Presented in this teacher's guide for grades 7-12 are lessons plans and ideas for integrating industrial arts (power mechanics, graphic arts, plastics, and electricity/electronics) and environmental education. Each lesson originates with a fundamental concept pertaining to the environment and states, in addition, its discipline area, subject area, and problem orientation. Following this, behavioral objectives and suggested learning experiences are outlined. Behavioral objectives include cognitive and affective objectives and skills to be learned, while learning experiences list student-centered in-class activities and outside resource and community activities. Space is provided for teachers to note resource and reference materials-publications, audio-visual aids, and community resources. The guides are supplementary in nature and the lessons or episodes are designed to be placed in existing course content at appropriate times. This work was prepared under an ESEA Title III contract for Project I-C-E (Instruction-Curriculum-Environment). (BL)
A SUPPLEMENTARY PROGRAM FOR ENVIRONMENTAL EDUCATION

DISCIPLINE AREA Industrial Arts GRADE 9-12

1. Power Mechanics
2. Graphic Arts
3. Plastics
4. Electricity - Electronics

Produced under Title III E.S.E.A.
PROJECT I-C-E
Serving Schools in CESA's 3-8-9
1927 Main Street
Green Bay, Wisconsin 54301
(414) 432-4338
(after Dec. 1, 1972 - 468-7464)
ENVIRONMENTAL EDUCATION

Arts, GRADE 9-12

- Mechanics
- Graphic Arts
- Photography - Electronics

3-8-9

Robert Warpinski, Director
Robert Kellner, Asst. Director
George Howlett, EE Specialist
"Oikus" is the Greek origin of the term "to study our house--whatever or wherever it may be. Like expand or contract to fit many ranges--natural and man-environments, our many "houses" if we omit rancor and complexities. Our "oikus" uses the insights of all sub-multidisciplinary program like ours necessarily results a long time, our program ranges K thru 12. The environ values. These values have their origin in the "oikus" minds. Let us become masters of our house by replacing with "Know thyself and thine house."

1. Written and designed by your fellow teachers, this guide to fit appropriately into existing, logical course c
2. Each page or episode offers suggestions. Knowing yo to adapt or adopt. Limitless chances are here for y Many episodes are self contained, some open-minded, developed over a few days.
3. Try these episodes, but please pre-plan. Why? Simpl and no curriculum will work unless viewed in the con
4. React to this guide with scratch ideas and notes on 5. After using an episode, fill out the attached evalua duplicate, or request more of these forms: Send the We sincerely want your reactions or suggestions--neg evaluations are the key in telling us "what works" a

----------------
TERMS AND ABBREVIATIONS

ICE RMC is Project ICE Resource Materials Center serv school districts in CESA 3, 8, and 9. Check the Projec resources. Our address and phone number is on this gu or call us for any materials or help.

BAVI is Bureau of Audio Visual Instruction, 1327 Univ Madison, Wisconsin 53701 (Phone: 608-262-1644). Cognitive means a measurable mental skill, ability, or Affective refers to student attitudes, values, and fe
As the Greek origin of the term "ecology". Environmental education whatever or wherever it may be. Like an umbrella, our house can fit many ranges—natural and man-made. We can add quality to our "houses" if we omit rancor and cite long range gains, costs, and likus" uses the insights of all subjects. Thus, a rational, positive, gram like ours necessarily results. Also, since attitudes grow over our ranges K thru 12. The environment mirrors our attitudes or have their origin in the "oikus" of our collective and individual masters of our house by replacing the Greek adage of "Know thyself" with thine house.

ed by your fellow teachers, this guide is supplementary in nature--into existing, logical course content.

de offers suggestions. Knowing your students best, you decide what Limitless chances are here for your experimentation and usage. self contained, some open-minded, still others can be changed or few days.

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ONS

ICE Resource Materials Center serving all public and non-public
ESA 3, 8, and 9. Check the Project ICE Bibliography of available pieces and phone number is on this guide's cover. Feel free to write materials or help. Audio Visual Instruction, 1327 University Avenue, P. O. Box 2093, 701 (Phone: 608-262-1644).

 measurable mental skill, ability, or process based on factual data. student attitudes, values, and feelings.
ACKNOWLEDGEMENTS: The following teachers and consultants participated in the development of the Supplementary Environmental Education Materials:

**CESA #3**
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- R. A. Dirks, Gillett
- Dennis Dobrzenski, White Lake
- LeRoy Gerl, Oconto
- Karen Grunwald, St. James (L)
- William Harper, Lena
- Sister Claudette, St. Charles
- Ervin Kunesh, Marinette
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- P. E. Lewicki, Gillett
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- James Huss, Freedom
- Sister Lois Jonet, Holy Angels
- Kenneth Kappel, St. Aloysius
- Kenneth Keliher, Appleton
- Everett Klinzing, New London
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- Jim Krueger, Winneconne
- Mae Rose LaPointe, St. John
- Rosemarie Lauer, Hortonville
- Robert Lee, Neenah
- Harold Lindhorst, St. Martin (L)
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- Robert Meyer, Neenah
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- Connie Peterson, St. Martin (L)
- Rosemary Rafath, Clintonville
- Mark Reddel, St. Martin (L)
- Gladys Roland, Little Wolf
- Kathryn Rowe, Appleton
- Mary Margaret Sauer, Menasha
- Edwin Schaefer, Kaukauna
- Lee Smoll, Little Chute
- Doris Stehr, Mt. Calvary (L)
- Ginger Stuvetraa, Oshkosh
- Richard Switzer, Little Chute
- Tim Van Susteren, Holy Name
- Lila Wertsch, St. Margaret Mary
- Warren Wolf, Kimberly
- Gery Farrell, Menasha
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- Linda Hess, Freedom
- Sister Lois Jonet, Holy Angels
- Matthew Kappell, St. Aloysius
- Matthew Kelly, Appleton
- DeEtta Klinzing, New London
- David Krueger, Oshkosh
- Patricia Krueger, Winneconne
- Rose LaPointe, St. John High School
- Marie Lauer, Hortonville
- Mary Lee, Neenah
- Mildred Lindhorst, St. Martin (L)
- Ms. Lord, Little Wolf
- Art Meyer, Neenah
- Beld Neuzil, Shiocton
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- Jane Peterson, St. Martin (L)
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- Carol Reddel, St. Martin (L)
- Yvonne Roland, Little Wolf
- Cheryl Rowe, Appleton
- Margaret Sauer, Menasha
- Inge Schaefer, Kaukauna
- Smoll, Little Chute
- Mrs. Steh, Mt. Calvary (L)
- Ger Stuvetraa, Oshkosh
- Earnest Switzer, Little Chute
- Van Susteren, Holy Name
- Mary Wertsch, St. Margaret Mary
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- Mike Gleave, St. Matthews
- Herbert Hardt, Gibraltar
- Gary Heil, Denmark
- Nannette Hoppe, How.-Suam.
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- William Roberts, Sturgeon Bay
- Roger Roznowski, Southern Door
- Jan Serrahn, Sevastopol
- Calvin Siegrist, How.-Suam.
- Mary Smith, Green Bay
- Carol Trimberger, Kewaunee
- Mary Wadzinski, How.-Suam.
1. Energy from the sun, the basic source of all energy, is converted through plant photosynthesis into a form all living things can use for life processes.

BEHAVIORAL OBJECTIVES

Cognitive: The student will be able to write a short paragraph briefly explaining the relationship of sun energy to fuel sources.

Affective: The student will gain an appreciation for the role of the sun in raw fuel production.

Skills to be Learned
1. How fuels are formed.
2. How fuels are refined.
3. How fuels are used.

