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ABSTRACT

This document is the third of seven accompanying volumes included in the Rachel Carson Project. The project attempts to introduce environmental education lessons and units into existing courses of study within a high school rather than to implement environmental education through the introduction of new courses. This volume reports the environmentally-related activities implemented in a physics and a chemistry program by two of the teachers involved in the project. The physics unit concentrates on a study of energy beginning with an introduction of the various forms of energy, i.e., kinetic, potential, work, and heat. Next is an examination of the first law of thermodynamics and its application to steam engines and power sources. The unit concludes with an inquiry into the environmental impact of energy use. A bibliography of the texts and materials used is included. The chemistry unit consists of environmental projects in three areas: literature research, model building, and field research. It includes examples of book reports, an example of a student investigation of the water quality of streams in the area, and a student project involving the construction of an electrostatic precipitator. (MLB)

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ENVIRONMENTAL STUDIES IN THE PHYSICAL SCIENCES

Project Reports, Volume III
The Rachel Carson Project
USOE Project No. 1-0839
Grant No. OEG-0-71-4623

R. Thomas Tanner, Director

September, 1972

The research reported herein was performed pursuant to a grant with the U.S. Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

This volume is one of seven which constitute appendices to the "Operating Manual for Rachel Carson High," final report to the U.S. Office of Education, U.S.O.E. grant number OEG-0-71-4623. That report describes the Rachel Carson Project, which was supported by a grant from the Office of Environmental Education of the U.S.O.E. The Project was an attempt to pervade the existing curriculum of a high school with environmental education, with participation by faculty members representing many (ideally all) disciplines.

The project was based upon the philosophy that a positive environmental ethic should pervade our culture subtly but powerfully, just as - some people would say - materialism or pragmatism now do. Perhaps the best way to encourage the new ethic through formal education is to pervade the culture of the school, subtly but powerfully, rather than to establish a single new course such as "Man and Environment" or "The Environmental Ethic." (Note that the American public school does not offer courses in "Materialism" or "Pragmatism" - enculturation to these values, if indeed it occurs, is via more subtle means.)

This philosophy at work was exemplified by the present writer in an article extitled "A Day At Rachel Carson High," which appeared in the Phi Delta Kappan in March, 1970 (vol. 52, no. 7, pp. 399-401). The article follows a boy through one day at the fictitious Carson High. On this day: his chemistry class is dealing with the chemistry of the internal combustion engine and its emissions as they interact with biota; his English class is discussing the novel The Roots of Heaven, about one man's war against ivory hunters; his physical education class is examining various outdoor recreational activities and the degree to which they do or do not interfere with the activities of others; his American problems class is reviewing old American values such as freedom and equality before the law, and discussing the kind of physical environment in which they can best be popularly achieved.

On this particular day, classes are shortened so that teachers may have one of their regular planning meetings, the object of which is to facilitate the planning of their courses around such themes as:

Tomorrow's Technology and Today's License. (Rapaciousness toward natural resources is frequently excused with the rationale that tomorrow's as-yet-undeveloped technology can restore or offer satisfactory substitutes for those resources. This is a dangerous and irresponsible fallacy.)

Man in Nature, Man over Nature. (The belief that we can conquer nature has traditionally pervaded our culture - another dangerous fallacy.)*

*The reader may wish to refer to other themes and concepts underlying the project. Various of these have been elucidated by the present writer in articles in: The Science Teacher (April 1969, pp. 32-34; April 1972, pp. 12-14); Phi Delta Kappan (March 1970, pp. 353-356); Environmental Education (Summer 1971, pp. 34-37); AIBS Education Division News (August 1972). See also Hawkins, Mary E. (editor), Vital Views of the Environment, National Science Teachers Association, 1971, for an excellent selection of important concepts explained in brief articles by highly qualified authors. We have found this volume useful.

At the fictional Carson High, more or less standard course titles are retained, but each course includes lessons or units reflecting themes such as those above. During the 1971-72 school year, we attempted to implement this model at the new Crescent Valley High School in Corvallis, although some of our work was also done in Corvallis High School, for reasons discussed in the body of our final report.

Participation was sufficiently wide and diverse as to include classes in typing, modern foreign languages, home economics, industrial arts, drivers' training, English, the natural and social sciences, and mathematics, as well as so-called extra-curricular activities. As noted earlier, this volume is one of seven, largely teacher-written, which describe the lessons and units developed during our brief experiment in curriculum innovation.

We hope that the Rachel Carson idea and at least some of these materials will be found worthy of emulation elsewhere.

We wish to thank all of those who participated in the project, and we especially wish to thank Dr. Clarence D. Kron, now Chairman of the Department of Education at the new University of Texas of the Permian Basin in Odessa. As Superintendent of Corvallis Schools, he offered the unfailing support which made the project possible. We are confident that vision and dedication will continue to characterize his performance at his new position, as was true here. We wish to thank also our new Superintendent, Dr. Thomas D. Wogaman, for continuing to provide an atmosphere congenial to our work during its final stages.

The titles of the report and the seven accompanying volumes are as follows:

Main Report: OPERATING MANUAL FOR RACHEL CARSON HIGH

Accompanying Volumes:

I. MAN AND NATURE - A LITERATURE COURSE
II. THE AMERICAN AND HIS ENVIRONMENT - A SOCIAL SCIENCES COURSE
III. ENVIRONMENTAL STUDIES IN THE PHYSICAL SCIENCES
IV. ENVIRONMENTAL STUDIES IN SEVERAL SCIENCE COURSES
V. CASE STUDIES OF CONSERVATION "BATTLES"
VI. ENVIRONMENTAL STUDIES IN NINE COURSES AT CRESCENT VALLEY HIGH
VII. ENVIRONMENTAL STUDIES: FIVE MISCELLANEOUS REPORTS

R. Thomas Tanner, Director, The Rachel Carson Project

Cispus Environmental Learning Center
Randle, Washington 98377
September 23, 1972

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THE APPLICATION OF THE LAWS OF THERMODYNAMICS TO THE EARTH SYSTEM, IN A PHYSICS CLASS

By

William T. Johnson

Editor's Note: This unit is notable for the sound conceptual framework (the first and second laws of thermodynamics) given to the study of practical problems (alternative energy sources for Spaceship Earth). The reader will note also the way in which this young teacher has used a simulation game to vary the pace in a conceptually-laden unit; yet, the simulation game itself is pointed out to be a technique of modern science.

No multidisciplinary program of environmental studies worth its intellectual salt can fail to deal with the topic herein; the teacher drew especially upon the first three books cited in his references in order to attain background information on this problem area.

INTRODUCTION

The purpose of this paper is to document and comment on the classroom activities of the fourth period physics class at Crescent Valley High School during February 9-25, 1972. In its first year of operation the high school has developed an environmental education program supported through the federally funded Environmental Education Act. This program, the Rachel Carson Project, attempts to work material dealing with environmental and pollution problems into all course areas where appropriate, rather than offer only a few isolated courses. The philosphy here is that sound environmental values and practices should permeate throughout all corners of our society rather than be the concern of only a few. As a result the physics class teacher, Fred Sutherland, felt that an upcoming unit on energy would be an appropriate time for including some segments of the Rachel Carson project.

The energy unit began with an introduction and several problem sessions dealing with the various forms of energy, i.e., kinetic, potential, work, heat, etc. Next was an examination of the first law of thermodynamics (conservation of energy) and its application to steam engines and power sources. It was from the latter discussion on February 9 that two weeks of inquiry into the environmental impact of energy use began. On the following pages is a daily account of the events which occured in the physics class; a total of eight class periods were used for the unit.

OBJECTIVES

The general objectives of the environmental unit on energy were to cause the student to realize that:

(1) the Earth can be considered as a finite, isolated, and essentially closed system.

(2) there is a finite amount of energy-producing fossil fuel resources.

(3) there may be finite amount of "waste" heat that the Earth can absorb and radiate.

(4) all isolated systems conform to the first and second law of thermodynamics.

(5) alternatives to fossil fuels as energy sources do exist, ie., geothermal, solar, wind, hydroelectric, and tidal, but they too have limitations.

(6) the limiting factor for the life system of the Earth could occur as we test the limits of either #2 and #3.

(7) the solution to the power crisis is not simply the discovery of a low polluting, essentially endless energy source, but also the stabilization of our energy requirements.

WEDNESDAY, FEBRUARY 9

An explanation was given on the operation of steam engines, and power generators, and how they are affected by the first law of thermodynamics ($\Delta E = \Delta W + \Delta H$). The concept of efficiency was introducted along with the fact that in any energy transformation process $\Delta H \neq 0$, so that $\Delta W \neq \Delta E$. For example, a fossil fuel power plan uses the potential energy stored in coal (E) and transforms part of that energy into useful work (W), such as generating electricity. The transfer of potential energy into work cannot be 100% efficient, that is, $\Delta E \neq \Delta W$, and according to the first law the left-over potential energy of the coal is turned into heat energy (H) so that $H > 0$. ΔH, then, is the increase in heat energy of the power plant; this heat does no useful work and flows out of the power plant system and into the surrounding environment. This outward flow of heat causes an increase in the temperature of the surrounding environment, resulting in thermal pollution of the water and air.

The point made here was that whenever potential energy is transformed into useful work, waste heat is a by-product. Thus the more energy that is generated by power plants, the more waste heat is made available to result in thermal pollution problems. The slightest increase in the temperature of a lake, river, or estuary could play havoc with the life system there.

The students' reaction was one in which many felt there must be some way to "beat" the system. Either ΔH must be made to equal zero, or the heat must be diverted so that its effects cannot be noticed. The students proved to themselves by devising various schemes (cooling with ocean water, cooling towers) that the waste heat cannot be ignored; it must go somewhere. They also learned that the percentage of work energy transfer from the potential energy of fossil fuel and uranium is only 25%, which means, from the first law, that the waste heat is 75% of the energy source. Thus the reason why nuclear power plants generate so much waste heat is that a greater amount of potential energy per power plant is involved.

Friday, February 11

A film narrated by Walter Cronkite titled, What Are We Doing to Our World? was shown to the class. Among the topics discussed and comments made in the film were the following:

- -explanation and worldwide impact of the greenhouse effect.
- -CO_2 increase in the atmosphere since 1900 has been 15%.
- -a baby is born every nine seconds, an auto made every five seconds
- -contrails of a fleet of SST's could alter the climate.
- -loss of open space; 2 acres developed every minute
- -problems involved in transporting oil to meet energy needs, as Torrey Canyon, Santa Barbara oil spill; oil spill effects on oxygen producing diatoms.

-pesticide problem examined from both sides of the argument.
-automobile congestion and pollution.
-radiation and radioactive waste problems--both sides of question.
-thermal pollution by power plants; by 1980 amount of water needed to cool all plants will equal one-sixth of total annual run-off.
-analysis of the death of Lake Erie; aged one million years in fifty.
-"...the end of the human race will be that it will eventually die of civilization." -Emerson
-what was once a question of discomfort (conservation) is now a question of a health hazard (survival).
-view of an experimental forest conducting research on soil nutrient flow.
-man has not been holistic in his views; nature has been considered an opponent; we must learn to work with her and maintain the environment and ourselves.
-threat to Everglades due to lack of fresh water flow in Florida.
-discussion of the ecological impacts of the Aswan Dam.
-consideration of mon-biotic farming.
-problems involved in using nuclear blasts to cut a new Panama Canal which would allow Atlantic and Pacific waters to freely mix.

Wednesday, February 16

The class was introduced to the Planet Management Game, an educational game which helps students to understand how our present-day problems of pollution, population, gorwth, and famine must be dealt with. As suggested by the authors, the opening question presented to the class was "What projects would you carry out to make the Earth a better place to live during the next five years?" Answers ranged from "spend less money on the space program" to "spend more money on pollution controls." The class was about to get the opportunity to test their solutions. Since it is unreasonable and impractical to conduct experiments with the whole earth, a simulation was to be used. It was pointed out that simulations of real situations are used in all areas of science to test theories. With The Plant Management Game, it is possible to simulate conditions similar to those on the planet Earth. The data in the game is realistically planned, that is, outcomes represent what could be expected to happen if a particular plan were implemented to improve the Earth's condition. Of course, there is an element of chance in the game, as in real life, so that the same plan used twice will not necessarily yield the same outcome.

The students were to group into teams of four or five, with one game to a team. They were asked to work together to try to improve conditions on a fictitious planet called Clarion, a replica of the Earth only smaller in size. Each team was given a fixed amount of money per round to spend on a variety of projects. After each round of spending, a computer book was used to determine if conditions improved, worsened, or

remained the same. The game continued for ten rounds. The changing conditions of the planet Clarion were measured by four indexes: population, income, food, and environment. Initially all indexes were arbitrarily placed at 100 except for the environment which assumed a value of 90 (ten points below what it was before the planet became inhabited.

The game allows students to cooperate in a group activity by making group managerial decisions. It helps them to understand our contemporary problems and the frustration involved in dealing with them. Most important, the students decide for themselves how well they managed Clarion. The students, not the teacher, decide on the criteria for improving conditions on the planet, and then set out to work towards those goals.

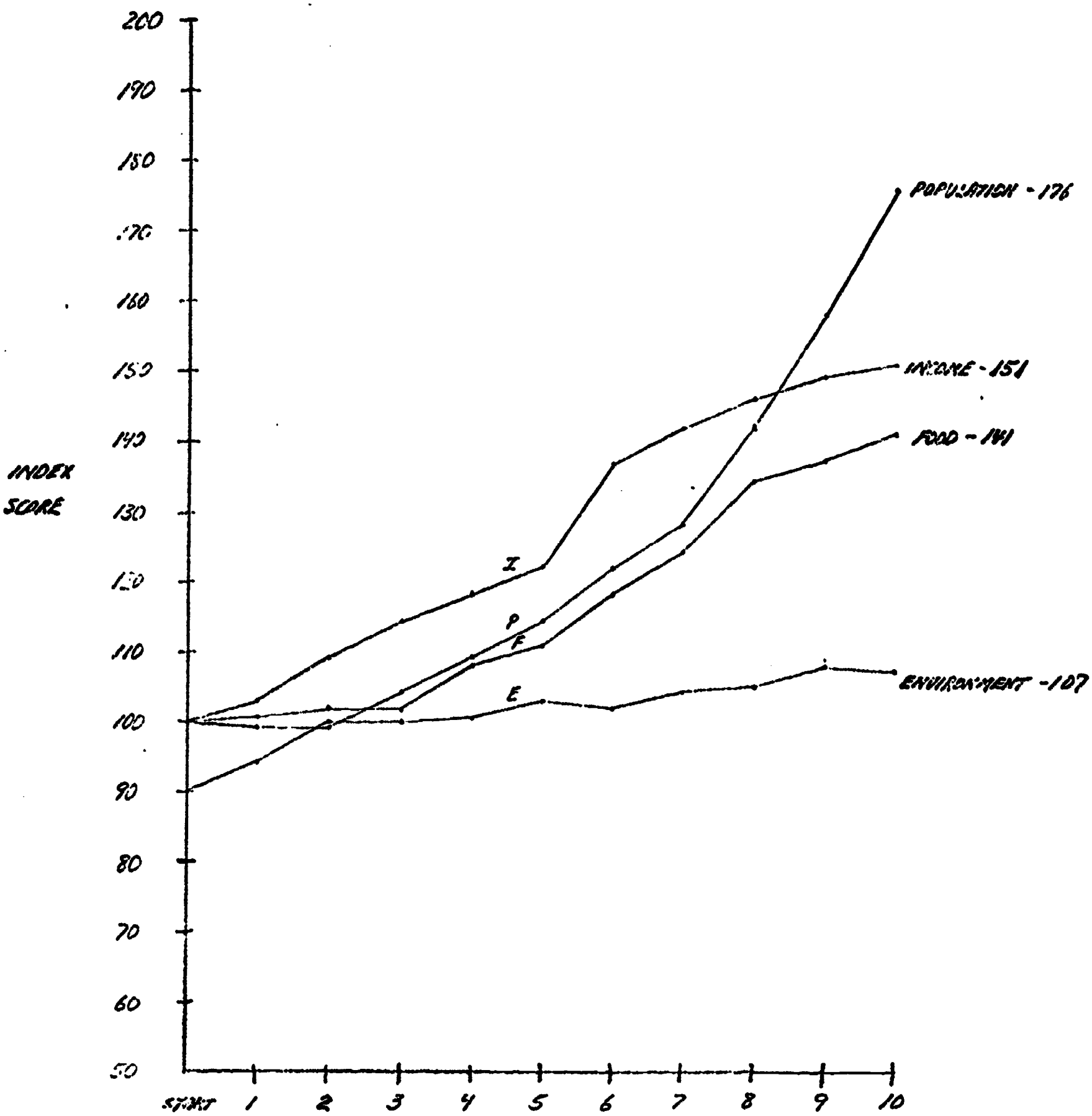
The next two days were spent playing the games; discussions followed each session. It was important for the students to play the game a second time after discussing various techniques and criteria with other teams. This brought about new insight and a renewed determination to discover a better solution to the Clarion dilemma.

