimilar elements. I will provide graphs based on showing the flow of electrons in Ionization Energy, Electron Affinities and Electronegativity. I will give chemical formulas as well as graphs to give a physical view of the subjects that will be discussed in my paper. This should be a very interesting paper for as well as my fellow classmate.

10

Frasier, LaDawn, St. John's High, John's Island, SC
Temperatures and Solutions

This demonstration illustrates graphically the relationship between temperature and solubility of two kinds of solutions, the influence of temperature on the solubility of a gas in a liquid and the influence of temperature on the solubility of a solid.

Temperature can be defined as the degree of hotness or coldness of an object, which is a measure of the average kinetic energy of the molecules of the object. Solubility can be defined as the amount of a substance that dissolves in a given quantity os a solvent at specified conditions of temperature and pressure to produce a saturated solution.

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Gilbert, Angela, Seneca High, Seneca, SC
Your Two Main Senses

My research paper is the ability to hear with and without glasses. The question is, Does a person with glasses have a better hearing then a person without glasses? or vice versa. In this paper you will see how the ability to see affect the way you hear things. In this paper I have taken a survey on the people who wear glasses compared to people who don't wear glasses. I ask does wearing glasses affect the way you hear things, the answers to this question was very interesting. Overall my project has people asking themselves does my sight really interfere with my hearing.

Hampton, Nakpangi, Seneca High, Seneca, SC
Two Steps from Death

My research project is about the Herpesviruses, and how there is a unknown cure for it. The name of my paper is Two Steps from Death. The main reason that I choose this particular topic is because Herpies is one step away from Aids, and Aids is one step away from death. I hope to encourage safe sex. I am going to explain different types of symptoms and how frequently you need to visit the doctor. My goal is to better your knowledge as well as mine about Herjpies and how it is Two Steps from Death.

Jones, Patrick, Marion High, Marion, SC
pH

pH is a measure of the acidity or the basicity of an aqueous solution. The symbol "pH" represents the power (or exponent) of the hydrogen ion concentration, (H+) in units of moles of H+ per liter of solution. It is defined as the negative logarithm of that concentration, that is pH= -log (H+). In dealing with small concentrations of hydronium ion, it is convenient to express them as pH. In this experiment, I will prepare various solutions of known pH and find out the colors that are characteristics of various indicators in solutions of different pH. I will then use this information to determine the dissociation constants of a weak acid and of a weak base.

Ladson, Tinisha, Middleton High, Charleston, SC
The Wine and Water Trick

A glass pitcher filled with water is set out, along with five glasses. The first glass contains approximately one-half teaspoon of potassium carbonate solution, the second glass contains a few drops of the phenolphthalein solution, the third glass contains about one teaspoon of tartaric acid solution, the fourth and fifth glasses contains a few drops and one teaspoon of phenolphthalein solution, respectively.

The water from the glass pitcher is poured into the five glasses, and the first and third glasses appear as water, and the second and fourth glasses appear as wine. The contents of the first and second glasses are poured back and forth, and they both appear to be wine. The contents of the third and fourth glasses are poured back and forth, and they both appear to be water. The first and second glasses of "wine" poured back into the pitcher, and the "wine" in the pitcher is then poured into the fifth glass, and it changes to milk.

Linning, Katrina, Summerville High, Summerville, SC
Atomic Bonding

All matter is made up atoms. An atom is the smallest particle of an element that can enter into a chemical combination. An atom consists of a nucleus and outer energy levels. The nucleus contains protons which have a positive charge and neutrons which have no electrical charge. The outer energy levels contain electrons which have a negative charge.

When atoms bond together, they create matter. This is a difficult concept to understand because atoms are so small that they cannot be seen. This presentation shows the history of the atom and gives a good visual representation of how atoms bond to create matter.

Maynor, Sharon, Bamberg-Ehrhardt High, Bamberg, SC
The Effect that Color has on the amount of Radiation that and Object Absorbs

My project is on radiation and the effect that color has on the amount of radiation that an object absorbs. I will be doing a report on radiation and a short experiment showing that darker colors absorb more radiation than lighter colors.