II. Student-Centered activity

A. Thru class develop a list of combustible fuels
   1. Oil
      a. Gas
      b. Fuel
      c. Kerosene
      d. Tar
   2. Coal
      a. Gas
      b. Coke
   3. Natural gas
   4. Wood
      a. Turpentine
      b. Wood

B. How was/is responsible for "fuels"?

C. How is sunlight released from plant release?
   1. Burn some in a pan.

D. Films "Refining the Sun"
**Discipline Area**  Industrial Arts

**Subject**  Power Mechanics

**Problem Orientation**  Fuel Sources & The Sun

<table>
<thead>
<tr>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>II. Student-Centered in class</strong> activity</td>
</tr>
<tr>
<td>A. Thru class discussion develop a list of combustible fuel sources.</td>
</tr>
<tr>
<td>1. Oil</td>
</tr>
<tr>
<td>a. Gasoline</td>
</tr>
<tr>
<td>b. Fuel oil</td>
</tr>
<tr>
<td>c. Kerosene</td>
</tr>
<tr>
<td>d. Tar.</td>
</tr>
<tr>
<td>2. Coal</td>
</tr>
<tr>
<td>a. Gas</td>
</tr>
<tr>
<td>b. Coke</td>
</tr>
<tr>
<td>3. Natural gas</td>
</tr>
<tr>
<td>4. Wood</td>
</tr>
<tr>
<td>a. Turpentine</td>
</tr>
<tr>
<td>b. Wood alcohol</td>
</tr>
<tr>
<td>B. How was/is sun energy responsible for these &quot;fuels&quot;?</td>
</tr>
<tr>
<td>C. How is sun energy released from fuel?</td>
</tr>
<tr>
<td>1. Burn some fuel oil in a pan to demonstrate release.</td>
</tr>
<tr>
<td>D. Films &quot;Refinery at Work&quot; &quot;Story of Gasoline&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. Outside Resource and Community Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Field trip to refinery.</td>
</tr>
<tr>
<td>2. Representative from petroleum industry.</td>
</tr>
</tbody>
</table>
Resource and Reference Materials

Publications:
Auto Mechanics Fundamentals,
Martin W. Stockel
Goodheart-Willcox

Audio-Visual:
Refinery at Work, Shell film library
Story of Gasoline
U. S. Bureau of Mines
#52385 Conserving Our Natural Resources, Univ. of Ill.
#00864 Treasures of The Earth, University of Ill., Champaign,

Community:
1. Representative from petroleum industry.
2. Fuel Oil Dealer.
3. Combustion engineer.

Continued and Additional Suggestions:
1. Develop collection of "fuel refined"
2. Develop bulletin board of "fuel refined"
3. Develop bulletin board of "fuel refined"
Continued and Additional Suggested Learning Experiences

1. Develop collection of "fuels" both raw & refined.
2. Develop bulletin board of fuel cycle (sun-raw-refined)
3. Develop bulletin board of a refinery process.
All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem._

Discipline Subject:

Problem Oriented unit called an ecosystem.

Behavioral Objectives:

I. Students-centered in content.

Skills to be learned:

1. Principles of internal combustion.
2. Systems analysis of basic systems of internal combustion.
3. Basic systems of internal combustion.
4. Exhaust systems necessary to human existence.
5. Electrical systems necessary to human existence.
6. Fuel systems necessary to human existence.

Cognitive: The student will name and compare in writing the four basic systems of an internal combustion engine and the effects produced if one or more systems fail to function properly.

1. What is the interaction between the four basic systems of an internal combustion engine and the effects? Discuss function & importance of gauge (compare in today's engine and living.)
2. Develop flow charts of basic systems.
3. Fuel systems necessary to human existence.
4. Exhaust systems necessary to human existence.
5. Electrical systems necessary to human existence.

Elective activity:

A. Film on internal combustion.
B. Transparency series on basic combustion.
C. Discuss function & importance of gauge.
D. Develop flow charts of basic systems.
E. Compare function & importance of gauge (compare in today's engine and living.)

Skills to be learned:

1. Principles of internal combustion.
2. Systems analysis of basic systems of internal combustion.
3. Basic systems of internal combustion.
4. Exhaust systems necessary to human existence.
5. Electrical systems necessary to human existence.
6. Fuel systems necessary to human existence.
Organisms interact

and their

an intricate

ystem.

Discipline Area: Industrial Arts

Subject: Power Mechanics

Problem Orientation: Internal Combustion vs. External Existence

<table>
<thead>
<tr>
<th>I. Student-Centered in class activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Film on internal combustion.</td>
</tr>
<tr>
<td>B. Transparency series &amp; discussion of basic internal combustion systems</td>
</tr>
<tr>
<td>1. Fuel</td>
</tr>
<tr>
<td>2. Electrical</td>
</tr>
<tr>
<td>3. Cooling</td>
</tr>
<tr>
<td>4. Exhaust</td>
</tr>
<tr>
<td>C. Discuss function &amp; importance of gauges or performance indicators.</td>
</tr>
<tr>
<td>D. Develop flow chart on what results if one of these systems or gauges fails to function properly.</td>
</tr>
<tr>
<td>E. Compare basic systems &amp; their functions to people living in today's world. (Compares to) egs.</td>
</tr>
<tr>
<td>1. Engine--Living in general.</td>
</tr>
<tr>
<td>2. Fuel--Gas, oil, food, electricity.</td>
</tr>
<tr>
<td>3. Cooling--Air, water.</td>
</tr>
<tr>
<td>4. Exhause--Waste disposal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. Outside Resource and Community Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Sociologist</td>
</tr>
<tr>
<td>B. Have students find examples in community and determine basic integral systems and their functions.</td>
</tr>
</tbody>
</table>
Continued and Additional Suggestions:

5. Gauges--Communications
   (Cont'd from II.)
   - Have students find other interaction in the community and identify the basic functions.

Audio-Visual:
   Film--ABC's of Internal Combustion,
   Gen. Motors

Community:
   1. Sociologist
Continued and Additional Suggested Learning Experiences

(Con't from I.)

5. Gauges--Communications
(Con't from II.)

1. Have students find other examples of interaction in the community and have them identify the basic systems and define their functions.
3. Environmental factors are limiting on the numbers of organisms living within their influence, thus, each environment has a carrying capacity.

**BEHAVIORAL OBJECTIVES**

**Cognitive:** Students will orally, or in writing, list and illustrate at least three physical and three psychological effects of crowding.

**Affective:** The student will realize that crowding results in adverse physical and psychological effects.

**Skills to be Learned**

Hazards in environmental crowding.

**SUGGESTED ACTIVITY**

I. Student-Centered in activity

A. Conduct experiment in the following condition:

1. Develop simple students, in pairs
   will disassemble a single cylinder
   2. Provide only one of tools req'd.
   3. Limit work area one table.
   4. Limit time.
   5. First team finish

B. Discuss personal and feelings experienced experiment,

1. Low production
2. Confusion
3. Frustration
4. Irritability
5. Waste
6. Injury

C. What is the result of this happened in total

D. Relate experienced in concept #3.
factors are limiting

<table>
<thead>
<tr>
<th>Discipline Area</th>
<th>Industrial Arts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>Power Mechanics</td>
</tr>
<tr>
<td>Problem Orientation Crowding in the Grade 9-12 shop.</td>
<td></td>
</tr>
</tbody>
</table>