Thursday, February 17

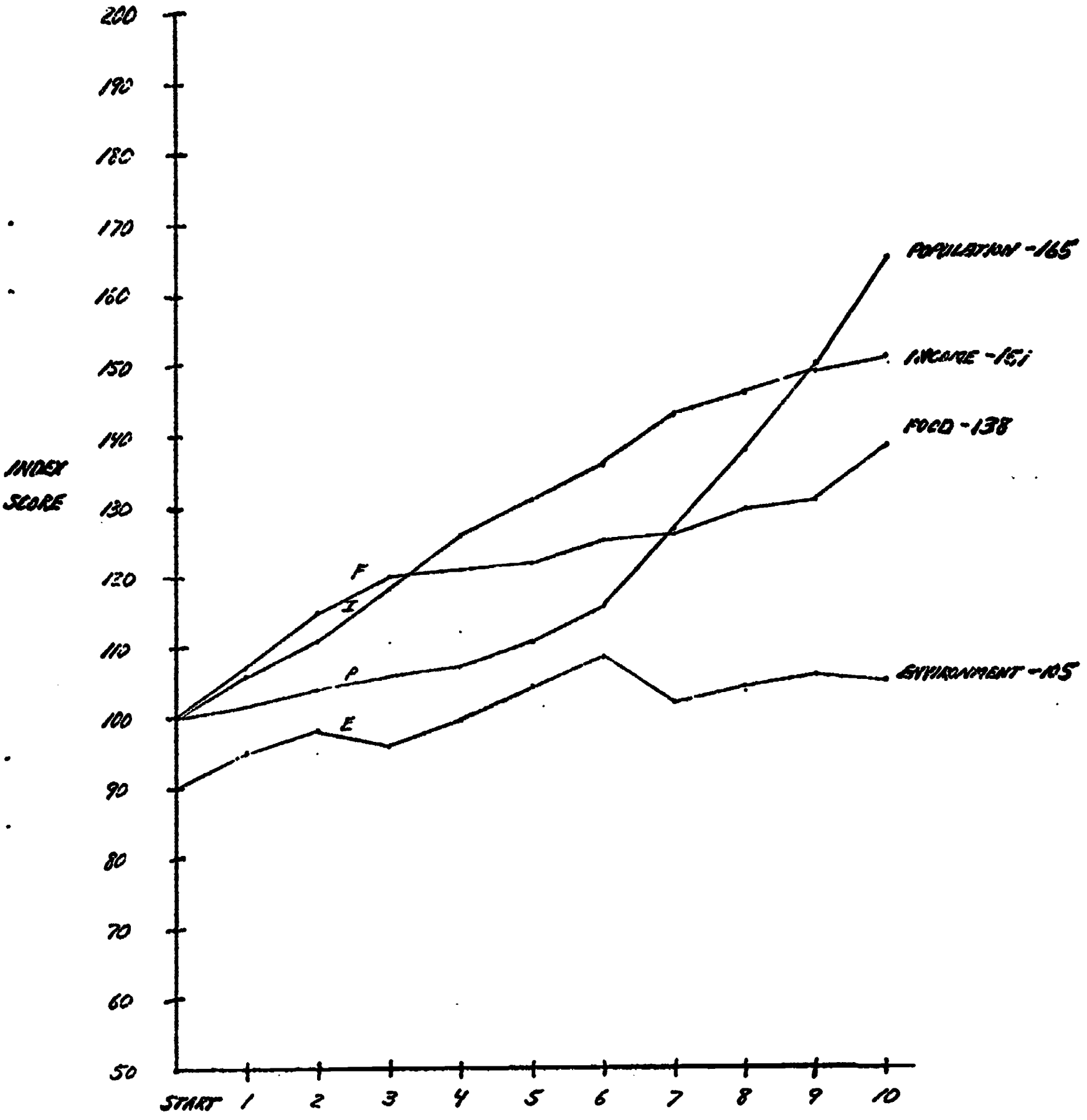
The class was divided into three teams and began playing The Planet Management Game. The score results are depicted graphically on the following three pages. All teams did equally well (or poorly depending on your perspective). All finished with a planet with about 70% more people than when they started, and an insufficient food supply for the population. Teams A and B improved on the condition of the overall environment although on a per capita basis, it was low. The environment for team C dropped significantly, perhaps to crisis conditions. The per capita income for teams A and B was rather low, but team C kept the income level high throughout. A conflict may have arisen for team C in trying to keep the income up and maintain an adequate environment. Evidently one area had to suffer eventually, and it turned out to be the environment. Note that for all teams the population curve simulates the current trend here on Earth.

The students felt that no team actually improved the conditions of Clarion since in all cases some people were starving and the environmental quality was down. No real insights were formed as to how planning could be more effective in meeting the students' objectives of moderate population, enough food for all, reasonable income levels, and a good, quality environment.

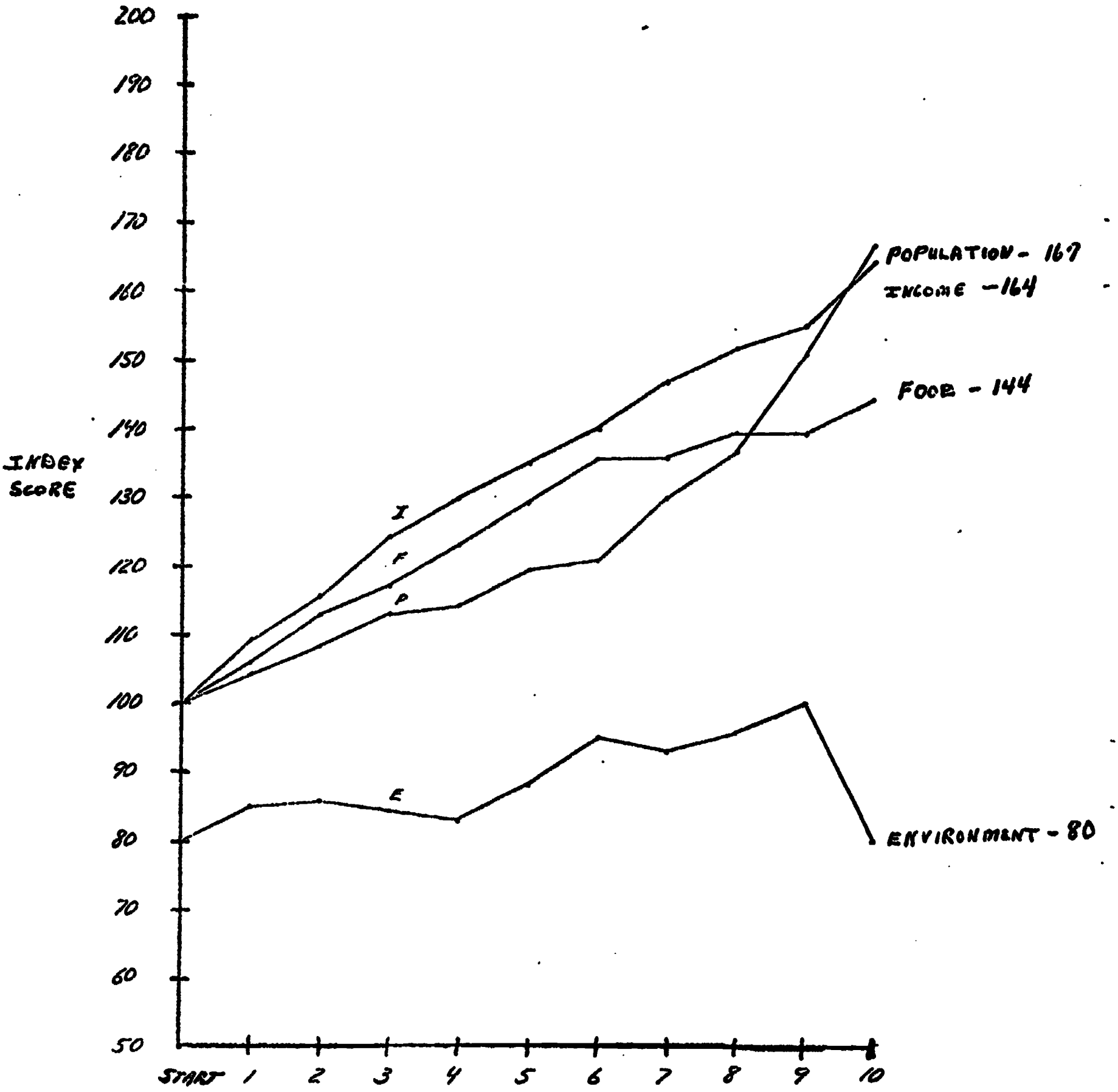
TEAM A. - GAME 1



TEAM B - GAME 1



TEAM C - GAME 1

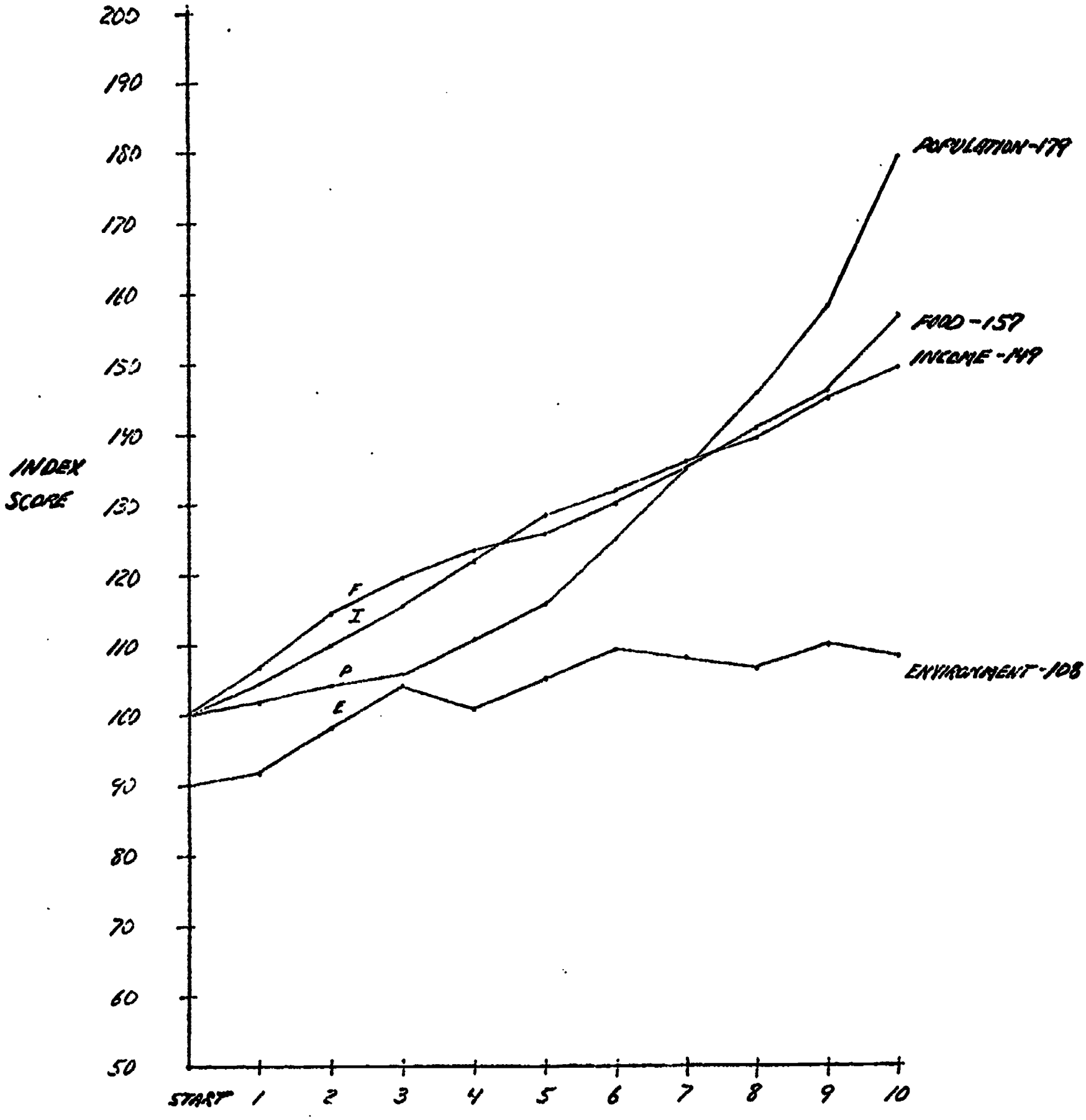


Friday, February 18

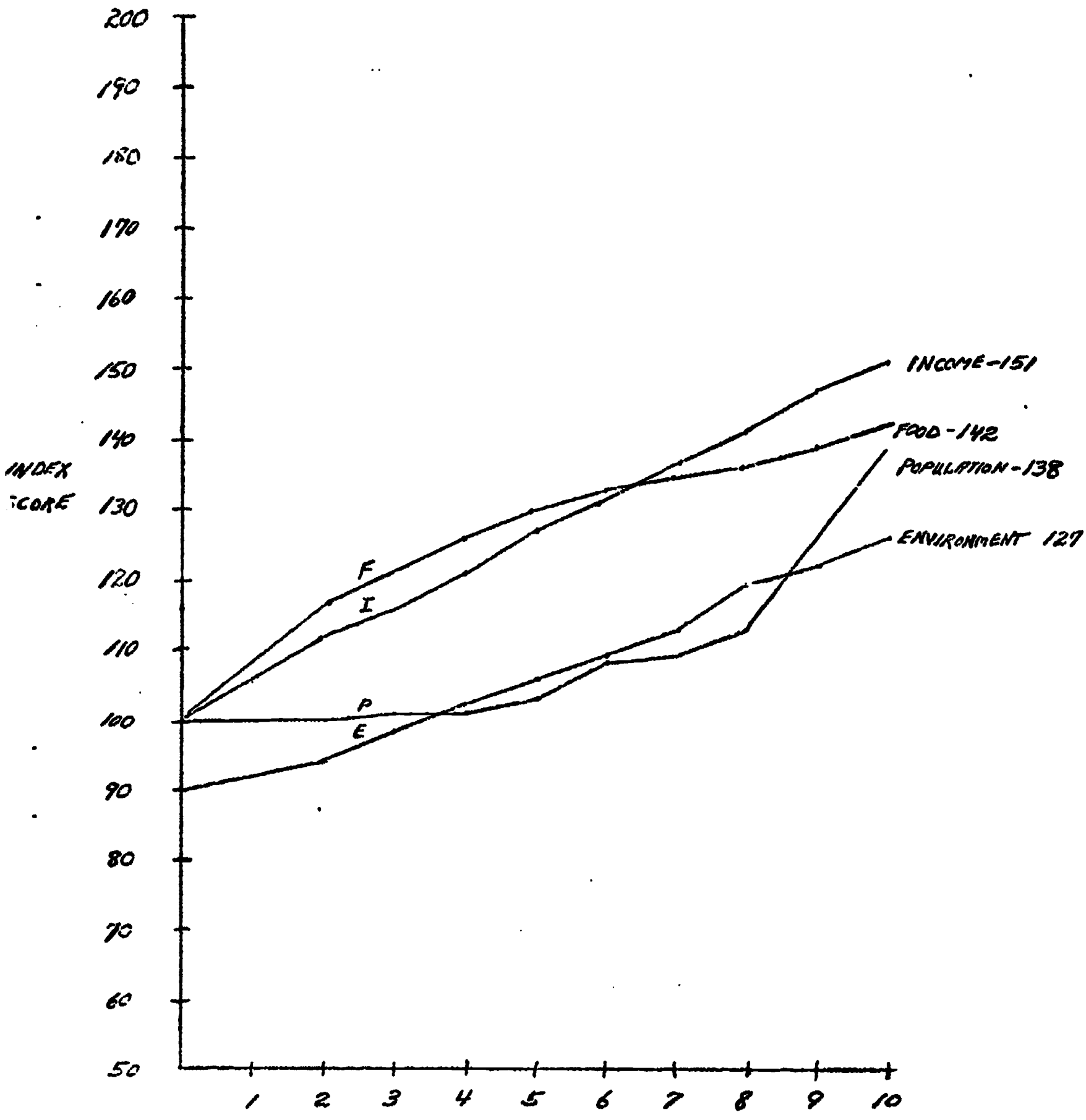
The students made their second attempt at improving conditions on Clarion in the Planet Management Game. The teams moved through the ten rounds more quickly leaving more time at the end of the period for discussion and evaluation. From the results shown on the following three pages, note that only team B made a significant improvement with their planet. A lower population level was achieved with a high per capita income, plenty of food, and a reasonably good environment. Teams A and C found their results to be similar to those on the previous day.