The materials that will be used for this project include black construction paper, a 100-watt light bulb, aluminum foil, a stapler, 2 outdoor thermometers, and a ruler. I will fold the black construction paper in half and stapler it on both sides. The same will be done with the aluminum foil. Then, I will record the temperatures of the thermometers at the present time. After recording the readings, I will place a thermometer in the black construction paper and also in the aluminum foil. The 100-watt light bulb will be placed about one (1) foot above the pouches. After I turn it on, I will read the temperatures of the thermometers after 10 minutes. The result of my experiment should prove that darker colors absorb more radiation than light colors.

McFarlin, Areshia, Northside High, Atlanta, GA
The Theory of Evolution V/S the creation of Man

As titled my paper will show the complete diversities of two very similar matters. Evolution of man - the idea that man evolved from other animals and organisms. It is the idea that man was not created by a higher power or force, but, rather by organisms in the earth. This will be put to challenge with the idea that man was created by a God. A superior force, a power higher than that of any mere mortal. I will show the diversities and likenesses of the two subjects. In doing this I plan to bring forth a information view on experts opinions on how man come to be. By the completion of this paper I also plan to have formed my own opinion.

Moss, James, St. Andrews High, Charleston, SC
Hydrated Chrystals

Some compounds are formed in reactions that take place in water solutions. In some cases water molecules are weakly attracted to the ions or molecules that make up the compound and are retained within the crystal structure. These crystal structures are referred to as being hydrated. In this experiment I will show the amount of water within a given amount of the e crystals by heating the substance by taking the water out.

Owens, Boyd, Palmetto high, Williamston, SC
The History of Drugs

In my project I will inform you on most of the history of drugs. My purpose is to set forth the major events which constitute the accessible history of those "Mind-Altering" Drugs popularity used prior to our own time. I hope that such a history emphasizing social features of use when everpossible will help create a perspective form which to view the contemporary phenomenon in our own society of widespread and expanding use of Mind-Altering drugs, which is often coupled with intense interest and emotion. To conduct this historical review, we expect to find certain principals operating ones which would help us understand how drugs come to be adopted for use, in ways, and by what groups. I also looked at society or era to era in means, and the circumstances under which would be reduced or constraints would be place upon a particular kinds of conduct emerging as affects.

Robinson, Walter, Blackville-Hilda High, Blackville, SC
Fire Writing

Combustion is defined by science as anything that's capable of burning. Here's an experiment I've made to demonstrate to you.

To conduct this experiment I had to first mix a saturated solution of potassium Nitrate, with distilled water. Secondly, I took this mixture and heated it over an Iron Ring and stand with a burner. After about two minutes I removed this mixture and let it stood for one minute. After this, I used a brush to spread out some of the solution on paper.

Sawyer, Nicole, Mayo High, Darlington, SC
Chemical Reaction In Your Mouth

The purpose of this project is to show that chewing is part of a chemical reaction. The materials include white bread, a tincture of Iodine, an eyedropper, and 2 sheets of waxed paper. First, cut two pieces of white bread into one-inch wide squares. Then, chew one piece about 30 times until it becomes very mushy. Next, spit it on a piece of waxed paper. After this place the second piece dry bread on a piece of waxed paper. Then add four drops of Iodine to both bread pieces.

My hypothesis is that the saliva mixed bread will change colors and the dry bread will not.

Sawyer, Nikki, Mayo High, Darlington, SC
Spheres of Oil

The demonstration that I am about to perform will show how gravity has little effects on bodies submerged in a liquid. The water will form a layer on top of the alcohol by carefully pouring the two liquids on top of each other. By dropping a few drops of oil below the surface of the alcohol, the oil will form perfect spheres that float in the center below the alcohol and on top of the water. This will show a separation of the two liquids.

Simmons, Chrystal, Summerville High, Summerville, SC
How Arthritis Affects the United States

The project I am working on is based on how many people in the United States are suffering from Arthritis. By using the computer I will show you the different programs on how to tell the rapid growth of Arthritis and the causes. Eleven million persons in the United States suffer from some form of Arthritis. The computer will show how rapid the growth of Arthritis through the United States. Using Graphics I will show the growth of arthritis in ages. Then using graphics again I will show how many women get arthritis more than men using spreadsheet will show the total amount of people suffering form arthritis in the United States. Total number of people with different ages. Total number of medicine needed for people with different types of Arthritis. Using graphics I will show how different are affected by arthritis.