### Suggested Learning Experiences

<table>
<thead>
<tr>
<th>I. Student-Centered in class activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Conduct experiment around the following conditions:</td>
</tr>
<tr>
<td>1. Develop simple task i.e., students, in pairs, will disassemble a single cylinder engine.</td>
</tr>
<tr>
<td>2. Provide only one each of tools req'd.</td>
</tr>
<tr>
<td>3. Limit work area to one table.</td>
</tr>
<tr>
<td>4. Limit time.</td>
</tr>
<tr>
<td>5. First team finished wins.</td>
</tr>
<tr>
<td>B. Discuss personal and physical feelings experienced during experiment,</td>
</tr>
<tr>
<td>1. Low production</td>
</tr>
<tr>
<td>2. Confusion</td>
</tr>
<tr>
<td>3. Frustration</td>
</tr>
<tr>
<td>4. Irritability</td>
</tr>
<tr>
<td>5. Waste</td>
</tr>
<tr>
<td>6. Injury</td>
</tr>
<tr>
<td>C. What is the result if this happened in town.</td>
</tr>
<tr>
<td>D. Relate experienced results to concept #3.</td>
</tr>
</tbody>
</table>

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<thead>
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<th>II. Outside Resource and Community Activities</th>
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<tbody>
<tr>
<td>A. Psychologist.</td>
</tr>
<tr>
<td>B. Community planning committee.</td>
</tr>
<tr>
<td>C. Real estate developer.</td>
</tr>
</tbody>
</table>
Resource and Reference Materials

Continued and Additional Suggestions:

Publications:

Audio-Visual:
#53525 Man's Effect on the Environment, U. of Ill, Champaign

Community:
A. Psychologist or sociologist
B. Community planning committee
C. Real estate developer
Continued and Additional Suggested Learning Experiences
4. An adequate supply of clean air is essential because most organisms depend on oxygen, through respiration, to release the energy in their food.

<table>
<thead>
<tr>
<th>BEHAVIORAL OBJECTIVES</th>
<th>SUGGESTED LEARNING ACTIVITY</th>
</tr>
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<tbody>
<tr>
<td><strong>Cognitive:</strong> The student will be able to list 4 advantages &amp; 2 disadvantages of atomic energy as a means of producing electricity.</td>
<td><strong>I.</strong> Student-Centered in class activity</td>
</tr>
<tr>
<td><strong>Affective:</strong> The student will become aware of the possible detrimental effects of producing electricity by atomic means, as well as the advantages.</td>
<td><strong>A.</strong> Show films Atomic Power Production, How a Boiling Water Reactor Operates</td>
</tr>
<tr>
<td><strong>Skills to be Learned</strong></td>
<td><strong>B.</strong> Field trip to a nuclear power plant</td>
</tr>
<tr>
<td>Generation of atomic power.</td>
<td><strong>C.</strong> Presentation by rep. from local power company.</td>
</tr>
<tr>
<td><strong>Problem Orientation Water:</strong></td>
<td><strong>D.</strong> Read text units on Atomic Power Production.</td>
</tr>
<tr>
<td><strong>Subject:</strong> Power</td>
<td><strong>E.</strong> Debate in class the advantages &amp; disadvantages of Atomic Power Production.</td>
</tr>
<tr>
<td><strong>Discipline Area:</strong> Industrial</td>
<td><strong>F.</strong> The students will write a report on the effects on water used in the production of atomic power.</td>
</tr>
</tbody>
</table>
The supply of clean industrial materials is most dependent on oxygen, through which to release the energy.

**Discipline Area**: Industrial Arts  
**Subject**: Power Mechanics  
**Problem Orientation**: Water Use & Atomic Grade 9-12 Energy.

**OBJECTIVES**

<table>
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<td>1. Field trip to a nuclear power plant</td>
</tr>
<tr>
<td>2. Local power company rep.</td>
</tr>
</tbody>
</table>
Resource and Reference Materials

Publications:
Power Technology,
Geo. Stephenson,
Delman Publishing

Audio-Visual:
#6373 Atomic Power Production,
Bay 1
#1706 How a Boiling Water
Reactor Operates, HAVT

Community:
1. Local power company rep.

Continued and Additional Suggested Learning
1. Develop bulletin board on atomic energy
2. Develop a newspaper clipping file relating energy production (community involvement)
3. Have students measure & chart water temp at various distances from an atomic power plant to determine possible thermal pollution of

___
Continued and Additional Suggested Learning Experiences

1. Develop bulletin board on atomic energy production.
2. Develop a newspaper clipping file related to atomic energy production (community involvement).
3. Have students measure & chart water temperature at various distances from an atomic power plant to determine possible thermal pollution of the water.
An adequate supply of clean air is essential because most organisms depend on oxygen through respiration, to release the energy in their food, to breathe. Oxygen is obtained from the air we inhale through our lungs. Oxygen is a necessary component for the survival of most organisms, including humans. It is used in the process of respiration to convert food into energy. Without oxygen, the cells of the body cannot function properly, leading to various health issues and even death.

In biology, organisms obtain oxygen from the air and water by diffusing it across the respiratory surface. Respiratory rate and capacity are critical for maintaining adequate oxygen supply across the respiratory surface. The ability of an organism to effectively utilize oxygen is crucial for its survival and well-being.

**Behavioral Objectives**

1. Students list the procedures for engine tune-up.
2. Students list the advantages of low/no lead gasoline.
3. Students list the procedure for engine tune-up.
4. Students describe emission control devices.

**Suggested Learning Activities**

1. Visit a car dealership service department to observe emission control devices and the maintenance of vehicles.
2. Develop a service cart to maintain emission control devices.
3. Develop a display of emission control devices.
4. Debate the pros/cons of using low/no lead gasoline.
5. Round table discussion on emission control devices. Why do we need emission control devices? In summation, relate discussion to concept #5.

**Air Pollution**

- Problem Orientation
- Power A.
- Discipline Area
- C.
- Subject B.
- Depend on oxygen through respiration, to release the energy in their food.

**Cognitive Objectives**

1. Students list the procedures for engine tune-up.
2. The students describe emission control devices.
3. The students describe advantages of low/no lead gasoline.
The adequate supply of clean air is essential because most organisms release oxygen through respiration. Discipline Area: Industrial Arts

Subject: Power Mechanics

Problem Orientation: Air Pollution

Grade: 9-12

I. TOTAL OBJECTIVES

A. The students describe emission control devices and their maintenance.

B. The students list the pros and cons of using low/no lead gasoline.

C. The students develop a display of emission control devices.

D. The students debate the pros and cons of using low/no lead gasoline.

E. The students develop a service chart for emission control devices.

II. SUGGESTED LEARNING EXPERIENCES

A. Student-Centered in class activity:

1. Visit car dealership service dept. Talk on emission control devices.

2. Round table discussion "Why do we need emission control devices" (in summation relate discussion to concept of air pollution)

3. Develop a display of emission control devices.

4. Debate the pros/cons of using low/no lead gasoline.

B. Outside Resource and Community Activities:

1. Visit local dealership.

2. Oil Co. distributor.


C. Films for wrap-up:

1. Fair and Cars

2. The Answer is Clear

- The students list the main features of low/no lead gasoline.

- The students describe the importance of engine tune-up.

- The students learn about emission control devices and their effectiveness.

- The students gain an appreciation for environmentally friendly vehicles.

- The students have an appreciation for the importance of air pollution.
Resource and Reference Materials  Continued and Additional Suggested Leads

Publications:
Automotive Emission Control, 
Wm. H. Crouse, Gregg/McGraw-Hill
The Quest for Cleaner Air, 
Motor Service, Aug. 71
Principles & Promises of the 
Wankel, Road & Track Feb. 71
Feb. 71
Audio-Visual:
To Clean the Air, United World
Free Film Service, 221 Park Ave.
N.Y. N.Y. 10003
Toward Cleaner Air, Assoc.
Sterling Film, 866 3rd Ave.
New York, N.Y. 10022
Air Pollution & Cars
The Answer is Clear
GM Corp. Public relations staff
Film library at GM bldg.
Detroit, Mich. 48202
No Time To Waste
Modern Talking Picture Service
2523 New Hyde Park Rd.
Long Island, N.Y. 11040

Community:
1. Local service dept.
2. Oil Co. dist.
4. Big 3 rep.