One of the students in team B had thought about the game before class and had come up with the insight that general education of the population was one of the areas not included in their plan. Incorporating education into their plan evidently helped to keep the population down and improve the quality of the environment. Teams A and C placed more emphasis on education in their final rounds of the game, but by that time it was too late. It was pointed out to the students that among all the plans available to them, spending money on general education yields results that are somewhat hidden. For example, building more sewage plants and pollution control devices will result directly in cleaner water and air. More farm machinery and intensive farming will result in an increase in food production. But spending more on general education increases the population's awareness and can change their sense of values. These are things that are difficult to observe and measure, and are not directly associated with public education.

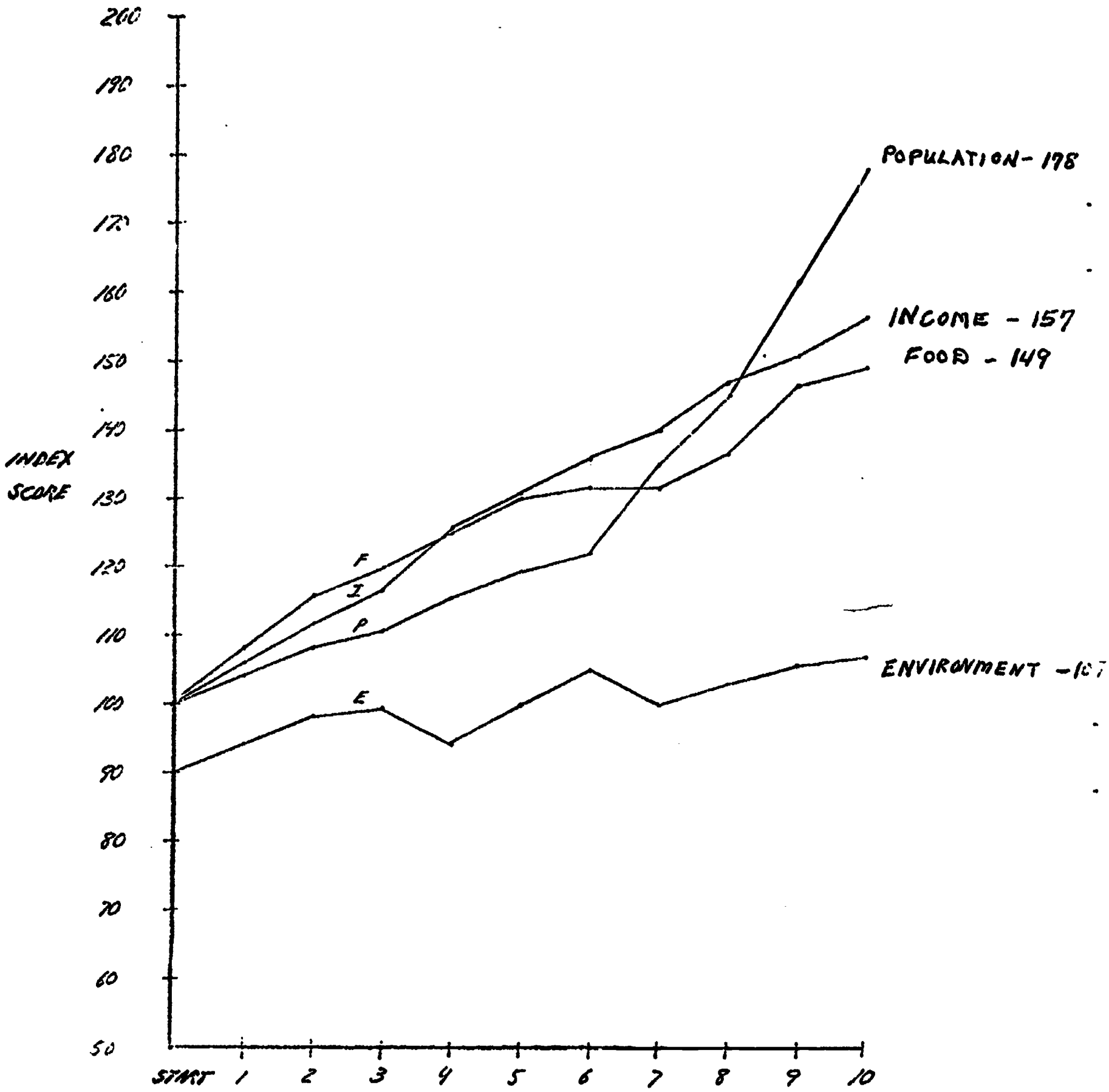
TEAM A. - GAME 2



TEAM B - GAME 2



TEAM C - GAME 2



Monday, February 21

An introduction to the second law of thermodynamics led off the discussion. It was pointed out that the second law can be stated in a variety of ways: everything tends towards more disorder, matter and energy always tend towards the most probable states, heat flows only from a hot source to a cold source, and a perpetual motion machine cannot be built. Both the first and second laws operate only on closed or isolated systems, or on a system where the input equals the output.

In order to apply the first and second laws, the students had to be convinced that as a system, the earth and our power generating machines fit the closed, isolated, or equal input-output criteria. Once the notion was established, it made sense that according to the second law, the earth and our machines are taking ordered energy from the sun, coal, oil, and uranium and changing the energy into a disordered, non-usable form of heat. Even the useful work energy obtained from potential energy sources will eventually end up as a disordered energy as it is transferred from machine to machine. Thus, we are constantly using energy that eventually cannot be reused. If we are to continue using energy we must look for a source that is not easily depleted (which is what life systems have done in selecting the sun).

Another consequence is that even if there were no threat of depleting our potential energy supply, what about the large amounts of waste heat we are generating? Could thermal pollution occur on a wide scale if the Earth cannot absorb and radiate out this heat fast enough?

Tuesday, February 22

The initial comments made were that no isolated and finite system such as the Earth can tolerate unrestricted growth indefinitely. We cannot continue to use our finite fossil fuel energy at an ever increasing rate. It would seem reasonable then to look for alternatives to our present energy sources of fossil fuels and nuclear fuel. The intended meaning of this discussion was to explore the advantages and disadvantages of each source. No attempt was made to present one source of energy as the superior one. Listed below are several energy alternatives and points made about each:

A. Solar energy

transmission of energy and distribution is free; no power lines across towns or the countryside; explanation of how it is now being used, as water heating, air conditioning, electric heat

greenhouse effect may make it possible to collect and store small amounts

possibility of concentrating energy with lenses in satellites and beaming it down with microwaves.

- thermal pollution may not be a problem as heat would have appeared in the system anyway

- if satellites provided us with large amounts of energy for our future needs it could cause climatic changes because large amounts of energy that would have been reflected and thus would never have struck the Earth at all would now be collected and eventually dissipated on the Earth as heat

- total amount is spread out thinly over the earth or diluted; to acquire enough to equal a power plant would mean collecting the solar energy over a large surface area

- solar energy is variable, with less on cloudy days and in the winter; storing large amounts of heat or electricity is difficult and expensive

B. Geothermal - source is heat from Earth's interior; escaping steam

- inexpensive; drill down and tap

- no smoke or combustion products or hazardous wastes

- localized power sources

- minimum of power could be generated; won't last long (150 years) because of increasing power demands

- could be environmental hazards if too much water is removed too fast from the Earth

C. Tidal energy - gravitational pull of moon and sun

- essentially lasts forever

- not enough to meet needs of man

- localized power source

D. Wind - due to solar energy

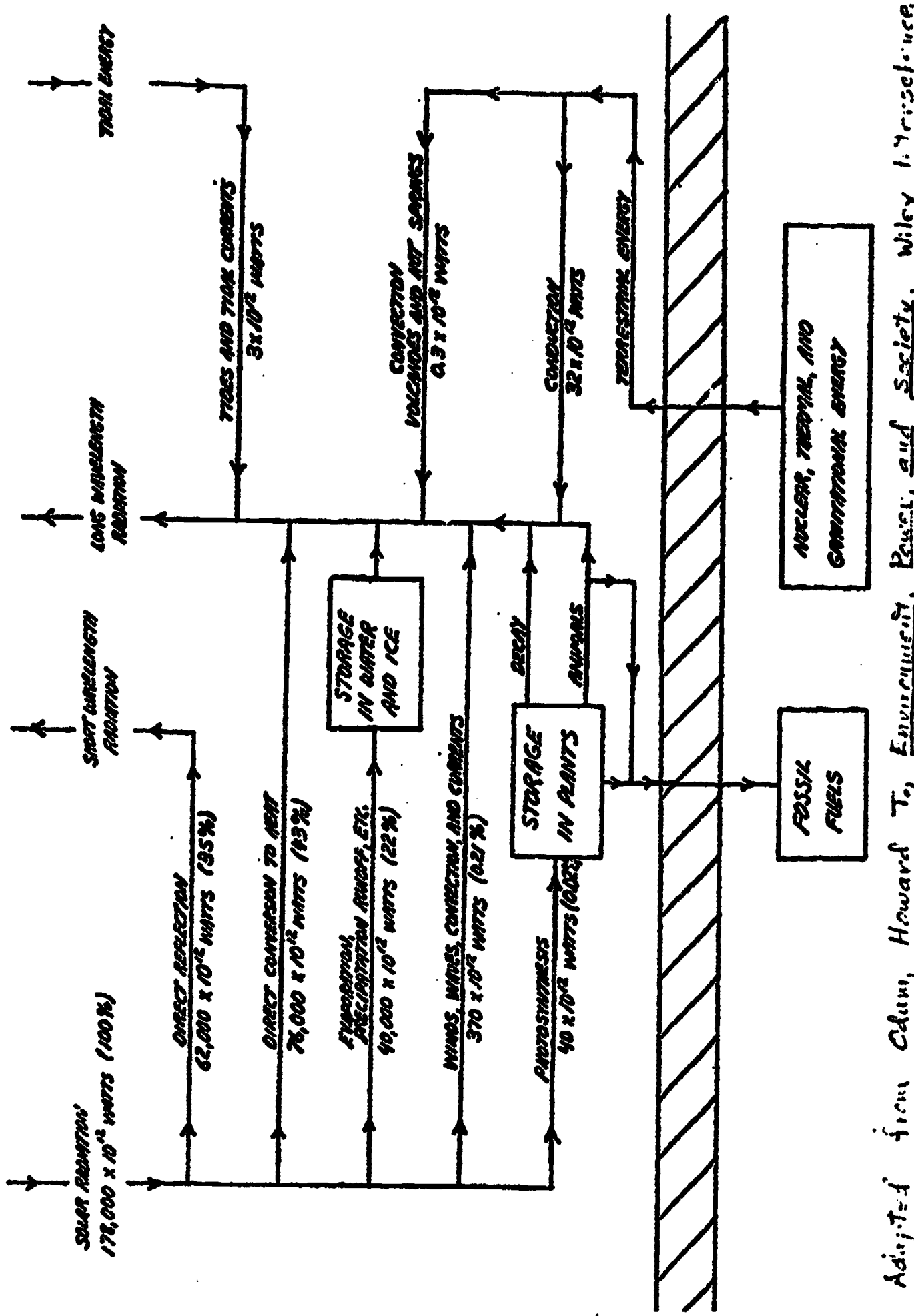
- inexpensive

- few places where wind is strong enough and steady enough to make it promising and meet demands.

E. Burning garbage

- abundant supply; everyplace has it

- smell, smoke, and health hazards



Adapted from Odum, Howard T., Environment, Power, and Society, Wiley Interscience, 1971.

Wednesday, February 23

In order to tie together all the activities and material presented during the two week period, the students were assigned a paper to write covering:

(1) the implications of the first and second laws of thermodynamics to the Earth's environment.

(2) comments on the energy and environment lesson.

The following attachments are the papers turned in by the students. In using these papers as guidelines for evaluating the degree to which the course objectives were met, it appeared that we were successful in most cases, although the reader can make the final judgment. Several students found it hard to accept the closed system model for the Earth, and for good reason. It may be more accurate to state that the Earth is closed in some respects (population, fossil fuels, pollution) and open in others (total energy flow, meteors, radiation).

In teaching the lessons, perhaps too much emphasis was placed on the difficulty involved in turning around our spiraling energy consumption, pollution, and population growth. While the serious nature of our present environmental situation should be related to the students, it is also important for them not to be overcome by a sense of hopelessness, as some of the papers tend to indicate. Rather, students should be made to realize that man has the potential, but needs the direction to alleviate some of the world's problems; and at the same time, man's limitations should be clearly recognized. For example, man can continue to improve the quality of life, but will continued increasing energy usage lead us there? As one student recognized, "...no matter what you do to improve our way of life and our surroundings, you are involved in a losing battle with energy. It's just that sometimes you lose worse than at other times."

SAMPLE STUDENT PAPERS

-A-

The way I see the world situation is that the only way we can ever survive we must educate so people know the problems. When I found out that we are going toward disorder and there's nothing we can do about it, I think that this is a problem (though possible not the greatest) and people should know about it. I am reading also "The Population Bomb" and according to the book, our major problem is starving because of the growing population. When I think about it, there doesn't seem to be anything I can do about it. In the whole world people are going out and having babies without realizing what they are doing to the population. It seems like even the people that know what they are doing to the population, they probably don't take seriously the fact that there is a food shortage now and with present population growth, everybody will be starving. The thing that gets me is that he says it will be only a few years and Americans just sit around and say, "Look, we've got plenty of food and money. I don't believe that we're all going to starve." Also, I don't think people really believe that all our pollution is really hurting anything. They believe that we are doing just great and who really knows how big a problem pollution, population, and the effects of the first and second laws of thermodynamics are. If by some chance we did get through a population crisis without destroying everything there are still the problems of thermodynamics--because in order to survive, we have to do some work and a result of this work is heat and with all the work we're doing now we're creating a lot of heat and nobody really knows what it's going to do. The second law says we are going toward disorder and there's nothing we can really do about it except prolong it by slowing down the pace. I feel this will be the final way the world ends rather than other problems. Since the birth rate is exceeding the death rate so much, the whole thing is going to level out by a massive starvation and in that way the death rate will balance with the birth rate. The people that survive will probably be smarter about population control than we are now and since there will be a small population they can use very little of our resources to survive and let the earth clean itself up. They might have the same standard of living as we do now after a time but if they keep the population down they won't have to use so many resources and might be able to improve the technology so that they can do work without exploiting the resources very quickly. Who knows, maybe they'll even figure out a way to reverse the process of disorder.

-B-

I feel that the past week in physics has been very beneficial for me. I now understand the problems of pollution control a lot better than I did before. I always thought that environmental pollution could be stopped immediately, but now I see why it can't. I also see that no matter what you do to improve our way of life and our surroundings, you are involved

in a losing battle with energy. It's just that sometimes you lose worse than at other times!

I also enjoyed it because we were given a chance to use what we had learned to come up with some important real-life answers to some real-life problems. It's a lot more interesting for me if I know what I can do with what I know.

As far as the planet management game was concerned, it was fun at first, but not too realistic. All you had to do was spend your money on education, and everything came out fine. Also, in each color group, it didn't matter what you picked to finance, it only mattered how much you spent. For instance, if you put the two cards together which were for research in better crops, and research for getting a cure for the weird disease, as long as the amount was the same, the holes in the cards were the same. I think that the food should go up more for the one with the crops, and the population should go up more for the one with the cure for the disease.

-C- Physics

The First law of Thermodynamics says that $\Delta E = \Delta W + \Delta H$; Law Number Two of Thermodynamics is the Law of Disorder. These are the first two laws of thermodynamics and their importance cannot be underestimated.

Related to these laws is the idea of the earth being a closed and finite system. Except for sunlight radiation and meteorites, this is a true statement.

To me and the other human bodies on Planet Earth, these above statements have the utmost importance. People (at least in this country) have the idea that you can go to one place, use up all the resources, then move on to a new place.