Stewart, Kesha, Tyler, Stephanie, Berkeley High, Wagener-Salley High
The Flame Test: What's Burning?

The purpose of the flame test project is to indicate three elements by the color of the light they give off when their atoms absorb heat energy.

The problem is to tell which element is burning: Lithium, Potassium, or sodium?

The conclusion of our project is that the three metals: Lithium, Potassium and Sodium will be identified by the analytical method called the fame test. We will know which element is burning by the color of the flames. Lithium will have a crimson or red flame, while sodium well have a yellow flame, and poassuim will have a violet flame.

Washington, Hazel, South Florence High, Florence
Preparation of Hydrogen

In this experiment, I will make hydrogen just as Henry Cavendish did. I will be able to collect the hydrogen and see how it explodes in air. First it will be necessary to cut and ben glass tubing in order to construct the apparatus for collecting the hydrogen.

The purpose of this project is to see how I can produce, collect, and test for hydrogen. In the laboratory,, hydrogen can be produced by the electrolysis of water. Hydrogen can also be produced by either passing steam over hot coke or iron or by causing steam and natural gas to react in the presence of a catalyst. There are different ways to produce hydrogen but I want to produce hydrogen just like Henry Cavendish in 1766.

White, Dwayne, Holly Hill-Roberts High, Holly Hill, SC
Role of Computer in Modern Age

My project is based on computers in the modern age. It will demonstrate how computers are used in the modern world, and what fields are they used in. As you know, computers are becoming more practical in all aspects of life.

Remember when there was no MTV, Sony Walkman, or Nintendo Video game; when there were no FAX machine, car phones, or compact disk players, or IBM Personal Computer. That just show's how far technology has come since the decade. Yes computer and technology are becoming the world and it's coming very rapidly.

Williams, Jennifer, Cheraw High, Cheraw, SC
Light Refractions in the Eye

My project will be done of finding evidence to support the theory that the eye can view far away objects without a lens. I will try to demonstrate this by focusing the eye through a tiny hole. A farsighted person should be able to view an object at thought it were close. A nearsighted person should be able to view an object as though it were far away. This process will be proven with a demonstration, research paper, and visual aids.

Williams, Vonita, Wagener-Salley High, Wagener, SC
Periodic Law

The elements on the periodic table are arranged by their atomic number that reads form left to right in periods. The chemical properties of these elements differ as they go left to right, but they may look like repeats of elements that are above and below them as they go vertically. The periodic functions of the atomic numbers are the properties of the elements that are formed. This process is known as Periodic Law.

In this experiment four water reactive metals, Na, K, Mg, and Ca, are each placed into a beaker of water. After each reaction, the liquid is tested for its acidity. This demonstration points out the fact that metals increase in activity going down a group.

This demonstrations show how metals increase in activity in each group. It also shows that potassium is more reactive than sodium and calcium is more reactive than magnesium. It will show the metals that will decrease in activity going across in periods. It will show that magnesium is less active than sodium and calcium is less active than potassium.

This demonstration will explain Periodic Law, activity of the metals, chemical equations, indicators, and how to prepare bases to test acids.

Young, Keyonia, Mid-Carolina High, Prosperity, SC
Type of Chemical Reactions

Chemical reactions are continually taking place in us and around us. A chemical reaction can be concisely represented by a chemical equation. The substances that undergo a chemcial change are the reactants. The new substances formed are the products.

Reactants --- Products
$4FE + 3O_2$ --- $2Fe_2O3$

In chemical reactions the way in which atoms are joined together are changed. Bonds are broken and new bonds are formed as reactants are converted into products. The atoms are not created or destroyed. They are just rearranged. Since the substances in chemical reactions undergo so many changes they are classified into five general types: combination reactions, combustion reaction, single-replacement reaction. In a chemical reaction gases, precipitates, light energy, heat energy, or explosions will take place. In this presentation, chemcial reactions will be observed in order to determine the reaction type. One student will be called out of the audience to record observation of the experiment.