1. Write a paper on the development of control devices.
2. Develop a graph showing % of air pollution.
3. Develop a graph of various types of pollutants comparing (1) efficiency (2) % poll. (3) economy.

4. Big 3 rep.
Continued and Additional Suggested Learning Experiences

1. Write a paper on the development of emission control devices.
2. Develop a graph showing % of air pollution by cars.
3. Develop a graph of various types of engines comparing (1) efficiency (2) % pollution (3) economy.
6. Natural resources are not equally distributed over the earth or over time and greatly affect the geographic conditions and quality of life.

**Behavioral Objectives**

**Cognitive:** The student will write a research paper on oil pipeline and their impact on the environment.

**Affective:** The student will understand problems involved in transporting crude oil.

**Skills to be Learned**

1. How crude oil is located.
2. Problems involved in transporting crude oil to refinery.
3. Community involvement.

**Suggested Learning Activity**

1. Student-Centered in class activity
   - Lecture by oil co.rep. dealing with how oil deposits are located
   - Round table discussion: How that the oil is discovered & the well brought in how do you get it to the refinery?
   - Truck
   - Boat
   - Pipe line
   - Railroad
   - Combination

2. What factors are considered in selecting a transportation system?
   - Cost
   - Environmental impact
   - Natural terrain
   - Distance
   - Profit margin

3. How do the above considerations affect the quality of life at:
   - Well site
   - Transportation route
   - Refinery site (Cont.)
Natural resources are not equally distributed over the earth or prime and greatly affect the ecological conditions and quality.

CRITICAL OBJECTIVES:
The student research oil pipe lines act on the student understand problems transporting

I. Student-Centered in class activity
   A. Lecture by oil co. rep. dealing with how oil deposits are located
   B. Round table discussion: Now that the oil is discovered & the well brought in how do you get it to the refinery?
       1. Truck
       2. Boat
       3. Pipe line
       4. Railroad
       5. Combination
   C. What factors are considered in selecting a transportation system?
       1. Cost
       2. Environmental impact
       3. Natural terrain
       4. Distance
       5. Profit margin
   D. How do the above considerations affect the quality of life at:
       1. Well site
       2. Transportation route
       3. Refinery site

II. Outside Resource and Community Activities
   A. Oil co. rep.
   B. D.N.R.
   C. Dept. of Interior

Discipline Area: Industrial Arts
Subject: Power Mechanics
Problem Orientation: Transportation of Grade 9-12 Crude Oil
Resource and Reference Materials

Publications:
Free literature from oil companies.

E. Debate pros & cons of the Trans-Alaska Pipeline using facts discovered by individuals (Have one group research pros others cons).

Audio Visual:

#52385 Conserving Our Natural Resources, University of Ill.

Community:

1. Oil company rep.
2. D.N.R.
3. Dept. of Interior
I. Develop map showing the following:
1. Well locations
2. Refinery locations
3. Route and mode of transportation
4. Severe environment impairment sites
   & description of cause of impairment.

E. Debate pros & cons of the Trans-Alaska Pipeline
   using facts discovered by individual research.
   (Have one group research pros, other group cons)
7. Factors such as facilitating transportation, economic conditions, Discipline Area Industry, population growth, and increased Subject Power Problem Orientation Effect on changes in land use and centers Recreation. Recreational vehicles have a great influence of population density.

**BEHAVIORAL OBJECTIVES**

| Cognitive: The student will list 5 ways in which leisure vehicles, while contributing to our economy, are changing or damaging the environment, and changing our way of life. |
| Affective: The student will be aware of effects recreational vehicles are having on his surroundings, and realize its long-term effects. |

Skills to be Learned

1. Research.
2. Harmful results of leisure vehicle operation.

**SUGGESTED LEARNING EXPERIENCES**

I. Student-Centered in class activity

A. Develop (through discussion) a list of factors which have contributed to the development of the popularity of recreational vehicles.
1. Snowmobiles
2. Boats
3. All terrain vehicles

B. Brainstorm list of detrimental effects to water, land, and air quality as a result of these vehicles.
1. Pollution of water.
2. Pollution of Air.
3. Compacting of land.

C. Have students project (via small group conference & discussion) long-range effects of use of recreational vehicles.

D. Discuss movement of people to "recreational areas" for usage of leisure time.
### Objectives

The student learns to:

- **Student-Centered in class activity**
  
  A. Develop (through discussion) a list of factors which have contributed to the development & popularity of recreational vehicles.
  
  1. Snowmobiles
  
  2. Boats
  
  3. All terrain vehicles

  B. Brainstorm list of detrimental effects to water, land, & air quality as a result of these vehicles.
  
  1. Pollution of water.
  
  2. Pollution of Air.
  
  3. Compacting of land.

  C. Have students project (via small group conference & discussion) long-range effects of use of recreational vehicles.

  D. Discuss movement of people to "recreational areas" for usage of leisure time.

### Suggested Learning Experiences

- **Outside Resource and Community Activities**
  
  A. Conduct traffic surveys during different times of the year, counting number of vehicle's towing recreational vehicles, and comparing to total number of vehicles.

  B. Observe areas receiving heavy snowmobile traffic before & after the snowmobiling season. Compare growth of grass on trail & adjacent to it.

  C. Chamber of Commerce representative to point out major geographic recreation areas.
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggested Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
<td>1. Create map showing geographical location of major recreational areas and their type of recreational activity.</td>
</tr>
<tr>
<td></td>
<td>2. Draw charts or graphs to illustrate results of traffic survey (Community Activity)</td>
</tr>
<tr>
<td></td>
<td>3. Keep perpetual survey of geographic area use of students in class. This can also be used as a local recreation study.</td>
</tr>
<tr>
<td><strong>Audio-Visual:</strong></td>
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<tr>
<td>Maps, Charts, or Graphs</td>
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<tr>
<td>developed by students from traffic survey.</td>
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<tr>
<td><strong>Community:</strong></td>
<td></td>
</tr>
<tr>
<td>Chamber of Commerce rep.</td>
<td></td>
</tr>
</tbody>
</table>
1. Create map showing geographical locations of major recreational areas and their main type of recreational activity.
2. Draw charts or graphs to illustrate results of traffic survey (Community Activity A)
3. Keep perpetual survey of geographic recreational area use of students in class. This will not only be of benefit in meeting objectives, but can also be used as a local recreational guide.
8. Cultural, economic, social, and political factors determine the status of man's values and attitudes toward his environment.

**BehavIIral Objectives**

<table>
<thead>
<tr>
<th>Skills to be Learned</th>
<th>Suggested Learning Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>The operation of anti-pollution devices on internal combustion engines.</td>
<td>I. Student-Centered in class activity</td>
</tr>
<tr>
<td>Cost analysis</td>
<td>A. Students will study anti-pollution devices for internal combustion engines.</td>
</tr>
<tr>
<td>Data gathering</td>
<td>B. Students will develop a list of social and political factors which lead to the required use of these devices.</td>
</tr>
<tr>
<td>Data analysis</td>
<td>C. Students will figure economic factors which have resulted from the required use of these devices.</td>
</tr>
</tbody>
</table>

**Cognitive:**
- The student will be able to list anti-pollution devices required on internal combustion engines. The student will be able to list the cultural, social, political, and economic factors which these devices have caused.

**Affective:**
- The student will understand the factors which lead to the requirement of anti-pollution devices and the results of their use.