The earth, being a finite and closed system, cannot afford to have this continually done to it. Finite means that it has a limit to it, and being a closed system means that what we do with our earth stays with us.

The first two laws of thermodynamics tie directly in with the finite and closed system of the earth. Energy, after it has been converted into heat cannot be reused. Hence, everytime energy is used to do work, the energy that is used cannot be reused. This rules out the possibility of building a perpetual motion machine (a machine that doesn't need energy to work), since to do work requires energy.

Energy supplies on earth are finite, since mechanical energy turned into heat cannot be turned back into mechanical energy.

Whatever we used today as energy supplies - coal, oil, nuclear energy, etc., the supplies are finite, since once the energy from it is used,

it cannot be reused. This won't effect us today, but in the future when these supplies may run out, new sources of energy will need to be found. Some possibilities of new energy sources might be sunlight or ocean tides. Whatever happens we must remember that we are a part of the earth, that the earth is not something to be warred upon but a system to live with.

William T. Johnson

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Holdren, John; "Defusing Old Smoky by Plugging into Nature"; Sierra Club Bulletin; September, 1971

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Film - What Are We Doing To Our World? narrated by Walter Cronkite; from the CBS program "The 21st Century".

CHEMISTRY

by

Wayne Spletstoser

Editor's Note: We feel that this unit is exemplary as a marriage of rigor with relevance, with an appropriate measure of variety, change of pace, and individual field work. It demonstrates the project philosophy of maintaining the integrity of the disciplines: this is a chemistry unit and some of the research activities completed under item 5 are indeed impressive.

The students' book reviews have been reproduced with a minimum of editing, and are included not only to exemplify student work, but to provide possibly useful reviews for the reader. It should be noted that the books tend to represent one segment of the literature on environmental problems, that which another segment - rightly or wrongly - refers to as "the disaster lobby" or "prophets of doom." Also, the students tend to display an incomplete grasp of what constitutes "qualifications" of an author. These provisos aside, it is hoped that the included reviews will prove useful.

The final item in this unit is a paper completed by two students who built and successfully demonstrated an electrostatic precipitator. The plans for this device were found on pages 37-39 of:

> Hunter, Donald C. and Henry Wohlers (eds), Air Pollution Experiments for Junior and Senior High School Science Classes, Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15123, $1.00.

A Summary of Rachel Carson Project Activities for Chemistry Students of Crescent Valley High School for the 1971-1972 School Year

Submitted by Wayne Spletstoser, Instructor

Introductory Remarks

As a member of the science-math curriculum planning committee prior to the opening of Crescent Valley High School (CVHS), I was fortunate to be on the ground floor of science-math curriculum development. As a member of this committee, I fully concurred that the CVHS science program should be committed to an environmentally-centered program, which would attempt to be cross-disciplinary in nature.

It is my understanding that the Rachel Carson Project got its start within this committee, and I am privileged to think that I may have contributed in some small measure.

I was, therefore, committed to the concepts of the Rachel Carson Project in teaching my chemistry class. I hope, however, it does not seem paradoxical that it was my decision not to commit my classes to related activities until after the Christmas Holiday break. There were a number of contributing reasons for my decision:

1) This was my first year in teaching Chem Study Chemistry--a challenge in itself!
2) This was my first year of teaching at the high school level, my previous five years experience being at the junior high level.
3) This was the first year of operation for CVHS.
4) School's opening was delayed due to the incompletion of the CVHS physical plant.
5) Necessary materials were arriving in an unpredictable piecemeal fashion.

with so many unsettling variables it was my decision that Rachel Carson activities would be best begun after school was, so to speak, 'in the groove'.

Summary of Activities

It was my plan to begin Rachel Carson activities early in January upon reopening of school after Christmas vacation. An outline of planned activities for the remainder of the school would be roughly as follows:

1) An introductory class period designed to introduce the students to the nature of the Rachel Carson Project and to strengthen their resolve for a commitment to such activities.
2) Students selected readings within the area of environmental concern and which were of individual interest to them.
3) Students composed written reviews of individual books which were read, and submitted copies of such to members of Mrs. Margo Sutherland's typing classes.
4) Instructor-selected reports, representing at least every separate work which was read, were typed, dittoed, mimeographed, and collated into one collection of book reports by members of the typing class.

5) Using their individual reading experiences, plus the material in the collection of book reports, the chemistry students were to select some topic or area of interest for which they would complete an individual project by the year's end.

Specific Comments

This outline of activities is by no means complete, but represents the main thrust of Rachel Carson activities for chemistry class members. Students were advised that during any class, with few exceptions, if they wished to discuss some topic of environmental concern, they could do so. A note of caution, however! It was my personal wish that such discussions not be simply "rap sessions", since it was my belief that Rachel Carson was committed to seeking some underlying truths to man's ecological concerns; this is also consistent to the scrupulous treatment of detail as found in the Chem Study Program.

A list of some of the digressive activities would appear somewhat like the following:

1) A student presentation of local picture slides accompanied by the contemporary song entitled, "Mercy, Mercy, Me". The slides were chosen to forewarn the problems of urban blight for Corvallis, should the area continue to grow in population as in the past. The song certainly offered an emotional factor.
2) Class visitation to the national meeting of the Environmental Protection Agency which was being conducted at regional locations through a closed circuit television network. The meeting proper originated in Washington, D.C., but was held regionally in the auditorium at CVHS.
3) A guest speaker from the local regional offices of the EPA presented a program which included a series of tests which the students could perform themselves on local fresh water. For example, dissolved oxygen, temperature, bacterial count, pH, phosphate content, etc.
4) A student report of water monitoring work, which he had done the previous summer for a local Oregon State University scientist. He demonstrated the test for dissolved oxygen and shared the results of his summer's research with other classmates.
5) A number of environmentally oriented films were shown.
6) Numerous spontaneous class discussions.

I should like to make some detailed comments on each of the five items I listed earlier under summary of activities, and direct you to related materials which I have chosen to include in my report.

Item 1

It was my intent that with the introductory class presentation which I prepared, students would be left in a thoghtful mood concerning social problems of every nature. An ambitious objective, indeed! As a chemistry teacher it was my intent to have the students at least consider science as a possible endeavor for truth. I considered this

consistent with the nature of the Chem Study Program...an energetic seeker of accuracy and factual justification for experimental conclusions.

The content of this presentation consisted in the playing of two records, "Who Will Answer", by Ed Ames, and "In The Year 2525", by Zager and Evans; printed lyrics for each record was provided for the students. A number of thought-provoking cartoons were projected for all to see via the overhead projector.

Although this presentation was originated in the hope of arousing in the students a firmer resolve to seek solutions to environmental problems, I soon learned that in the Corvallis community, many young people already possessed a resolute determination to confront the environmental deterioration going on about them.

Item 2

Sometime after the "formal kickoff" of the Rachel Carson activities, all students were provided with a bibliography of possible books to read.

It was hoped that through their individual reading the students would get some idea for a later project, or at least understand one facet of the problem a bit more fully. The students were given about five weeks to complete their reading and submit a written report in which they were to not only consider a given work's content but also a number of other concerns. A list of 11 items for concern was provided by this instructor and is enclosed as part of my report.

Item 3

Since all students were limited by time in how much reading they could do over and above their normal course work, it was impossible for an individual to fully appreciate the broad spectrum of environmental concerns covered by contemporary authors of varied specialization. For this reason, it seemed an excellent opportunity for our class to participate in cross-disciplinary activities by requesting typing students to compile the book reports that they might be read by all chemistry students, and thereby enlarging their pre-project reading experience. This gave the written reports more meaning. Mrs. Sutherland reported that her students were eager to engage in projects of this type for it offered a digression from their routine and gave more meaning to what they were doing.

Item 4

It seems I have covered this area adequately under Item 3. Suffice it to mention that great cooperation was received from Mrs. Sutherland, and I was gratified that some measure of cross-disciplinary activity took place. Again, a copy of the final collation of all reports has been included as part of my report.

Item 5

For the final two months of the school year students were to be engaged in some environmentally-related project. They were encouraged to enter into some type of actual research, if possible. However, for reasons cited earlier in this report, this was most difficult. Consequently, many students chose to do more detailed reading on particular topics of interest and submit a written report.

I think it is of importance to mention at this point that the directors of the Rachel Carson Project were instrumental in providing many and varied materials from which students could get ideas, as well as detailed instructions for various projects, experiments, models, etc. Also Rachel Carson funds enabled this instructor to attend a special conference on environmental teaching, sponsored by the Oregon Museum of Science and Industry, and held in Portland, Oregon. Such funding is seldom, if ever, available to classroom teachers in a day of economic belt-tightening.

I do not intend to offer an evaluation of the projects as submitted by the students. Rather, I think it expedient simply to include, as part of my report, copies of reports which I was able to retain. (Unfortunately for me, many students valued their end products and requested to have them returned...many students were able to use portions or all of their reports as part of their requirements for other courses involved in Rachel Carson activities.

The projects fall roughly into three categories plus one:

a) literature research
b) model building
c) actual field research
+ 1) one student did a water pollution study via computer simulation (Bohard, Eric, Water Pollution Study, O.S.U. Computer Program).

A listing of the projects completed follows under the three general categories...those marked by an asterisk (*) were unavailable for enclosure in this report:

a) literature research (no special order is attempted)

Berman, Fred. "The Production of Radioactive Wastes and The Containment and Disposal of Radioactive Wastes"

Kipper, Robert. "Pesticides"

Firey, Margaret. "The Student's Handy-Dandy Guide to Water Pollution"

Kliewer, David. "Sanitary Landfills"

Houck, Doug. "Insecticides"

Williams, Diane. "Noise Pollution"

Hornberger, Marlow. "Water Pollution"

Denison, Thomas. Untitled report on the problems of the internal combustion engine.

Lincoln, Todd. "Noise Pollution---Its Effects on the Human Body"

Short, Kevin. "The Dangers and Effects of Herbicides and Defoliants Upon Terrestrial, Aquatic, and Arboreal Animal Life"

McCarthy, Connie. "Lake Eutrophication"

McHenry, Judy. "Chemicals and Their Effect on Soil"

Bartholomaus, Judy. "Phosphates---Their Effect on the Environment and People"

Charbonneau, Jeannie. "Pollution on the Ballot"

Dooley, Harry. "Air Pollution and How It Effects (sic) Man"

McCann, Greg. Untitled report which...deals with how air pollution will affect the weather.

*Pritchard, Pamela. Extensive report on the controversy encircling the construction of nuclear power plants. (40 type written pages)

*Hunt, Cindy. Extensive report on the ill effects of sound pollution.

b) <u>model building</u>

Brown, Galen, and Hooven, Rudolph. Construction of an Electrostatic Precipitator, Experiment No. 12 as found in <u>Air Pollution Experiments for Junior and Senior High School Science Classes</u>, Edited by Hunger, Donald C., and Wohlers, Henry, Air Pollution Control Association. (Model was demonstrated in class and functioned properly).

*TenPas, Thomas. Construction of a Hydro-Electrostatic Precipitator. (Model was demonstrated in class and functioned properly)

*Bohard, Eric. Construction of a model which simulated a temperature inversion in apopulated valley...Experiment No. 17 as found in <u>Air Pollution Experiments for Junior and Senior High School Science Classes</u> (see model by Brown and Hooven)

c) <u>actual field research</u>

Doubleday, Steven, and Shoemaker, Robert. "The Levels of Five Gases in the City of Corvallis and Their Effects on Humans" (This project was made possible by using special gas detecting

ampules, which were provided through Rachel Carson funding and energies.)

Jeffrey, Ron, and Willis, Paul. Water Quality of Streams Near Corvallis, Oregon. (In this instructor's opinion, perhaps the most impressive project submitted.)

*Meares, David, and Ferguson, Robert. A study of radioactive levels in various locations about Corvallis. (Civil Defense provided a geiger counter which these students used to take counts in such places as dental offices, jewelers, city dump, industrial locations, river waters, etc.).

Closing Remarks

Items which are to be enclosed as part of this report will be marked and in order of the item number under which they were discussed.

One cannot at years' end adequately summarize all the activities which occurred in the class which might be of interest to those evaluating the Rachel Carson Project. However, I hope I have been able to give a fairly clear picture of the main thrust of activities which occurred in my class, as well as, a bit of what occurred spontaneously.

My experience with Rachel Carson has been that it contributed pedagogically to what was being attempted under the title of "chemistry". If one considers only the increased availability of resource materials, as well as personal assistance from the building directors, one must remain positive in a subjective, although limited in scope, evaluation.

CVHS experienced a good portion of the growing pains which any newly begun institution would be expected to incur. CVHS will grow and flourish, if for no other reason, simply because it shall continue to exist and, therefore, have that opportunity. It would sadden this instructor greatly should Rachel Carson, and related programs, not be given a measure of this same opportunity.

ITEMS REFERRED TO IN FORECOING REPORT

Item 2: Reading Lists and Book Review Guide

SUGGESTED READING LIST FOR CONCEPTUAL CHEMISTRY

TITLE	AUTHOR
SILENT SPRING	CARSON
SINCE SILENT SPRING	GRAHAM
DEFOLIATION	WHITESIDE
THE CHEMICAL FEAST	TURNER
NUCLEAR DILEMMA	BRYERTON
THE CARELESS ATOM	NOVICK
THE FRAIL OCEAN	MARX
MOMENT IN THE SUN	RIENOW & RIENOW
THE POPULATION BOMB	EHRLICH
HOW TO BE A SURVIVOR	EHRLICH
POPULATION, RESOURCES AND ENVIRONMENT	EHRLICH
FAMINE 1975	PADDOCK
SCIENCE AND SURVIVAL	COMMONER
THE ARTHUR GODFREY ENVIRONMENTAL READER	GODFREY
CHEMISTRY CREATES A NEW WORLD	JAFFE
THE BEST KEPT SECRETS	PURCELL
ATOMS FOR PEACE	WOODBURY
THE SEA AROUND US	CARSON
ECOLOGICAL CRISIS - READING FOR SURVIVAL	(ED. LOVE & LOVE)

This listing is by no means complete. Other choices may be read by arrangement with instructor.

The titles on this list indicate books and simulation games which have been acquired with Rachel Carson funds as of December 14. These have been catalogued and -- for now at least -- are available in the humanities resource area, along with a variety of magazines such as Africana, Audubon, Living Wilderness, etc... These may be moved soon to a more central location.

Asterisks indicate multiple copies.

301.3	Abrahamson, Dean E., Environmental Cost of Electric Power
591.51	Ardrey, Robert, The Territorial Imperative
628.16	Berg, George G., Water Pollution
630.1	Bromfield, Louis, Malabar Farm
632.9	Carson, Rachel L., Silent Spring
016.333	Carvajal, Joan, Conservation Education
823.914	Clarkson, Ewan, Halic
353.008	Congress and the Environment
333	Coyle, David Cushman, Conservation
628.16	A Curriculum Activities Guide to Water Pollution & Environmental Studies
614.715	Curtis, Richard, rils of the Peaceful Atom
632.95	Dahsten, Donald L., Pesticides
333.72	Dasmann, Raymond F., Environmental Conservation
301.3	DeBell, Garrett, The Environmental Handbook
301.3	DuBos, Rene Jules, So Human an Animal
901.9	Eisley, Loren, The Invisible Pyramid
301.3	Enrlich, Paul R., Population Resources Environment
596	Fisher, James, Wildlife in Danger
500	Fuller, Richard, Approaching the Benign Environment
632.95	Graham, Frank, Since Silent Spring
301.3	Hafner, Everett M., Environmental Education 1970
301.320	Hardin, Garrett J., Population, Evolution, and Birth Control

301.310	Holdren, John P., Global Ecology
614.7	Johnson, Cecil E., Eco-crisis
574.5	Kormondy, Edward John, Concepts of Ecology
500.9	Leopold, Aldo, A Sand Country Almanac
301.3	McClintock, Michael, Environmental Effects of Weapon Technology
301.3	Mead, Margaret, Hunger
599.744	Mowat, Farley, Never Cry Wolf
301.3	Murdock, William W., Environment, Resources, Pollution & Society
614	Nadler, Allen A., Air Pollution
333	Nash, Roderick, The American Environment
917.303	Nash, Roderick, Wilderness and the American Mind
333	National Research Council, Committee on Resources and Man
301.3	Novick, Sheldon, Our World in Peril: An Environment Review
623	Nuclear Explosives in Peacetime
574.5	Odum, Eugene P., Ecology
301.3	Odum, Howard T., Environment, Power, and Society
301.24	Osborn, Fairfield, Our Plundred Planet
598	Peterson, Roger T., A Field Guide to Western Birds
301.3	Rienow, Robert, Moment in the Sun
632.95	Rudd, Robert L., Pesticides and the Living Landscape
534.55	Shurcliff, William A., S/S/T and Sonic Boom Handbook
598.2	Sprunt, Alexander, Gamebirds
301.24	Storer, John H., Man in the Web of Life, Civilization, Science and the Natural Law
731.3	Terry, Mark, A Handbook for Environmental Education
309.173	Toffler, Alvin, Future Shock
799	Trefethen, James B., Crusade for Wildlife

333.720	Udall, Stewart L., The Quiet Crisis *	
574.5	Van Sickle, Dirck, The Ecological Citizen	
301.3	Voter's Guide to Environmental Politics Before, During, and After the Election	
582.13	Zim, Herbert S., Flowers	
595.7	Zim, Herbert S., Insects	
599	Zim, Herbert S., Mammals	
598.1	Zim, Herbert S., Reptiles and Amphilians	
582	Zim, Herbert S., Trees	
371.3	Planet Management Game)	
371.3	The Pollution Game)	*Games
371.3	The Redwood Controversy)	

Conceptual Chemistry
Environmental Reading Report
Date Due: Friday, March [illegible]

Your report should [illegible] author, publisher and copyright [illegible] edition. A brief summary of the book's [illegible] should not be your only purpose. You may want to treat any of the following questions:

1. Would you recommend this book to others? Why?
2. Is the author qualified to publish in this area?
3. How might this book change your life style?
4. Does the author tend towards sensationalism?
5. Is the book well documented?
6. Does the author have any biases? What are they?
7. Is what you have learned applicable in chemistry?
8. What are some of the major "things" you have learned?
9. Do you agree or disagree with the author's ideas?
10. Has the area of the author's concern improved or deteriorated since publication?
11. Do you now have an idea for research or experimentation for this class?