**Discipline Area:** Industrial Arts

**Subject:** Power Mechanics

**Problem Orientation:** Pollution Devices
Discipline Area: Industrial Arts
Subject: Power Mechanics
Problem Orientation: Pollution Control
Grade: 9-12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
   A. Students will study anti-pollution devices for internal combustion engines.
   B. Students will develop a list of social and political factors which lead to the required use of these devices.
   C. Students will figure economic factors which have resulted from the required use of these devices.
   D. Student will list cultural factors produced by the required use of these devices.

II. Outside Resource and Community Activities
    Rep. from auto manufacturer.
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggested Learning Experiences</th>
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<tbody>
<tr>
<td><strong>Publication:</strong></td>
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<td>National newspapers.</td>
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<tr>
<td>Auto Mechanics Fundamentals,</td>
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<td>Martin W. Stockel</td>
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<tr>
<td>Goodheat-Willcox</td>
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<tr>
<td>Power Technology</td>
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<tr>
<td>George E. Stephenson</td>
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<tr>
<td>Delmar Publishing</td>
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<tr>
<td><strong>Audio-Visual:</strong></td>
<td></td>
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<tr>
<td>Charts from auto manufacturers.</td>
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</tbody>
</table>

**Community:**
- Rep. from auto manufacturer.
Continued and Additional Suggested Learning Experiences
9. Man has the ability to manage, manipulate, and change his environment.

**Discipline Area** Industrial Arts

**Subject** Power Mechanic

**Problem Orientation** Engine Tuning

<table>
<thead>
<tr>
<th>BEHAVIORAL OBJECTIVES</th>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive: The student will be able to tune-up an engine to reduce exhaust emission and increase engine efficiency.</td>
<td>I. Student-Centered in class activity</td>
</tr>
<tr>
<td>Affective: The student will realize the difference proper adjustment makes in exhaust emission, both the pollution and economic standpoint.</td>
<td>II. Outside activity</td>
</tr>
<tr>
<td>Skills to be Learned</td>
<td>A. Discuss increased uses of small engines in recent years.</td>
</tr>
<tr>
<td>A. Carburetor adjustment.</td>
<td>1. Develop a list of ways in which small engines are changing our environment.</td>
</tr>
<tr>
<td>B. Checking and adjusting ignition system.</td>
<td>2. Using an exhaust analyzer, test emission from a badly tuned engine.</td>
</tr>
<tr>
<td>1. Plugs.</td>
<td>3. Tune-up same engine and retest for exhaust emission.</td>
</tr>
<tr>
<td>I. Student-Centered in class activity</td>
<td>II. Outside Resource and Community Activities</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>A. Discuss increased uses of small engines in recent years.</td>
<td>A. Rep. from a small engine manufacturer.</td>
</tr>
<tr>
<td>1. Develop a list of ways in which small engines are changing our environment.</td>
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<tr>
<td>2. Using an exhaust analyzer, test emission from a badly tuned engine.</td>
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<tr>
<td>3. Tune-up same engine and retest for exhaust emission.</td>
<td></td>
</tr>
</tbody>
</table>
Resource and Reference Materials

Continued and Additional Suggested Learning

Publications:
Power Technology,
George E. Stephenson
Delmar Publishers
Small Gas Engines,
Jud Purvis
Goodheart-Willcox

Audio-Visual:
Spark In Time On The
Firing Line, University of
Ill., Champaign, Ill.

Community:
Rep. from small engine manu.
Continued and Additional Suggested Learning Experiences
10. Short-term economic gains may produce long-term environmental losses.

**BEHAVIORAL OBJECTIVES**

<table>
<thead>
<tr>
<th>Cognitive: The student will list 3 improper oil disposal methods &amp; write a brief description of possible long-term environmental losses related to disposal.</th>
<th>Affective: The student will realize that improper disposal of waste oil may cause long-term environmental losses.</th>
</tr>
</thead>
</table>

**Skills to be Learned**

1. Environmental losses as it relates to waste oil disposal.
2. The proper handling of waste oil.
3. Oil changing procedure.

**SUGGESTED LEARNING EXPERIENCE**

<table>
<thead>
<tr>
<th>I. Student-Centered in class activity</th>
<th>II. Out activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Students will survey local garages to find out how they dispose of waste oil &amp; why they use the method they do. Assign garages so owners are not assaulted by the whole class.</td>
<td></td>
</tr>
<tr>
<td>B. Individually report on disposal method discovered</td>
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<tr>
<td>1. Dump in sewer</td>
<td></td>
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<tr>
<td>a. Storm</td>
<td></td>
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<tr>
<td>b. Sanitary</td>
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<tr>
<td>2. Burn</td>
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<tr>
<td>3. Dump on land</td>
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<tr>
<td>a. At garage pit</td>
<td></td>
</tr>
<tr>
<td>b. Local dump</td>
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</tr>
<tr>
<td>4. Store for reclaim</td>
<td></td>
</tr>
<tr>
<td>5. Personal reuse</td>
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</tr>
<tr>
<td>C. Round table discussion &quot;How Do These Disposal Methods Produce Long-Term Environmental Uses&quot;</td>
<td></td>
</tr>
<tr>
<td>Discipline Area</td>
<td>Industrial Arts</td>
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</tr>
<tr>
<td>Subject</td>
<td>Power Mechanics</td>
</tr>
<tr>
<td>Problem Orientation</td>
<td>Disposal of Waste Grade 9-12 Oil</td>
</tr>
</tbody>
</table>

**SUGGESTED LEARNING EXPERIENCES**

**I. Student-Centered in class Activity**

Students will survey local garages to find out how they dispose of waste oil & why they use the method they do. Assign garages so owners are not assaulted by the whole class.

Individually report on disposal method discovered:
1. Dump in sewer
   a. Storm
   b. Sanitary
2. Burn
3. Dump on land
   a. At garage pit
   b. Local dump
4. Store for reclaim
5. Personal reuse

Round table discussion
"How Do These Disposal Methods Produce Long-Term Environmental Uses"

**II. Outside Resource and Community Activities**

1. Local garages.
2. Local oil company
3. See "I.-A."
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggested Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
<td>1. Have students develop alternative disposal methods that will not have detrimental and/or uses for waste.</td>
</tr>
<tr>
<td>1. Oil company literature.</td>
<td>2. Develop slide series on waste oil.</td>
</tr>
</tbody>
</table>

**Audio-Visual:**
1. Teacher/student developed slide series.

**Community:**
1. Local garages.
2. Oil company rep.
1. Have students develop alternative waste oil disposal methods that will not have environmental detriments and/or uses for waste oil.
2. Develop slide series on waste oil disposal methods.
C. Individual acts, duplicated or compounded, produce significant environmental alterations over time.

 Discipline Area: Industrial Arts
 Subject: Power Mechanics
 Problem Orientation: Tire Selection

 BEHAVIORAL OBJECTIVES

Cognitive: The student will be able to list 3 good and 3 harmful effects of studded tires.

Affective: The student will remove studded tires from his car whenever their use is not vital.

Skills to be Learned
- The wearing effect studded tires have on highway surfaces.
- The environmental problems and economic loss involved in highway resurfacing.

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
   A. Study wheels, hubs, tires
      1. Wheel parts
      2. Hub lubrication
      3. Tire plys
      4. Tire size
      5. Tire balance
      6. Tire inflation
      7. Tire composition

   B. Slide presentation on studded tire
      1. How made
      2. Uses
      3. Effects on road surface
      4. Regulations on use
      5. Comparison to snow tires

   C. Highway engineer to make presentation on highway resurfacing due to studded tires.
Problem Orientation Tire Selection  Grade 9-12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
   A. Study wheels, hubs, tires
      1. Wheel parts
      2. Hub lubrication
      3. Tire plys
      4. Tire size
      5. Tire balance
      6. Tire inflation
      7. Tire composition
   B. Slide presentation on studded tire.
      1. How made
      2. Uses
      3. Effects on road surface.
      4. Regulations on use.
      5. Comparison to snow tires.
   C. Highway engineer to make presentation on highway resurfacing due to studded tires.

II. Outside Resource and Community Activities
   Highway engineer.
   Tire dealer.
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggested Learning</th>
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<tbody>
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<td>Auto Mechanics Fundamentals,</td>
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<td><strong>Audio-Visual:</strong></td>
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<tr>
<td>Auto Mechanics: Wheels and Tires</td>
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<tr>
<td>U. of Ill, Champaign, Ill.</td>
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<tr>
<td><strong>Community:</strong></td>
<td></td>
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<tr>
<td>Local tire dealer</td>
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<tr>
<td>State Highway engineer</td>
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</tbody>
</table>
Continued and Additional Suggested Learning Experiences
Private ownership must be regarded as a stewardship and discipline area involved should not enroach upon or violate the individual right of others.

**Problem Orientation**

- BEHAVIORAL OBJECTIVES

1. The student will be able to list the ways man has wasted power supplies in the areas of coal, oil, and gas.

   - C. The student will help through work with community action groups to reclaim wasted power supplies and conserve the remaining supplies.

2. The students will develop a list of ways man can reclaim some of the wasted power supplies, and a list of ways man must conserve his remaining power supplies.

   - A. The students will study, Man's Struggle To Harnes Energy.

   - B. The students will develop a strategy to help the community in reclaiming power supplies.

   - C. The student should not enroach upon or violate the individual right of others.

**Skills to be Learned**

- Conservation and reclamation of power supplies.
- Cooperation.

**SUGGESTED LEARNING ACTIVITIES**

- Student-Centered In-class Activity

  A. The students will study, Man's Struggle To Harnes Energy.

  1. Early attempts to control and develop power supplies.

  - C. The student will help through work with community action groups to reclaim wasted power supplies and conserve the remaining supplies.

  B. The students will develop a list of ways man can reclaim some of the wasted power supplies, and a list of ways man must conserve his remaining power supplies.

  - A. The students will study, Man's Struggle To Harnes Energy.

  - B. The students will develop a strategy to help the community in reclaiming power supplies.

  - C. The student should not enroach upon or violate the individual right of others.
<table>
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<tr>
<th>ACTIVITIES</th>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Student-Centered in class activity</td>
<td>II. Outside Resource and Community Activities</td>
</tr>
<tr>
<td>A. The students will study, Man's Struggle To Harness Energy</td>
<td>A. D.N.R.</td>
</tr>
<tr>
<td>1. Early attempts to control. 2. Current power developments.</td>
<td></td>
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<tr>
<td>B. The students will develop a list of ways man can reclaim some of the wasted power supplies, and a list of ways man must conserve his remaining power supplies.</td>
<td></td>
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</tbody>
</table>
Resource and Reference Materials

Publications:
Power Technology,
George E. Stephenson
Delmar Publishers, Inc.
Encyclopedias
History Books

Audio-Visual:
Fuels: Their Nature and Use
U. of Ill. Champaign, Ill.

Community:
D.N.R.
<table>
<thead>
<tr>
<th>Service Materials</th>
<th>Continued and Additional Suggested Learning Experiences</th>
</tr>
</thead>
</table>

and Use, Ill.
1. Energy from the sun, the basic source of all energy, is converted through plant photosynthesis into a form all living things can use for life processes.

**Cognitive:** The student will be able to identify in writing how a laser basically operates and how it is used for the composition of printed matter.

**Affective:** The student will appreciate the value of the sun's energy for type composition.

**Skills to be Learned**
1. Type composition
2. Physics of light and energy as it is related to the printing industry.

**BEHAVIORAL OBJECTIVES**

**I. Student-Centered in class activity**
A. The student will write a brief paper on the discovery and history of lasers.
B. The student will identify by listing the characteristics of lasers that relate to and from the sun and how it is utilized in the graphic arts industry.
C. Small groups of students will report on:
   1. Industries that use lasers and how they are applied.
   2. Different energy's from the sun that are used for the life process.
from the sun, the basic
all energy, is converted
ant photosynthesis
all living things
r life processes.

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>student</td>
<td>I. Student-Centered in class activity</td>
</tr>
<tr>
<td>identify</td>
<td>A. The student will write</td>
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<td>a laser</td>
<td>a brief paper on the</td>
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<td>for the</td>
<td>discovery &amp; history of</td>
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<td>printed</td>
<td>lasers.</td>
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<td>student</td>
<td>B. The student will identify</td>
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<td>by listing the character-</td>
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<td>istics of lasers that</td>
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<td>&amp; how it is utilized in</td>
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<td>the graphic arts industry.</td>
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<td>C. Small groups of students</td>
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<td>are applied.</td>
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<td>from the sun that</td>
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<td>are used for the life</td>
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<td>process.</td>
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<td>3. Man's future uses of</td>
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<td>the laser beams.</td>
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<td>II. Outside Resource and</td>
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<td></td>
<td>Community Activities</td>
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<tr>
<td></td>
<td>A. Physics teacher to</td>
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<td></td>
<td>explain lasers and</td>
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<td>their uses.</td>
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<td>B. Physicist or nuclear</td>
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<td>engineer to explain</td>
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<td>the history &amp; how</td>
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<td>lasers are used for</td>
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<td>the Federal govern-</td>
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<td>ment.</td>
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<td>C. Local printer who</td>
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<td>has knowledge of</td>
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<td></td>
<td>lasers to discuss</td>
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<td></td>
<td>the use of them in</td>
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<td></td>
<td>the printing industry.</td>
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<td>D. Visit to a plant that</td>
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<td>uses lasers for scient-</td>
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<tr>
<td></td>
<td>ific purposes, man-</td>
</tr>
<tr>
<td></td>
<td>ufacturing, etc.</td>
</tr>
</tbody>
</table>
Resource and Reference Materials

Publications:
Graphic Arts Tech. Found, Inc.
4615 Forbes Ave.
Pittsburgh, Pa 15213
Tech Abstracts

Audio-Visual:
Lasers: An Introduction
#533313 U. Ill.
Champaign, Ill.

Community:
Local printer having knowledge of laser use.
Continued and Additional Suggested Learning Experiences
2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.

### Behavioral Objectives

**Cognitive:** The student will clean-up when the clean-up period arrives, and not only complete his own responsibility, but also check overall results.

**Affective:** The student will understand that all living systems interact among themselves and their environment, realizing clean-up is a combined effort, not an effort by an individual.

### Skills to be Learned

1. Cooperation
2. Responsibility
3. Benefits of clean-up
   1. Neater work results.
   2. Equipment in proper place-easier to find & use.
   4. Safer working atmosphere.

### Suggested Learning

1. Student-Centered in class activity
   A. Ignore clean-up for one day.
   B. Have students work next day in messy area with un-cleaned presses & other equipment.
   C. Evaluate on 3rd day the need for clean-up and relate it to the shop production and environment.
   D. Organize schedule of duties & responsibilities stressing teamwork.
   E. Discuss & compare results of clean-up vs. no clean-up, and discuss group interaction and cooperation as it relates to clean-up and everyday existence.
   F. From this discussion, develop a task list for each individual & a chain of command for each individual to answer to.
living organisms interact

mselves and their

ment, forming an intricate

led an ecosystem.