Items 3 and 4: Selected Book Reviews

A Collection

of

Book Reports

Chemistry

Mr. Spletstoser

March, 1972

Book Report By Paul Willis

The Sea Around Us
By Rachel Carson

I would recommend The Sea Around Us to anyone for the furtherance of their knowledge and appreciation of the ocean. The book looks at the world's seas from every angle (from all four corners of the earth), expositing watery facts and theories in interesting flowing style. A brief overview is given of sea life, the possible origin, underwater topography, ancient seas, islands, wavers, currents, the ocean's effect on the weather, and of man's dealings with the sea throughout history. From the reading of this book, a basic understanding of three-quarters of our earth can be attained.

The author, Rachel Carson, was an outstanding marine biologist in her lifetime. She was part of the Woods Hole Oceanographic Institute in Massachusetts and took part in various oceanographic expeditions in the North Atlantic. Her authority in ocean knowledge is as unquestioned as King Neptune's. Davy Jones himself could not better tell the story of the sea, or be more qualified to do so.

Only in one part of the book do I feel Rachel Carson has substituted emotionalism for fact. This is in the Preface, where she voices her concern over radioactive wastes being dumped into the ocean. She exaggerates the dangers of the problem and throws suspicion on the Atomic Energy Commission's concern for the well being of the environment. A radiation scientist states that she is out of her field in this regard, and does not well understand what she is writing about here.

However, I did learn many enlightening facts about the ways of the ocean. For example:

Shallow water in the Mediterranean evaporates quickly in the hot climate, being replaced by a rushing current from the Atlantic. In the old sailing days, Atlantic bound ships had to wait inside the Straight of Gilbralter for as much as six weeks because they could not buck this racing current. As for ocean currents they do not all run in just surface waters. These rivers in the sea can be many layered, running in opposite directions above and below each other.

Sea creatures can be very noisy. There are shrimp which sizzle and crack like frying bacon, fish with froggy croaks, and others that sound off like pnuematic drills.

The backdrop for this delicately balanced chaos of undersea life is impressive. The continental slope drops twelve to thirty thousand feet down to the murky ocean floor. These great escarpments are cut by submarine grand canyons whose existance still baffles scientists.

Rachel Carson, The Sea Around Us Revised Edition, Oxford University Press c. 1961.

But while these undersea gullies are a mystery to oceanographers the sea's power over land is well understood. The eroding waves are forever wearing away the continents. In fact, the greater part of Cape Cod is scheduled to disappear within five thousand years.

Besides tearing down the land, angry seas can accomplish other tricks. Stormy waves on the coast of Scotland regularly throw rocks through windows of a lighthouse three hundred feet above sea-level.

That's enough with the facts. Just let it be understood that the book gives one a general feeling for the sea. It shows that there is more to the ocean than a blue expanse under the horizon, more than breakers, beaches, and starfish. The Sea Around Us gave me respect for the ocean's age, feeling for its size, awe for its power, wonder for its beauty, knowledge of its diversity, appreciation for its rhyme and rhythm and curiosity for its secrets.

Book Report by Bob Ferguson

Famine 1975
William & Paul Paddock

A locomotive is roaring full speed down the track. Just around the bend a mudslide has blocked the track. Nothing can stop the collision happening in time. Catastrophe is foredoomed. Miles back up the track the locomotive could have been warned and stopped. Years ago the mud-soaked hill could have shored up to prevent the landslide. Now it is too late.

The locomotive is the population explosion. The landslide across the tracks is the stagnant production of food in the undeveloped nations, the nations where the population increases are greatest. The collision is inevitable. The famines are inevitable.

That is basically what the book is about, the famines are inevitable. It lists all including even the remotest possibilities that can stop the famines. Then it tells why all of them aren't feasible. In addition to that they gave you a fifty page section on what the United States should do during the worst famines the world has ever known. The authors of this book predict the year will be 1975, the Department of Agriculture predicts it will be in the early 1980's, but no matter what the date, they will come.

I thought both authors knew what they were talking about and were extremely informative. Paul Paddock served in the U.S. Foreign Service for twenty-one years. Nearly every post he held was in an underdeveloped country. William Paddock is an experienced agronomist. He was Director of the Iowa State College-Guatemala Research Center in Antigua, Guatemala, developing new methods and crops for tropical agriculture. Like his brother, he has lived, worked and traveled extensively in the undeveloped nations. They are also the authors of the book, Hungry Nations.

In conclusion I can truthfully say that I would without any hesitation recommend this book to anyone that's at all interested in this subject.

Book Report by Cindy Hunt

The Quiet Crisis[1]
Stewart Udall

Former Secretary of the Interior, Stewart Udall's book--The Quiet Crisis --summed up the history of the American people in regard to their land. He first showed the Indians' love and respect for the country and then the land grabbing attitudes of the whites that have prevailed up to and including today. The stress in this writing is placed on the concept that land should be conserved for future generations. He also emphasizes individual action.

The Indians had an affection for the land; it was the center of their universe. A problem developed between the whites and the Indians because they could not understand each others ideas of ownership. The Indians held the land in common. The white looked on land as a symbol of prestige. "The confrontation of Indians and whites had in it the seeds of hopeless misunderstanding from the start."

The immigrants, coming from a highly populated Europe, were amazed at the vastness of the American continent. This was the beginning of the Myth of Superabundance. This was the idea that the resources of America were inexhaustable. This myth remained virtually unquestioned until the 1800's.

In the 1800's, several men got involved with conservation. These men were, among others, Eugene Hilgard (agronomy) and George P. Marsh (author). Marsh questioned the idea that progress was inevitable. "Progress was possible, he was convinced only if men used wisdom in managing resources."

John Q. Adams was a forerunner to the Roosevelt way of thinking. He felt that the government "...should be more than a passive referee; it should carry out positive plans to advance the common good."

Carl Schurz, as Secretary of the Interior under President Hayes, and John Wesley Powell both joined in the fight for conservation in the United States. Schurz was against the raping of forests. He investigated the raiding of national resources and saw that the penalties for timber theft and trespassing on public lands were enforced. Powell came within one year of working out a water sharing program for those west of the 100th meridian. Both of these men became victims of a populace unready for conservation. The society felt that their freedom was being restricted by controls on the environment. (A problem that is still with us)

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1 Stewart Udall, The Quiet Crisis, Copyright 1963

The interaction of Gifford Pinchot, John Muir, and Theodore Roosevelt, and later, Franklin Roosevelt, resulted in the formation of millions of acres of park lands. However, these national parks, monuments, and forests have been little enlarged since 1940. In 1940, 130,000,000 Americans shared 22,000,000 acres. Now over 200,000,000 Americans share just a few acres more. The Roosevelts made a major dent in the public's feelings towards conservation. FDR's concern for the environment is exemplified by a statement he made after receiving protests against a proposed artillary range:

> "...Please tell Major General Adams or whoever is in charge of this business that Henry Lake, Utah, must immediately be struck from the Army planning list for any purposes. The verdict is for the Trumpeter Swan and against the Army! The Army must find a different nesting place!"

This effort was side-tracked by two major world wars.

In recent years, John F. Kennedy proposed a revival of Roosevelt's Civilian Conservation Corps (CCC). The CCC was established to give work to unemployed men. They would work on projects such as re-forestation. I personally feel that this would be a good idea. In a time of peace, young men and women could be "drafted" and serve their country by helping to protect and renew its environment.

Udall points out that the Myth of Superabundance has been replaced by the Myth of Scientific Supremacy--"this rests on the rationalization that the scientists can fix everything tomorrow."

The author is afraid that many of today's land utilizers are more concerned with profit than with the preservation of the land. This is the same attitude as the land raiders of yesterday had. He feels their slogan is: "Present the repair bill to the next generation."

Udall presented this book in a straightforward manner. His main bias is all-out support for the President he was serving at the time.

Although published nearly a decade ago, Udall's ideas are still pertinent. I found it interesting that the current ecology movement is not the first time Americans have been concerned with their environment. This book was printed before the ecology movement caught on. Maybe the bringing to light of certain aspects of the quiet, but urgent, crisis helped to kindle interest in this area.

An important problem in our attitudes can be learned by reading this book. This is the attitude of: We own the land so we may do as we please with it.

> "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.
>
> -- segment from "A Sand County Almanac" by Aldo Leopold

The book was well written and placed emphasis on action. Although not resorting to sensationalism, the author presented the situation as it is. This was done through his journalistic style writing and several picture portfolios. Near the close of the book he urges action before it is too late:

> "We must act decisively--and soon-- if we are to assert the people's right to clean air and water, to open space, to well designed urban areas, to mental and physical health. In every part of the nation we need men and women who will fight for man-made masterpieces and against senseless squalor and urban decay. (Here Udall refers to the cities but this is his stand on the over-all nation.)

Book Report by Mike Anderson

Desalination
By Roy Popkins

This book is great for people who want to know a lot of facts. The book gives a very brief history of desalination then goes directly into the details of why water needs to be desalinified due to more people and less water available due to industries and pollution.

This book was very good on facts of how different processes for desalination would produce different amounts of water, how much it would cost, and where this process could most widely be used.

The cost of things seemed to be the main idea of the author. About all he talked about was how much the plant would cost to build, how much the fuel would cost, how much the transportation of the water and the price of the water per thousand gallons. I would recommend this book to people only as a resource. It was full of facts and figures and would give a person a very good idea of what desalination is all about. As for the author being qualified to write in scientific journals and great magazines, his materials were great although it got a little thick and dull near the end. All through the book he uses the quotes of different men who are outstanding in the field. In the back of the book he needed thirteen pages to write his bibliography on where he got his materials. Some of the things that I've learned are the ways salt water is converted into fresh clean water. In all the book stated fourteen different methods for the distillation of salt water.

From multistage fresh distillation where boiling sea water is lowered in pressure to make the water boil at lower temperatures to freezing precesses which uses the information that when salt water is frozen the fresh water forms ice crystals while the salt drops out into an unfrozen solution. Other points of interest which I learned were how different kinds of distillation plants were being used around the world.

Footnotes: Roy Popkins. Desalination: Water For The World's Future, New York, New York. Copyright 1968

How much water some of these plants could produce and how this water could be used for other purposes other than drinking.

In closing I'd like to say that anyone who wants to know something about desalination should read this book.

Book Report by Fred Berman

Nuclear Dilemma
By Gene Bryerton[1]

The book, Nuclear Dilemma, is an in depth report on the benefits and hazards of nuclear-powered power stations. This book seemed to have been written with the intended one-million kilowatt facility, to be built in Eugene, Oregon, in mind. The pros and cons of nuclear power are discussed in this book and many interesting facts are brought up making you wonder whether we should or should not use nuclear power.

Should we use nuclear power in our electric generating plants? The service record of these power plants has been exceptionally good. The plants are clean efficient, totally safe, and the pollution levels are very low, a lot lower than conventional fossil fuel plants but, there are hidden difficulties. Sure, the plants are safe and do have many safety devices attached but one report on nuclear reactor safety estimates that if a power plant of this kind were to be destroyed by natural or human faults the service record would drop far lower than a fossil plant. A 250 thousand kilowatt plant, if destroyed, would cause an estimated loss of seven billion dollars, 3,400 people killed, 43,000 injured, and land contamination that could total 150,000 square miles. That is if half of all the fission products were released. What if the one-million kilowatt plant were to have an excursion? (an excursion is if the radioactive material were to escape from the plant.) Remember, it is four times as large as a 250,000 kilowatt plant.

Pollution levels are low, too, but there are radioactive materials that have to be stored in containers underground for a long time. The material is diluted but it is still dangerous. Some materials that are taken underground have to be stored for over 600 years and with a container life of only twenty years, what happens? Some of the radioactivity is put into the air but, the levels are very low in radioactivity. The only fear in this is that the radioactivity will build up. Thermal pollution is also a danger to fish that live in cold water. It attracts pesty types of fish (carp) and encourages the growth of a dangerous species of algae. Also, radioactivity is put into the water which could build up in fish and plant life under the sea.

I have very briefly discussed some of the topics brought up in this book, which, biased or not, is well worth reading. Most people know very little about the nuclear power plant, which as of now number

1. Gene Bryerton, Nuclear Dilemma, Ballentine Books, 1970.

sixteen in the United States with forty-three more coming soon. It would be wise to read Nuclear Dilemma though, because your life can very well be influenced by the use of such devices in the near future.

The author of this book tended to be a bit emotionalized as far as facts and other information in this book goes. He uses the usual scare tactics when talking about the critics' point of view while he makes you feel almost like wanting a nuclear reactor in your back yard when expressing the advocate point of view. That is one of the good things about this book that makes you read all the way through without getting bored.

One out-of-date thing in this book though is that when it was written, the power reactor in Eugene was in the process of being approved and was going to be built. Since then, it was defeated.

Book Report by Ron Jeffrey

Moment In The Sun
Robert and Leona Rienow

Moment in the Sun, written by Robert Rienow and his wife, Leona, was first published and copyrighted in 1967. By May 1970, this book, published by Ballantine Books Inc. had undergone its sixth printing.

Broken up into six separate parts, Moment in the Sun takes a brief look at six different, but related problems.

These six problems, that the book talks about are all concerned in the area of pollution that man in his hurried modern day life has caused. Along with the problems, the author also gives some probable consequences that will result from the misuse of the environment.

With 30 years of research in back of both the authors, they are very qualified to publish a book of this type. Starting in the late 1930's Rienow and his wife have covered most of the country researching and trying to bring to the public's eye, the slow destruction of our natural resources. This book, as a result, has a big variety of examples.

Not written in a story book form, Moment in the Sun gives the facts of what is happening right now and the probable consequences if what we, the human race is doing, is not stopped.

If you at anytime wonder where the authors have gotten their information, you can turn to the back of the book where it has a bibliography for each chapter listing its sources.

Giving an overall view of the whole subject of environmental pollution, I think that it is better than a book only dealing with one area. The reason for this is that when you are dealing with only one area you can't see how the different areas interrelate with each other.

Since this book covered a broad range of aspects concerning pollution, chemistry application could only be made in a small amount of situations. But when you do read the areas that do apply to chemistry you can see how big a role chemical products play in pollution. Also after reading this book I will be more cautious of how I use chemical products and where I use them.

This book is now 5 years old and some areas of it are a little bit out of date, but I would still say that it is still a very good book on the whole. And because it is still excellent on the whole I would recommend it to anyone wanting to further their education in the environmental area.

Book Report by Pam Pritchard

The Careless Atom
By Sheldon Novick

The title of the book is a pretty good indication of the purpose or "message" of it. It exposes the careless manner in which atomic energy is used. The possible accidents and their potential dangers as well as accidents that have happened are discussed. The "near-miss" accidents are especially frightening because sometimes it was just luck that kept an accident or malfunction from becoming a disaster costing many lives. He also tells about the damage radiation can do to living organisms and particularly man.

Two of the dangers of nuclear reactors which were most impressed upon me were, 1. The still unsolved problem of how to better prevent the possibility of core meltdown (the core is the uranium-235 fuel, compressed into pellets which are packed into fuel rods several feet long and only a few inches thick, which are arranged into fuel assemblies). The controlled reaction occurs at extremely high temperatures, running into thousands of degrees farenheit and the core must be constantly cooled (usually by water). If anything goes wrong and the flow of cooling is impaired or stopped in some way, the temperature would, in seconds, rise to above the melting point of uranium and the molten fuel would literally melt thru anything in it's path, releasing large amounts of radioactivity. Partial core meltdowns have already occured in some reactors. And 2. The problem of waste disposal. Radioactive waste is produced not only in reactors but in uranium mining, refining, fuel reprocessing etc. and these must be safely stored until the radioactive elements become stable and cease to be radioactive. Some of the waste elements produced have half-lives of thousands and tens of thousands of years and the safe storage of them for that long is pretty hard to fathom.

In the last part of the book, Novick discussed the alternatives to nuclear power, whether they should ever be used, etc. He believes that nuclear power reactors are definitely a possibility for the future as well as solar power and other unresearhed and practically unsupported possibilities, but that it needs more research and time before they will be safe enough for his standards. I agree with that. I feel that

the problems in radiation pollution, waste disposal, thermal pollution and safety they pose can be solved (there are solutions to all of these now, but often they are very expensive) and thereby make them the clean power source that the power companies claim them to be now. A better solution, in my mind, that he didn't go in to, is that instead of constantly searching for new power sources and wrenching every last ounce of fuel from the earth, we should work to decrease our population and power needs. Fossil fuel plants aren't a good solution and neither is jumping into what I feel is an unready nuclear power industry, but nothing will be a good solution unless we can stem population growth.

I think (I don't really have any way to find out if his facts were accurate) the book is basically factual except for the last couple of chapters in which Novick gives more of his personal feelings. He was definitely biased against present day reactors, but I think he gave a pretty fair estimation of the hazards of reactors. And I would definitely recommend this book to others since we will probably all, and fairly soon, be faced with a decision between allowing or banning a reactor wherever we live.

Book Report by Karen Campbell

Man's Impact on Nature[1]
By Prof. J.A. Lauwerys

Ecology is defined as the entire household of nature, plants and animals, and their relationships to each other. The author is quick to point out that there is no such thing as ecology and man, because man is just as much a part of the ecosystem as are the other animals and plants. Man's place in the natural world is conditioned by his technology and scientific knowledge and he has created a unique capacity to intervene. His advancement in this field has given him the capacity to change the environment to meet his never-ending needs.

The Industrial Revolution has changed man's ecological status for all time. In replacing muscle power with machines, man transformed his capacity to intervene with all sorts of natural processes. He has changed the lives of not only whole populations but also their relationships with every part of the ecosystem. As man's power has increased, so have the ecological consquences with the use of that power.

Man's capacity to produce more food than ever before has led to a steadily rising population in all centers of cultivation which has led to two main consequences: First, the spread of farming communities in all directions and secondly, the development of urban communities in the great river valleys.

With the spread of farming, other ecological crisis develop. Insects have become serious pests only since the dawn of agriculture. Man

1. Prof. J.A. Lauwerys, "Man's Impact On Nature", Natural History Press, 1970

brought the insect problem upon himself. Insects made their mark only when man set aside particular areas of soil for particular crops. The development of insecticides is one of the most important by-products of the Industrial Revolution, since they have increased the effective yields of crops over all the world. One of the main problems with insecticides is that they are poisonous not only to the pests that they are designed to destroy but to other species also. The principal danger is that many insecticides retain their toxic properties over a long period of years. Public concern in the ecological side effects has led to much greater care in selection and use of the insecticides. Much damage can be prevented by careful and minimum application and by avoiding contamination of soil and other parts of the immediate environment.

Much of the ecological disorders of today is caused by man's desire to crowd together. Diseases thrive on overcrowding and the breakdown of social life. Anywhere that man flocks in numbers provides breeding grounds for rats which are well known carriers of diseases.

A key factor in the population explosion is the ratio between birth rate and death rate. The development of vaccines and the enforcing of laws of corporate hygiene have efficiently stamped out many of the most dangerous of the epidemic diseases that have kept the world population under check.

Where there are people there are cars and factories which pour toxic fumes into our air. Each year thousands of people are made ill when the stagnation of the atmospheric pollution levels rise catastrophically. Where there are people there must also be power. The most dangerous of all atmospheric pollutants is radio-active fallout, the by-products of nuclear bomb tests and atomic power stations.

People also need water. Only 0.35% of earth's water supply is immediately usable, but much of this is difficult to exploit. The fresh water crisis which affects almost every industrialized country depends on two factors: First, the difficulty of providing large cities with adequate supplies from a local source (a radius of 100 miles), and secondly the extent to which even present supplies are being rendered unusable for domestic and industrial purposes. Waterways are threatened not only by waste from industrial plants and domestic sewers but also from the agricultural fertilizers we depend on for our food supplies.

From the earliest days man has tampered with his environment with little thought of the consequences. Before, the consequences were rarely dangerous, short lived, and local. Today our problem is that we neglect our responsibility to understand the full consequences of such changes until it's too late. Man's technological history has a recurring theme: the solution of immediate problems with the creating of fresh problems. The environment cannot be altered or interfered with at one point without consequences.

I believe that Prof. Lauwerys is very qualified to publish in this field. He has put a good deal of research into this book and backed

up extremely well what he had to say. He has taken a look at the problem, and from that point looked to find the source, which is man himself. Prof. Lauwerys is not high strung on ecology but he is concerned. He does not drag out his ideas and feelings but makes them brief and to the point and covers a wide area of ground.

The author is biased in the sense that he blames everything on the Industrial Revolution. I disagree with this viewpoint because I believe that many good things have come of this period of time as well as a few undesirable aspects.

I agree with the author in his opinion that if the speed of science and technology were not prevalent in our society today that the ecological crisis would be set back many years.

Chemistry Book Report

A Report to Mr. Spletstoser
By Greg McCann

The book I read is called "Water, The Vital Essence" by Peter Briggs. It was published in 1967 by Harper and Row Publishing Company.

The book is a fair book. It has seven chapters on oceanography which are very interesting. The chapters I will talk about are chapters 8-11. These four chapters tell about how the rivers and lakes are slowly dieing because of man's carelessness and about how this is being done. It has several stories about companies polluting and refusing to clean up.

I would recommend this book to other people who are interested in oceanography and the situation of the water today.

The author is qualified to write in this area. He is experienced in science and a few of his sources were Woods Hole, Mass. and La Jolla, California. He has information from coast to coast.

This book made me think about how I am involed in pollution of the water and what I can do to help stop it.

I agree with the author on his ideas. He thinks the companies that are doing the polluting should clean it up with out being told by the government.

This book has given me an idea of what take samples of water from the rivers* around here. I will see how long guppies will live in it. Guppies will live in just about everything.

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* Marys River, Willamette River, and Jackson Creek.

Book Report by Jody Bartholomaus

The Frail Ocean
Wesley Marx

This book deals with the subject of the polluting of our greatest natural resource--the ocean. The following verses show that was once a common belief among men concerning the ocean:

> Roll on, thou deep and dark blue ocean--roll!
> Ten thousand fleets sweep over thee in vain;
> Man marks the earth with ruin--his control
> Stops with the shore.

But we are painfully becoming aware that this is no longer the case. As the land resources shrink, the world's population and its expectations expand. The continual depleting of our resources on the land show us now turning to the mighty oceans for help. Today, the "society where none intrudes" is being penetrated by great technological advances. If the ocean is to be a jumbo resource its exploitation must be carefully tended. It can no longer take care of itself. The concept of an all-powerful ocean is now obsolete.

As man pollutes land he also contributes extensively to the pollution of the ocean.

One of the major causes of pollution is oil. A vast amount of oil is lost from various sources every year--all of which is deposited on the surface of the ocean. There it destroys many things--water fowl, fish, microscopic organisms, and plant life.

Another major problem is the dumping of human wastes into the ocean, thinking that "the ocean can take care of it." But it can't! It would take a large amount of money for the making of proper sewage treatment plants to treat sewage until it was fit to put in the ocean--but it would be worthwhile in the end. After we have ruined, plundered and polluted the ocean we will be left with a ghost ocean--empty of everything but the sound of its waves.

I think that this book was very interesting but it would have been better for me if I would have had more time to read it. It was a new experience--I would never know about or even thing of many things in this book. I think that Mr. Marx did an excellent job. He believes quite strongly in what he is writing and because of that his book is very good.

After reading this book I now wonder what I can do to help this depressing situation. People are always clicking their tongues and saying "How terrible!" but many never do anything. The book made me more aware of what is going on in regards to water pollution.

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1. Wesley Marx, The Frail Ocean, (Ballantine Books, Inc., 1967).

I think that more people are becoming aware of the fact that the world is becoming more and more polluted. There is finally coming about a growing concern in the field of ecology. There has begun in many fields of technology a core of people who are starting to do something. Investigations have been started to check on the treatment plants and to try to improve the facilities so pollution will be lessened.

Book Report by Joe Blickenstaff

The Population Bomb[1]
Dr. Paul Enrlich

The subject of the book is the population problem of the world. It is quite evident that there is a population problem because the birth rate exceeds the death rate in all countries. Right now there are millions of people dying of starvation but the population keeps growing. According to Ehrlich if this continues we will have a world-wide famine in a few years because almost nobody will have enough food. This makes sense because if the birth rate is exceeding the death rate it is unbalancing the balance that keeps the population from growing too much. If the amount of unbalance gets too great then there must be a massive death rate to balance the population out again. Effective population control is needed to keep this crisis from occurring. The result of effective population control would be less people, of course, and the lack of people would lessen other major problems, such as pollution, war, and problems in our cities.

The biggest difficulty in getting anything done about the population problem is making people aware of the problem. Almost nobody knows of the population problem or if they know about it they don't realize how big the problem is. All of the concern in the United States is on other problems that are around like the war in Vietnam, all of the pollution going on, and the problems in the big cities. The concern must be shifted to the subject of population before any action will be taken. Even if the concern shifted to the population I don't think people would believe that the problem is so great. Ehrlich showed that the population is growing very quickly and there isn't that much food available to be had. Ehrlich doesn't think that we can turn to the ocean for food when the demand gets great enough because we would probably exhaust the supply of fish pretty soon. Also the ocean might be badly polluted before we turn to it for food. That isn't a solution to the problem anyway because even if we turn to the ocean for food and the population keeps growing the population will soon outgrow this source of food. All the evidence that Ehrlich had pointed toward a disaster in the future. Even if somehow everybody was made aware of the problem there would have to be effective birth control methods used to cut down the population. The under developed countries are the countries with the highest birth rates and in order to carry out birth control in these countries the people would have to be educated in this area. In the area of birth control, family planning is the most widely used method. Family planning

1. Dr. Paul Ehrlich, The Population Bomb, (Ballantine Books, 1968).

doesn't work as birth control because people want kids and family planning only gets rid of unwanted kids.

Ehrlich is well qualified on the subject of population. He is a professor of biology and Director of Graduate Study for the Department of Biological Sciences at Stanford University. He specializes in population biology. I think that Ehrlich has used sound reasoning in determining the problem and I think he is justified in being pessimistic. Ehrlich quoted a lot of resources in his book and used them to show his points. Even after reading the book I can't really believe the problem can be that big. It is hard to imagine a world-wide famine in a few years when I have good food to eat every day. If the problem is going toward a world-wide famine then I think it will result because nobody is going to do anything to prevent it. Ladies aren't going to quit having babies just because some guy says she's creating a problem. Not only is the world going towards the worst in population but also in every other aspect concerning the environment and it will only be a matter of time before a crisis does occur which is massive enough to shock everyone. Then maybe people will recognize the problems and do something about them.

Book Report by Steve Doubleday

Since Silent Spring[1]
Frank Graham Jr.

This book deals with the background of Rachel Carson's book "Silent Spring" and what has happened to the controversy over pesticides since the publication of that book. Almost the first half of the book deals with "Silent Spring" and the reactions it received upon publication and in the years afterwards.

Rachel Carson was born in 1907. She was not an unusual child and she led a normal life. Always interested in the sea and animals, she went to various universities and gained a master degree in biology. She first reached the public with her best selling book "The Sea Around Us", and later "The Edge of the Sea" appeared as an equal success. One day she received a letter from a friend who had found birds killed by pesticides dropped from planes, in her garden. This letter started the chain of events towards "Silent Spring". Four years in the writing, "Silent Spring" involved an immense amount of research and digging into widely separated areas of knowledge. She received assistance from many scientists and threats and warnings from opposing quarters. The thing that made "Silent Spring" such a controversial book was the fact that it was the first synthesized and understandable book that had ever been written about the bad side of pesticides. Other publications were far too complex, too short or too radical.

Upon publication, a controversy began that never died down again. "Silent Spring" served its purpose amply; it aroused the public to the disadvantages of pesticides.

1. Frank Graham Jr., Since Silent Spring, Fawcett Publications, Inc., Greenwich, Conn., 1970.

After this background information the book continues the tradition of "Silent Spring", by revealing new elements and facts about the pesticide situation. In some respects, things have worsened. DDT, the subject of greatest controversy is hardly used at all now by the U.S. government. That is not to say that private citizens and companies don't use it. Nor is it to say that even more toxic chemicals have not replaced it. Dieldrin, aldrin and endria, members of the chlorinated hydrocarbon chemical group of which DDT is the best known member, continue to be used, with bad, to say the least, effects.

Endrine residues from an endrine producing plant on the Mississippi River were found to be causes of massive fish kills in the late 50's and early 60's. It took government action to make the plant clean up its operating procedures.

Far more insidious than this, is the effect pesticides have on the complicated exosystem of our world. In 1958 an area around a small town in Bolivia was sprayed with DDT. Cats in the town picked up the DDT in their fur. When they licked the fur they were poisoned and they died. Five years later rats carrying the disease black typhur entered the town. Because there were no cats to kill them the rats spread the disease. 300 people died.

Another danger from pesticides is found on the American farm. Great areas of land are planted with one crop, inviting pests to come in swarms. Sprays are used on the pests. Since no pesticide is 100% efficient, some immune insects survive to breed more immune insects. The natural predators of these insects, being fewer in number, have less chance to mutate into immune forms, and the pest rages again stronger than ever. More and more deadly pesticides are needed. The cycle continues, until the land is barren, poisoned by the insecticides dumped onto it.

The list of dangers from pesticides grows. Already, the level of pesticide content of the oceans ecosystems is approaching and in some cases has surpassed the pesticide levels in inland waters. Predatory birds, our own bald eagle included, are threatened with extinction through eggs breaking due to shells which have been thinned by pesticides. The frightening thing about these facts is that there is no escape. Pesticides have been found in every corner of the world.

Some progress has been made though. Sweden has temporarily banned DDT and several other pesticides. Denmark has permantly banned DDT and Hungary has banned all chlorinated hydrocarbon pesticides. Slowly other countries are following suit. The U.S. is gradually coming to its senses with legislation governing and in some cases prohibiting the use of DDT. Private organizations, such as the Environmental Defense Fund, have sought legal action against pesticides in a number of cases and have been quite successful. New advances in selective controls on insects, such as hormones to kill insects before they reproduce, have been introduced. But progress is being made all too slowly and the pace must be accelerated to catch the crisis in time.

I would recommend this book as an informative sequel to "Silent Spring", carrying the pesticide controversy up to the present day. The book appears to be well documented, with an extensive and impressive bibliography and list of sources. The author tends slightly towards emotionalism and makes some broad and sweeping generalities. He would appear to have a small bias against pesticides. However, the book in general is precise and full of detail and facts.

I have learned from this book that the pesticides situation has deteriorated since the time of "Silent Spring" and that the problem is more urgent than ever. I think I shall be even more opposed towards indiscriminate use of pesticides now that I have read the book and I will endeavor to educate myself and others to the dangers of pesticides.

In conclusion, I find this book a disturbing document of the pesticide situation at present day.

A Book Report by Brent Webb

Fertility and Survival, Population Problems[1]
Alfred Sauvy

Mr. Sauvy stresses what a large population can and has done throughout history. In order to keep living standards the same, with a growing population, the economic standard must rise at a rate of six times that of population increase.