Discipline Area Industrial Arts

Subject Graphic Arts

Problem Orientation Clean-up Grade 7-12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class

activity

A. Ignore clean-up for one
day.

B. Have students work next
day in messy area with
un-cleaned presses & other
equipment.

C. Evaluate on 3rd day the
need for clean-up and
relate it to the shop
production and environment.

D. Organize schedule of duties &
responsibilities stressing
teamwork.

E. Discuss & compare results
of clean-up vs. no clean-
up, and discuss group
interaction and cooperation
as it relates to clean-up
and everyday existence.

F. From this discussion, de-
velop a task list for each
individual & a chain of
command for each individual
to answer to.

II. Outside Resource and
Community Activities

A. Field trip to local
printing industry
and view practical
applications & advan-
tages of neatness
& cleanliness

B. Industrial safety
commission rep.
Resource and Reference Materials

Publications:
- Graphic Arts,
- Frederick D. Kagy
- Goodheart-Willcox

Audio-Visual:

Community:
- Industrial Safety Commission representative.
- Representative of local printing industry.

Continued and Additional Suggested Learning Activities:

1. Have students develop "round robin" of making clean-up more efficient each student an opportunity to have up responsibility.

2. Develop a list on where else a team effort would be beneficial.
1. Have students develop "round robin" system of making clean-up more efficient and give each student an opportunity to have each clean-up responsibility.

2. Develop a list on where else a team clean-up effort would be beneficial.
3. Environmental factors are limiting on the numbers of organisms living within their discipline area. Subject to specific shop influence, thus, each environment has a carrying capacity.

**Subject Area: Graphic Shop**

**Problem Orientation**

I. Cognitive: The student will list & explain 3 physical & 3 psychological effects of environmental crowding & relate them to specific shop areas. The student will realize that crowding results in adverse physical & psychological conditions result.

**Skills to be learned**

- Hazards in environmental crowding.
- Crowding results in adverse physical & psychological conditions result.

**Behavioral Objectives**

I. Student-Centered activity

A. Conduct experiment around following conditions:
   1. Develop simple task list from Calif. job case.
   2. Provide only one set of tools required.
   3. Limit work area to one job case.
   4. Limit time (slight).
   5. Mass production not allowed.
   6. First three done win.

B. Discuss personal & physical feelings experienced during experiment:
   1. Low production.
   2. Confusion.
   3. Frustration.
   4. Irritability.
   5. Waste.

II. Affective: The student will realize that crowding results in adverse physical & psychological conditions result.

**Suggested Learning Experience:**

ESEA Title III - 59-70-0135-2 Project I-C 01/19/69-01/08/70
Environmental factors are influencing the numbers of students living within their environment, thus, each environment has a carrying capacity. Discipline Area: Industrial Arts
Subject: Graphic Arts
Problem Orientation: Crowding in the Grade 7-12 Shop

**ORAL OBJECTIVES**

The student will explain 3 psychological factors of an environment & relate specific shop activities. The student will discuss all psychological adverse results.

**SUGGESTED LEARNING EXPERIENCES**

I. **Student-Centered in class activity**
   A. Conduct experiment around following conditions:
      1. Develop simple task, i.e., set business card from Calif. job case.
      2. Provide only one each of tools req'd.
      3. Limit work area to one job case.
      4. Limit time (slight)
      5. Mass production not allowed.
      6. First three done win.
   B. Discuss personal & physical feelings experienced during experiment.
      1. Low production
      2. Confusion
      3. Frustration
      4. Irritability
      5. Waste
      6. Injury (Caution)

II. **Outside Resource and Community Activities**
   A. Sociologist
   B. Community planning committee rep.
   C. Real estate developer
Resource and Reference Materials

Publications:
Graphic Arts, Frederick D. Kagy
Goodheart-Willcox

Audio-Visual:
53525 Man's Effect on the Environment, Univ. of Ill.

Community:
1. Sociologist
2. Community planning committee rep.
3. Real estate developer

Continued and Additional Suggested Learning:

(Con't from I.)
C. Discuss what would result if a town were managed as in the experiment.
D. Relate experiment results to concept #1
Continued and Additional Suggested Learning Experiences

(Con't from I.)

C. Discuss what would result if a town were planned & managed as in the experiment.

D. Relate experiment results to concept #3.
An adequate supply of pure water is essential for life.

**Behavioral Objectives**

**Cognitive:** The student will be able to name the paper companies having waste water treatment facilities within a 50 mile radius of the school.

**Affective:** The student will learn to appreciate the clean water on recreation, fishing, etc.

**Skills to be Learned**
1. Paper composition.
2. How paper is made.
3. Treatment of water after it is used in a paper mill.

**Suggested Learning Activity**

I. Student-Centered in class activity

A. Lecture & discussion by paper mill rep. "Water treatment facilities in paper companies":
   1. Machines used in treatment.
   2. Chemicals used in treatment.
   3. Results achieved.
   4. Short & long term plans for water treatment facilities.

B. Write a short paper on water treatment on paper mills using lecture notes & related research.

C. Question & answer session with E.P.A. rep. to determine what & who is polluting water & what they are doing.
<table>
<thead>
<tr>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Student-Centered in class activity</td>
</tr>
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<td>A. Lecture &amp; discussion by paper mill rep. &quot;Water treatment facilities in paper companies&quot;</td>
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<td>2. Chemicals used in treatment.</td>
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<tr>
<td>3. Results achieved.</td>
</tr>
<tr>
<td>4. Short &amp; long term plans for water treatment facilities.</td>
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<td>B. Write a short paper on water treatment on paper mills using lecture notes &amp; related research.</td>
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<tr>
<td>C. Question &amp; answer session with E,P.A. rep. to determine what &amp; who is polluting water &amp; what they are doing.</td>
</tr>
<tr>
<td>II. Outside Resource and Community Activities</td>
</tr>
<tr>
<td>A. Field trip to a paper mill.</td>
</tr>
<tr>
<td>B. Public relations dept. of paper mill.</td>
</tr>
</tbody>
</table>
Resource and Reference Materials

Publications:
Pulp & Paper,
500 Howard St.
San Francisco, Calif. 94105
American Paper Industry,
2570 Devon Ave.
Des Plains, Ill. 60018
Chemical Paper Processing,
Hale Publishing Co.
One Bank St.
Stanford, Conn. 06901

Audio-Visual:
Recycling Paper,
Riverside Paper Co.
Appleton, Wis.
Great White Trackaway,
Hammermill Paper Co.
Erie, Penn.

Community:
Public relations dept. local mill.

Continued and Additional Suggestions:
1. Develop bulletin board for making effluent treatment:
2. Collect water samples from companies and other industries and return it to the river to denote waste treatment quality.
Continued and Additional Suggested Learning Experiences

1. Develop bulletin board flow chart showing paper making effluent treatment flow chart.
2. Collect water samples from various stages.
3. On a local map use colored pins to identify paper companies and other industries which use water & return it to the river, lake, etc. (Have pins denote waste treatment quality)
5. An adequate supply of clean air is essential because most organisms depend on oxygen, through respiration, to release the energy in their food.

### Behavioral Objectives

**Cognitive:** The student will be able to list the effects of solvent vapor on the respiratory system.

**Affective:** The student will use safety precautions to prevent the breathing of harmful solvent vapors.

**Skills to be Learned**
1. Composition of cleaning solvents.
2. Effects of solvent vapor on the respiratory system.
3. Safe disposal of used solvents.
4. Poster construction.

### Suggested Learning

1. **Student-Centered in Class Activity**
   - Student will write a short paper titled: "Is Air Pollution Caused By Cleaning Solvents Used in the Printing Industry?"

2. **As a Group, the Students Will**
   - Develop a plan for effective disposal of used cleaning solvents.