Mr. Sauvy states that with a large population, once crops start to fail, the population will start to eat the seed needed for next year's planting, which means a smaller harvest next time. But the trouble does not end there, if food is not to be found elsewhere, both the harvest and the population will spiral down until the population finally reaches a point where the land can support it. Not only does this take place with food supplies, but also with many other things that a civilization is used to having.

Mr. Sauvy suggests many different things keep the population down, and states how they effected the population growth in China, Japan and India just after the second world war until 1953. It is quite evident when the 1953 population of these three countries is compared to the projected estimated populations, that efforts have been made or things happened to limit population increase.

So whether a country, people, or government accepts the idea of birth control, the population is or must be kept at a relatively moderate number as compared to the food and resource supply level if a high standard of economy and health is to be maintained for man. Otherwise, all technology and energy would have to be directed toward growing enough food to feed the numbers of a hungry world and no advancements

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1. Sauvy, Alfred, Fertility and Survival, Population Problems From Malthus to Mao Tse-tung, Collier Books: New York, 1963.

in technology or improved economy would be made outside of food. This would but postpone the ultimate starvation of an unlimited population.

Chemistry is of help and applicable in several ways. The first way is to create new and better ways to control pests that damage crops. There are many ways of killing pests but the problem is finding one that is not harmful to friendly insects, animals and man.

Another way of using chemistry is to produce more productive strains of plants or to make foods directly from chemicals, proteins and elements that are needed to keep man alive. This may in turn produce new problems. The ultimate solution, it seems to me, is to use chemistry to improve food production while developing means to limit the Earth's population to what she can provide for adequately.

A Book Report by David McCarthy

The Chemical Feast
James S. Turner[1]

For those of us who have read or will read The Chemical Feast, I assure you that it will leave you with such a feeling of bafflement, frustration, rage, and anger that you will never again be able to eat any processed foods with a certain and secure conscience.

Reading this book might well provide you with enough information on the corruption and bureaucratic overkill which makes the Food and Drug Administration little more than its tile, the agency which has been entrusted with the duty of protecting the American consumer from harmful products.

The Chemical Feast reveals few reassuring hopes and a history, up until now, of the failures and inefficiency of the Food and Drug Administration to fulfill its duty to protect the health of the American People.

There are several examples of FDA inaction in the face of public danger recorded in this book.

One of the major examples is the case of cyclamates. It's shocking to find out that nineteen years before cyclamates were finally ordered off the market, FDA and other scientists had detected that cyclamate was a harmful and dangerous substance and should not be used as a generally accepted as safe food additive. And the book also reveals at least ten danger signals produced no response by FDA officials!

Learn how when cyclamates were ordered off the market how the public was deliberately deceived by the Secretary of Health Education and Welfare, to believe or to be led to believe that cyclamate was really

1. The Chemical Feast, Ralph Nader's study group report on Food and Drug Administration, by James S. Turner, Grossman Publishers, New York, 1970.

not as dangerous as some people said.

It was more dangerous! And when scientists of the FDA tried to inform the public with the information they had obtained from their research concerning the dangers of taking cyclamates during pregnancy, they were criticized of their jobs!

The book tells us that the Food and Drug Administration is more a partner of big business that its regulator. It tells us that of all appeals annually of new foods to go on the market, 50 percent are rejected because they are harmful to human consumption.

This book also points out that we all might be getting poisoned a little each time we eat all processed foods, because very few processed foods are required by law to list all their ingredients.

You learn that Wonder Enriched Bread is really enriched with four vitamins and you would have to eat sixty-two slices each day to get the minimum daily requirement of those vitamins. Wonder Bread is a favorite of commercial bread sellers because it can be stored in a warehouse and insects won't touch it. The insects would starve to death of malnutrition after they had finished the loaf!

The Chemical Feast is a hard hitting factual well documented attack on the Food and Drug Administration, which for all too long has been the protector of the 125 billion dollar food industry and the false myth of security for the consumerswho think that they are being protected by an agency they are paying for!

Some other facts that are brought out into the open are that American 20 year old men will live shorter lifetime on the average than thirty-six nations. For women of the same age and nationality, she underlives the lifetime expectancy of women in twenty-one other countries.

In the past decade American life expectancy has not dramatically increased.

The Journal of Nutrition Education conducted the most extensive review of nutrition studies ever conducted in this country. The study found "nearly all children under one year of age had an iron intake less than the recommended dietary allowance". The study also found "infants of higher income families to be less well nourished than those in lower income families".

In my opinion this book should be a must reading for everyone. Its message is too shocking not to realize and its message is more urgent because the shocking message is the truth!

We the consumers have been abused and misused for too long! And now the government agency we entrusted to protect at least our right to eat foods that weren't poison, we find out that we all may be on a malnutrition train of generations to come that will lead to extinction.

And to connect parallels of how this book can apply to out chemistry class, I see one parallel. I wonder if the chemicals we use for experimentation are in the foods we eat?

Something to think about!

A Report by Doug Houck

Perils of the Peaceful Atom[1]
By Richard Curtis and Elizabeth Hogan

Perils of the Peaceful Atom was a book about the hazards of nuclear reactors. The book started out by telling about an accident that happened in Michigan with an atomic reactor. This happened in what the author said was an experimental breeder reactor. The book then went on to tell about things like how much radiation the human body can take. The book then went into some of the dangers of a reactor constantly critizing the Atomic Energy Commission on the way. Some of the topics covered were the possibility of something happening as a result of a national disaster. The book then goes into such topics as thermal pollution, the power of the Atomic Energy Commission, or whether it would be economically feasible to run an Atomic Plant. The last chapter talks about what you can do to stop the spread of nuclear reactors.

Perils of the Peaceful Atom is written by an ecologist and a writer. I think that Elizabeth Hogan (the ecologist) had the idea and Richard Curtis (the writer) put it down in a very dramatic but extremely slanted way so that the public would buy it. Every word in the book is true, but most of it is very exaggerated. I don't recommend the book to anyone (unless they've read or heard about both sides) for this reason.

1. Richard Curtis and Elizabeth Hogan, Perils of the Peaceful Atom, (Doubleday and Company Inc., 1969).

Study Group Report by George Frey

Vanishing Air[1]
By Ralph Nader's Study Group

"Vanishing Air" was written by a screaming environmentalist and with good reason. At this point in time, we must start screaming about our environment, and its deplorable condition. Earth-lovers particulary of the species airnamiacus, will find their weapon in this innocent appearing paperback. It may be the only weapon they need, for it is astonishingly complete, a sort of world almanac of the skies. Thus, the most effective way to use it is, as with any reference book, not to read it from cover to cover, but locating the information and statistics pertaining to one's investigation, and marching into battle from there. Some of the chapters do, however, make good bedtime

reading, particulary the ones involving politicians and industrialists. Here are chronicled their slimy dealings and maneuverings to avoid effective air-pollution control, their clever means of misleading the public, their distortion of scientific evidence used for propaganda.

An excellent example of this, the tale of Nashville, Tennessee. In 1958 and 1959 the United States Public Health Service conducted an intensive survey of the air pollution condition in Nashville. Over 200,000 kerometric readings, taken at 123 sampling stations, were taken. The report, published in 1965 stated, "It is concluded that Nashville has excessive air pollution."

With reports like that floating around, the citizens of Nashville began to get a bit nervous. They decided to obtain an effective air pollution control legislation. Batting for their side appeared E. I. Dupont de Nemours and Co., the region's greatest employer, and "the world's mightiest chemical conglomerate." Representing Dupont was O. W. Hess, manager of Dupont's Old Hickory Plant. His contribution to the commission was testimoney claiming that there was "a substantial decrease of SO_2 concentrations in Nashville's air." The source of his data is interesting.

When Dupont learned of the activities going on in Nashville, the company very graciously took the financial burden of testing the atmosphere away from the people, and made it a private company effort, under company supervision. The sampling consisted of one monitor placed in the public square. The results may be considered worthless as measure of regional air quality. As Esposito points out, "Hess's testimony typifies the attitude of Dupont and other industries, an attitude sustained and nurtured by the harebrained scheme of the Air Quality Act of 1967: that is, if 200,000 readings from 123 monitors indicate that the air is grossly contiminated, and one lonely statistically insignificant sampler suggests that all is well, then all is well."

The poetic epologue to the story is that Nashville did not, due to the sway of Hess's words, get the emission control standards so desperately needed.

This book is excellent material for anyone generally interested in ecology. Political activists will find a large amount of information on Senator Edmund Muskie. Leaders of industry will find a painful expose. Perhaps this is the only way of stimulating change, change toward our salvation. Perhaps all we can do is try to change, rather than fight, the polluters, perhaps all we may do is repeat the words of Edwin Markham (1852-1940).

masters, lords and rulers in all lands,
is this the handiwork you give to God?

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1. Ralph Nader's Study Group Report on Air Pollution, John C. Esposito Grassman Publishers, New York, 1970 ($.95)

Book Report by Debbie Grant

Silent Spring[1]
By Rachel Carson

Though "Silent Spring" was published ten years ago it still has a big effect on our lives today. It was published in 1962 by the Houghton Mifflin Company, and it is still being read widely today.

This book is actually a series of incidents telling about the destruction of air, water, soil, wildlife, and our living environment by careless use of chemicals. Each chapter follows a pattern. For example one chapter might say that soil is mistreated, then it would tell what chemicals were being used, some specific incidents, and how they could have been prevented.

I think that it would be good for everyone to read this book because it makes you aware of many things that are wrong today. It awakens you to environmental problems and would probably make you think twice before using even a common weed Killer or insecticide.

At first this book is hard to understand, it starts out talking about chemicals compounds and equations. However, it soon gets interesting, as it starts to relate things to everyday life. The author also tends toward emotionalism occasionally to get a point across and this makes the book more interesting.

I think that this book has really made a lot more people more interested in ecology and protecting our environment. The book really brings out the fact that this is the only world we have, and we better take care of it before it is too late.

However this book is ten years old and I would like to read the book, Since Silent Spring. This is a sequel to Silent Spring and it would be interesting to see if the situation has improved or worsened. This is because Rachel Carson seems to be convinced that very little is being done and we are killing ourselves in apathy. The way the book was written it seems like we should all be dead by now.

However on the whole I agree with the author. She has several main points I think are very sound. They are: we can use more natural things and less deadly chemicals for weed and insect control, we can't afford to use sprays and insecticides without understanding their full power and their weaknesses, and most important of all we need to start now before it is too late. It is now or never if we want to save our world and ourselves.

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1. Rachel Carson, Silent Spring, Houghton Mifflin Co., 1962.

Item 5: Selected Project Reports

WATER QUALITY OF STREAMS NEAR CORVALLIS, OREGON

By Ron Jeffrey and Paul Willis

An Environmental Experiment

For Mr. Spletstoser's Chemistry Class

18 May 1972

Purpose of Experiment

The purpose of this experiment was to investigate the water quality of various streams in the Corvallis area. During the month of February, samples from three local streams were tested once a week for 1) pH, 2) phosphate content and 3) dissolved oxygen content. The air and water temperature was also taken at each site.

The results of each test are written up in three separate sections of the report. Then in the conclusion, we'll try to put together a general picture of each stream.

Keep in mind that these are only three water quality tests out of the many many that can be made. Also, we have but a month's worth of data. These facts put severe limitations on the validity of any sweeping conclusions we may make. We cannot make any all-inclusive statements such as- This water is polluted, or- This creek is clean and pure. Too many factors enter into such relative statements for us to make any such claims.

The Streams

The three streams that we tested are Jackson Creek, Dixon Creek and Mary's River. All three are tributaries of the Willamette River.

Jackson Creek originates in MacDonald forest and then flows through Crescent Valley. We obtained samples from the creek in MacDBnald forest before it runs past any houses or pastures. Here it is a clear forest stream, relatively untouched by man.

Dixon Creek has its sources in the cow pastures of IV Hill north of Corvallis. Like Jackson Creek it is a runoff stream, a rushing torrent during the winter rains and a trickle in the dry summer. We sampled the stream by the Toa Yen Restaurant on 9th Street. At this point the stream has run about two miles through a residential area. Its trashy appearance lives up to its nickname of Crud Creek.

The Mary's River comprises the eastern watershed of Mary's Peak, the highest point of the Oregon Coast Range. After flowing for miles through the mountain woods, it squiggles like a snake for five miles across valley farmlands before meeting the Willamette. We took our sample at Avery Park, about a half mile from the mouth. Here the water is brown and sluggish and park signs read: "Warning - polluted water."

pH Test

The term pH is correctly defined as the negative logarithm of the hydrogen ion concentration.

In our experiment we tested the water with a pH indicator solution that reacted with the water immediately to show the alkalinity, acidity or neutrality of the water.

Jackson Creek Water Quality Data

Date 1972	Air Temp.- Water Temp. (°C) uncertainty ± 0.2		pH Value nearest ½	Phospate (PO_4) Concentration in ppm.	Dissolved Oxygen Content in ppm. uncertainty ± .04
6 Feb.	10.2	7.0	7½	Less than 0.2	10.88
13 Feb.	8.0	7.4	7½	" " "	9.92
20 Feb.	8.8	7.6	8	" " "	11.16
27 Feb.	13.2	8.8	7½	" " "	9.84
3 Mar.	13.0	8.8	7½	" " "	———

Dixon Creek Water Quality Data

Date 1972	Air Temp.- Water Temp. (^{o}C) uncertainty ± 0.2		pH Value nearest ½	Phosphate (PO_4) Concentration in ppm.	Dissolved Oxygen Content in ppm. uncertainty ± .04
28 Jan.	1.6	2.6	---	-------	10.40
6 Feb.	10.4	6.2	7½	Less than 0.2	10.96
13 Feb.	8.4	8.6	7¼	" " "	9.56
20 Feb.	14.6	9.0	7½	Trace of color	10.92
27 Feb.	15.0	10.8	6½	" " "	9.32
3 Mar.	15.0	10.8	7	Less than 0.2	-----

Marys River Water Quality Data

Date 1972	Air Temp.- Water Temp. (°C) uncertainty ± C.2		pH Value nearest ½	Phosphate (PO_4) Concentration in ppm.	Dissolved Oxygen Content in ppm. uncertainty ± .04
6 Feb.	9.0	5.6	7	Less than 0.2	11.16
13 Feb.	8.8	7.0	7	" " "	9.56
20 Feb.	12.4	8.8	7	" " "	9.52
27 Feb.	15.0	9.4	6½	Trace of color	11.20
3 Mar.	14.2	9.4	6½	" " "	———

The indicator solution is a mixture of Phenol Phthalein, Bromthymol Blue, Methyl Red and Dinitrophenol. These organic dyes exhibit color change at various pH levels.

We were then able to determine the pH value of the sample by inserting the test tube with the reacted solution into a comparator unit. The comparator unit has color standards of known values of pH, so pH value of the water was made by comparing the sample with established values.

From our data there is no rash conclusion that can be made about the streams we tested. It was noticeable however that the pH does not fluxuate a considerable amount, but stayed near neutral. The graph does a good job in protraying this on the next page.

The graph does show that Jackson Creek had a consistently higher pH than Dixon Creek, and that Dixon Creek was always above Mary's River. These trends may be significant, but we aren't sure how they can be explained.

Phosphorus Test

Phosphorus is a nutrient important to the growth of aquatic plants. It is generally not more than 0.1 ppm. unless the water has been polluted. The main source of phosphate pollution is from agricultural areas where the runoff contains a excessive amount of fertilizer.

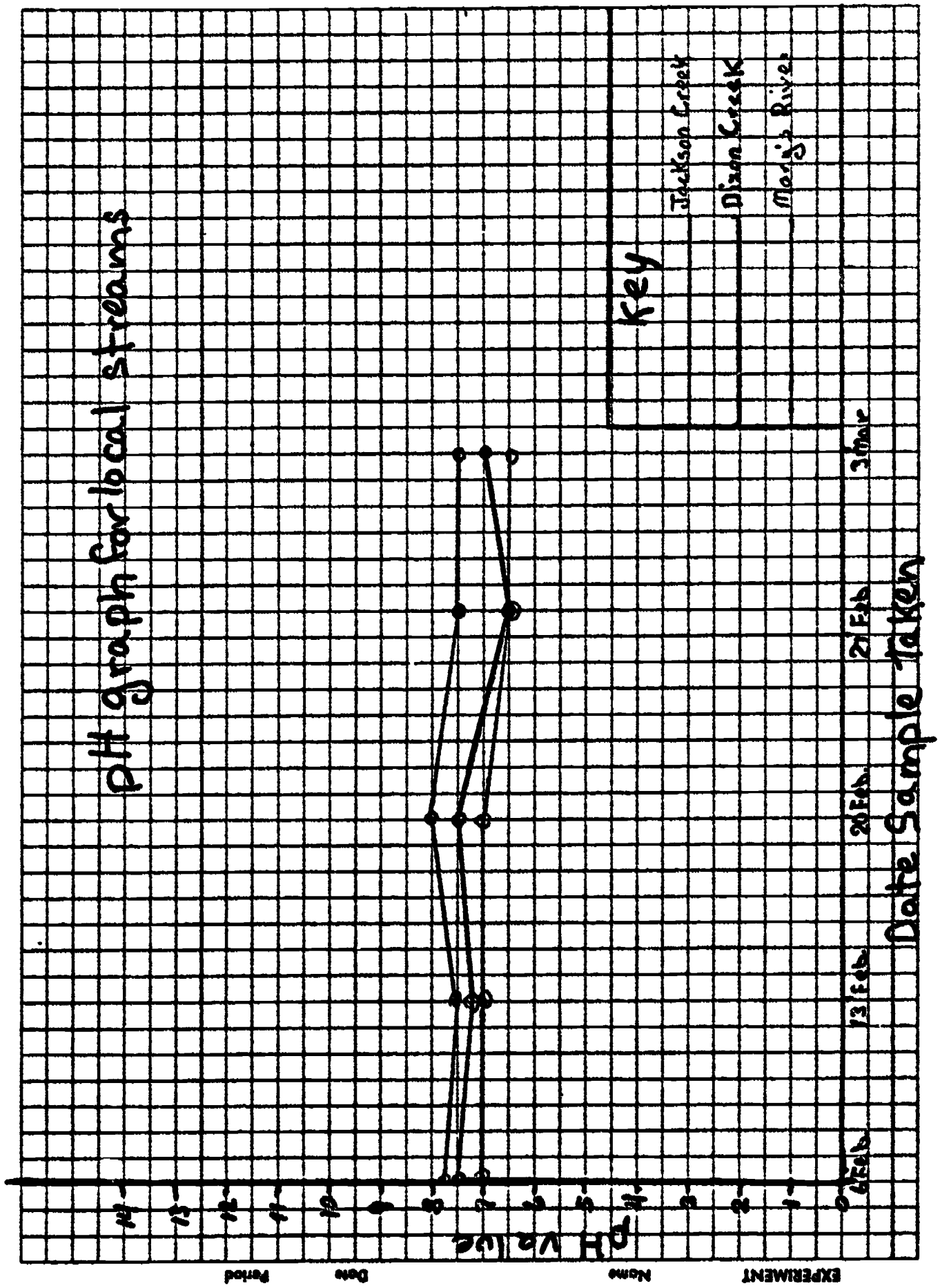
When phosphorus is present in excessive concentration a process called eutrophication takes place: an increase in growth of algae and other aquatic plants. When the algae and aquatic plants die, oxygen is used in their decomposition and the dissolved oxygen content in the stream is reduced. Fish cannot survive when too much oxygen is thus robbed from the water.

In our tests we used a water analysis kit which uses two chemicals to determine the phosphate content in ppm.

The first chemical, 1 ml of VM phosphate reagent (Ammonium Vanadate Molybdate in sulfuric acid solution) is added to 5 ml of the water to be tested and allowed to react for 5 minutes. In this reaction the inorganic phosphate reacts with the molybdate to form a phosphomolybdate compound.

The second chemical, three drops VM reducing reagent (stannous chloride in glycerin) is then added. This reduces the phosphomolybdate to form a blue color. The intensity of the color is used to determine the amount of inorganic phosphourus present in the sample. The test tube with the sample in it is inserted into a comparator unit with color standards of known values. The unit that we used ranged from .2 ppm. to 10 ppm.

Our results showed that Jackson Creek phosphate level was much less than 0.2 ppm. during the course of the experiment. However both Mary's River and Dixon Creek twice showed a trace of color which indicated a higher concentration of phosphorus than normal even though the level of 0.2 ppm. was not reached.



Dixon Creek flows through a residential area and contains the runoff water from many yards and gardens. If a large amount of fertilizer is used on these areas, some of it will runoff into the creek. This is one possible reason for the phosphate level in Dixon Creek.

You could account for the high level of phosphorus in Mary's River in the same way. Mary's River runs through a farm district and thus gets farmland runoff where large amounts of fertilizer is used. Again this is a possible conclusion that could be made for the high level of phosphorus.

Jackson Creek showed no signs of a higher than normal level of phosphorus at the location tested. This leads to the conclusion that an excessive amount of phosphorus is not being drained into the creek.

The data we obtained from this test indicated that the level of phosphates did not reach a dangerous level in the month of February.

Dissolved Oxygen

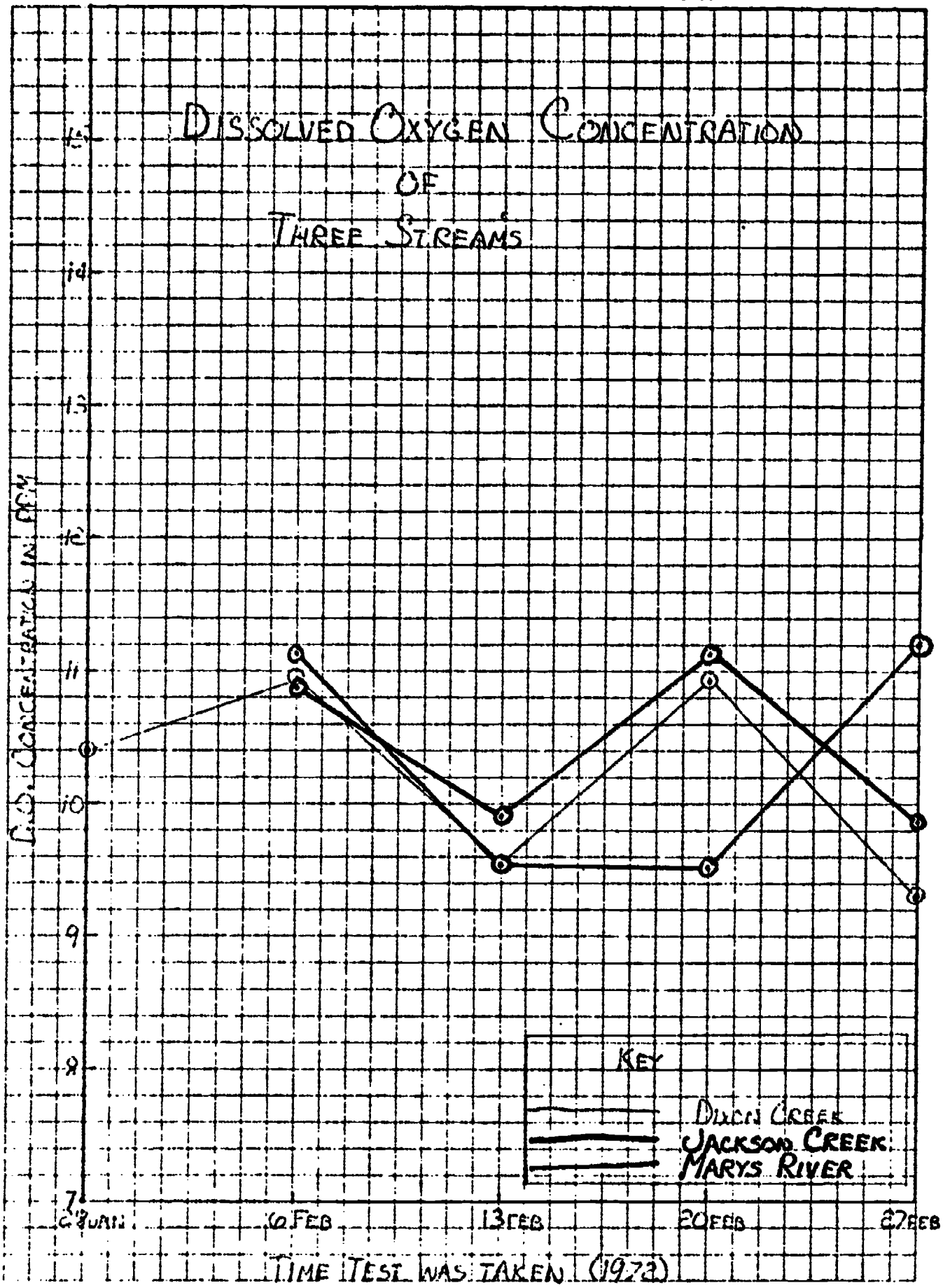
The dissolved oxygen test was more complicated than the pH or phosphate tests. First of all, 8 drops of Manganese Sulfate Solution and 8 drops of Alkaline Potassium Iodide Solution are added to the water sample. This forms a manganese hydroxide precipitate. Then 0.5 ml of Sulfuric Acid are mixed in to dissolve the precipitate. The sulfuric acid reaction frees iodine in proportion to the amount of oxygen in the water sample. The solution is then titrated with Sodium Thiosulfate solution, gradually washing out the brown-yellow color of the sample. When the solution is almost clear, starch is added to turn it a dark blue. Titration continues until the color goes from blue to colorless. Simple calculations, based on the amount of Sodium Thiosulfate used up, give the Dissolved Oxygen content of the solution.

The dissolved oxygen content is measured in ppm (parts per million). In Northwest waters, the D.O. content ranges between 7 and 15 ppm. Fish do not survive if the D.O. goes below 5 ppm. In a sluggish and warm river, the D.O. will probably be low. In a fast, bubbling, cold stream the D.O. is apt to be high.

In February, the streams we tested were cold, ranging from 2-10°C. They were also swift and churning, bubbling the oxygen of the air into the water. In fact, the Mary's River was almost at flood stage. These two facts account for the consistently high D.O. content which we measured.

The graph shows the D.O. to be generally between 9 and 11 ppm. for the entire month. We're not sure that the fluctuations in the graph are significant, because as far as water temperature goes, a rise in temperature was not always matched by a fall in D.O. content. However, it's interesting to see that the graphs of Jackson and Dixon Creek parallel each other while the Mary's River goes its own way. Does this have anything to do with the fact that 'Dixie' and Jackson are small creeks while the Mary's is a river? We can't say. We can say that there was sufficient oxygen in these streams during our testing period for fish to survive comfortably.

EXPERIMENT Name Date Period



Air and Water Temperatures

The temperature of the water was taken to go along with the D.O. testing. The air temperature was taken in each case just to see how it compared with the water temperatures. With a few exceptions, the air was always warmer, sometimes by as much as 5°C, or by as little as 0.2°C. On the average, the water was about 3°C colder than the air. The air and water at Jackson Creek was consistently colder than at the other two streams. This is probably because Jackson Creek was in a forested ravine, shaded from the warmth of the sun.

A Final Picture

From our data, we discovered these things about the three streams for the month of February:

Jackson Creek is slightly alkaline. Where it had not yet run through any developed areas, it contained no measurable amount of phosphates. The creek's water was fairly cold, and contained sufficient D.O. to sustain fish life.

Dixon Creek has a fairly neutral pH. It showed trace measurements of phosphates, but not at a dangerous level. The creek also had plenty of D.O. as far as fish are concerned.

The Mary's River is neutral to slightly acidic in nature. It too had some amount of phosphates, but not at a dangerous concentration. The river had plenty of D.O. for fish to use.

Construction of an Electrostatic Precipitator

by Galen Brown and Rudy Hooven

The electrostatic precipitator is a device used to remove liquid droplets or solid particles from gases. The process involves two steps.

1) The suspension passes through corona discharge (between high potential plates or wires) where the gas ionizes. The gas ions collide with the suspended particles and give them an electric charge.
2) The particles then drift toward an electrode of opposite charge.

Liquid droplets will condense on the sides and can be drained away at the bottom. Solid particles migrate to the sides and can be shaken off by mechanical vibrators or scraped off into a funnel at the bottom.

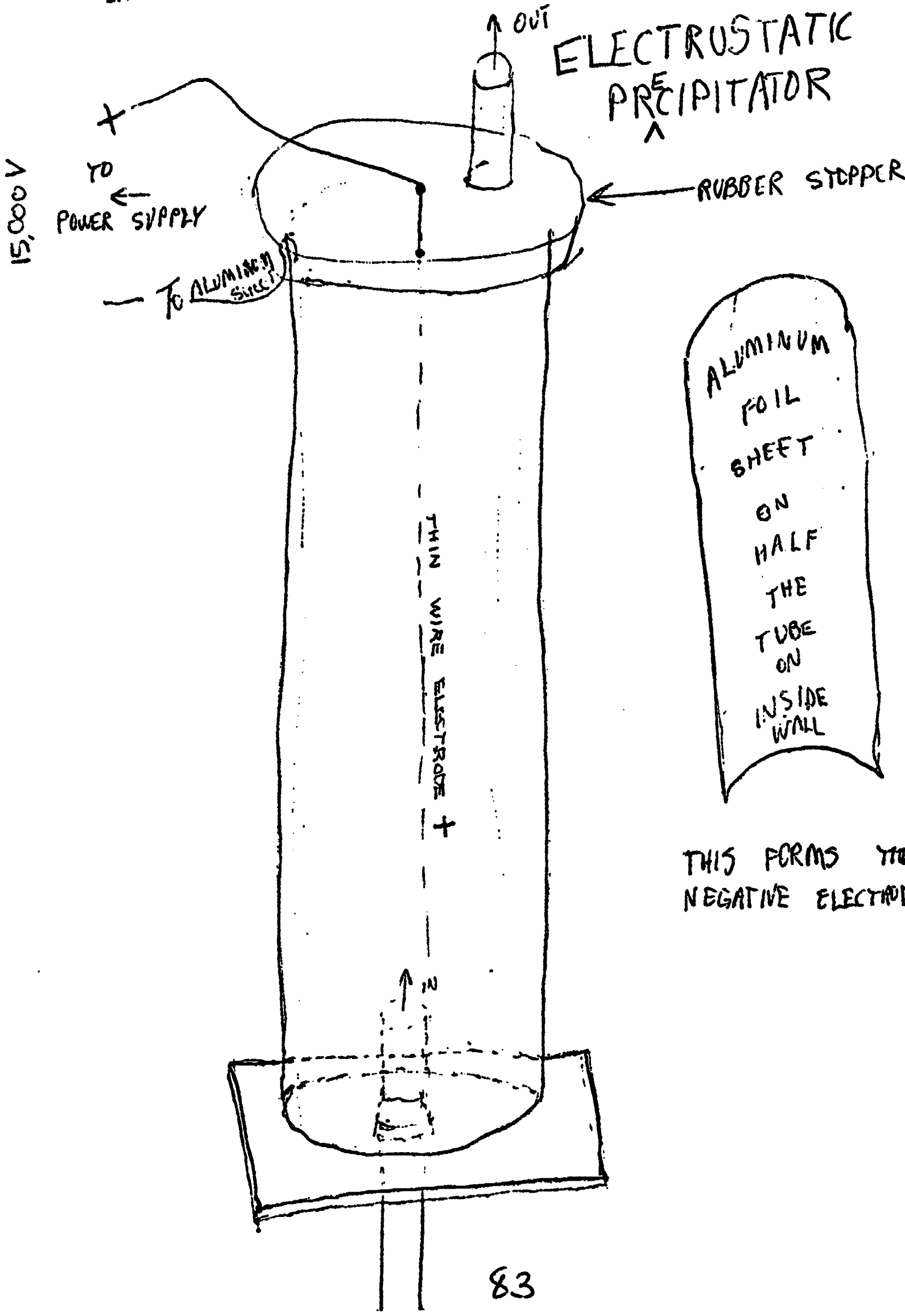
Advantages of the electrostatic precipitator are its abilities to handle large volumes of gases even at high temperatures with low pressure drops.

Environmental applications are:

1) Removal of dirt from flue gases in steam plants.
2) Cleaning of air to remove fungi and bacteria in pharmaceutical factories and operating rooms.
3) Cleaning of air in ventilation systems (air conditioning).
4) Removal of oil mists from machine shops and acid mists from chemical plants.
5) Cleaning of blast furnace gases.
6) Recovery of valuable materials such as oxides of Cu, Pb, Sn and As in factory stacks.
7) Separation of rutile from zirconium sand.

(See Editor's Note at beginning of unit for bibliographic information on this project.)

ELECTRUSTATIC PRECIPITATOR



THIS FORMS THE NEGATIVE ELECTRODE