3. **Students Will Construct**
   - A safety poster describing the effects of solvents on the respiratory system.
<table>
<thead>
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<tbody>
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<td>1. Student will write a short paper titled: &quot;Is Air Pollution Caused By Cleaning Solvents Used in the Printing Industry?&quot;</td>
</tr>
<tr>
<td>2. As a group, the students will develop a plan for effective disposal of used cleaning solvents.</td>
</tr>
<tr>
<td>3. Students will construct a safety poster describing the effects of solvents on the respiratory system.</td>
</tr>
<tr>
<td><strong>II. Outside Resource and Community Activities</strong></td>
</tr>
<tr>
<td>1. School chemistry teacher to give demonstration on effects of solvent vapor on materials related to human tissue.</td>
</tr>
<tr>
<td>2. Local doctor to discuss effect of solvent vapor on respiratory system.</td>
</tr>
</tbody>
</table>
Resource and Reference Materials

**Publications:**
- Graphic Arts,
- Frederic D. Kagy
- Goodheart-Willcox

**Audio-Visual:**

**Community:**
- Local doctor.
- Chemistry teacher.
Cont:ued and Additional Suggested Learning Experiences
6. Natural resources are not equally distributed over the earth or over time and greatly affect the geographic conditions and quality of life.

### BEHAVIORAL OBJECTIVES

**Cognitive:** Given a list of environmental conditions, land, man, employment, recreation that are affected by water shortage, the student will suggest solutions to printing operations that use water & how it can be saved.

**Affective:** The student will learn to appreciate the limited supply of water.

**Skills to be Learned**

1. Developing film
   a. Inspection
   b. Time & temp.
2. Plate-making with aluminum pre-sensitized plates.
3. Press operations

### SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity

A. Student will write a philosophical (dream) on paper on what might happen to his environment if there was no water.

B. Student will write a letter to the Bureau of the Interior to find out what locales have water shortages & what is being done to correct this i.e., Ventura, Calif.--building reservoirs.

C. Student will make a list of different chemicals that are added to water during printing operations & the amount of difficulty encountered in removing same.
<table>
<thead>
<tr>
<th>SUGGESTED LEARNING EXPERIENCES</th>
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</thead>
<tbody>
<tr>
<td>I. Student-Centered in class activity</td>
<td>II. Outside Resource and Community Activities</td>
</tr>
<tr>
<td>A. Student will write a philosophical (dream) on paper on what might happen to his environment if there was no water.</td>
<td>A. Biologist with knowledge of water shortage effects on the total environment.</td>
</tr>
<tr>
<td>B. Student will write a letter to the Bureau of the Interior to find out what locales have water shortages &amp; what is being done to correct this i.e., Ventura, Calif.--building reservoirs.</td>
<td>B. Water treatment plant tour.</td>
</tr>
<tr>
<td>C. Student will make a list of different chemicals that are added to water during printing operations &amp; the amount of difficulty encountered in removing same.</td>
<td>C. Marine biologist to discuss the effects of chemicals on water &amp; their impact on the ecosystem.</td>
</tr>
<tr>
<td></td>
<td>D. Writing assignment could be an interaction between English and graphic arts.</td>
</tr>
<tr>
<td>Resource and Reference Materials</td>
<td>Continued and Additional Suggested Learning Activities</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Publications:</strong></td>
<td>1. Have students experiment with ways the waste process can eliminate or minimize pollution.</td>
</tr>
<tr>
<td>U. S. Bureau of Interior</td>
<td></td>
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<tr>
<td>Water Related Publications</td>
<td></td>
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<tr>
<td>Dept. of Natural Resources</td>
<td></td>
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<tr>
<td><strong>Audio-Visual:</strong></td>
<td></td>
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<tr>
<td>#32027 Water-Old Problems, New Approaches, Univ. of Ill.</td>
<td></td>
</tr>
<tr>
<td><strong>Community:</strong></td>
<td></td>
</tr>
<tr>
<td>1. Local marine biologist</td>
<td></td>
</tr>
<tr>
<td>2. Sewage engineer</td>
<td></td>
</tr>
<tr>
<td>Continued and Additional Suggested Learning Experiences</td>
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<tr>
<td>--------------------------------------------------------</td>
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</tr>
<tr>
<td>1. Have students experiment with ways printing process can eliminate or minimize water use and/or pollution.</td>
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</table>

[Continued and Additional Suggested Learning Experiences]

[Cell contents not visible in the image]
7. Factors such as facilitating transportation, economic conditions, population growth, and increasing leisure time have a great influence on changes in land use and centers of population density.

**Concept**

**Behavioral Objectives**

| Cognitive: The student will write an analysis paper on current, local recycling efforts. | I. Student-Centered in class activity
A. Local official to speak on local recycling efforts. |
| Affective: The student will save paper and packages for recycling instead of sending them to the dump. | D. Students will write a brief paper on recycling in your city and make a comparison of these efforts to those of other cities. |
| Skills to be Learned 1. Methods of recycling packages. 2. Methods of designing packages for easier recycling. | C. The student will list the effects of non-recyclable material on land use. |
|  | D. Students will design recyclable packages for: 1. Bottles 2. Meat products 3. Other food products, etc. |
## Problem Orientation: Packaging for Grade 7-12

### SUGGESTED OBJECTIVES

1. **Student-Centered in-class activity**
   - A local official to speak on local recycling efforts.
   - Students will write a brief paper on recycling in their city and make a comparison to those of other cities.
   - The student will list the effects of non-recyclable material on land use.
   - Students will design recyclable packages for:
     1. Bottles
     2. Meat products
     3. Other food products, etc.

### SUGGESTED LEARNING EXPERIENCES

1. **Outside Resource and Community Activities**
   - Designer from packaging company.
Resource and Reference Materials

Publications:

Audio-Visual:

Community Crime Prevention: For educators and officials.
Cultural, economic, social, and political factors determine status of man’s values and attitudes toward his environment.

**BEHAVIORAL OBJECTIVES**

**Cognitive:** The student will list the various metals used in offset printing plates. The student will list the various natural resources used in retail plates and processing materials & their availability.

**Affective:** The student will appreciate his socio-economic status as related to natural resources, and how some of the resources on his list maintain and improve his standard of living.

**Skills to be Learned**
1. Plate make-up.
2. Plate processing.
3. Material derivations—where they come from.
4. Handling of pollutants.
5. Cause-effect thinking.

**SUGGESTED LEARNING EXPERIENCES**

I. Student-Centered in class activity
   1. Lecture—demonstration—discussion on plates and platemaking.
      a. Types of plates
      b. Plate composition
      c. Plate making and processing.

   2. Discuss and show (from demonstration) types of pollutants from plates.
      a. Organic oils
      b. Acidic waters
      c. Toxic materials

   3. Discuss plate disposal and recycling methods

   4. Relate the flow of events bearing out the fact that resources are needed to promote the flow of communications (via plate produced media) which very directly dictate man’s values & attitudes toward his environment.

II. Outside activity
   1. Hands-on activity
      a. Field trip to a printing press
      b. Workshop on environmental impact of printing

   2. Hands-on activity
      a. Laboratory experiments on pollutant identification
      b. Group discussion on the impact of printing on the environment

   3. Community activity
      a. Environmental clean-up day
      b. Workshop on sustainable printing practices

   4. Extension activity
      a. Research paper on the history and impact of printing on society
      b. Community presentation on the importance of sustainable printing

discipline area industrial arts
subject graphic arts
problem orientation plate-making grade 11-12

I. SUGGESTED LEARNING EXPERIENCES

1. Student-Centered in class activity
   a. Lecture--demonstration--discussion on plates and
      platemaking.
      i. Types of plates
      ii. Plate composition
      iii. Plate making and processing.

2. Discuss and show...(from
demonstration) types of
pollutants from plates.
   a. Organic oils
   b. Acidic waters
   c. Toxic materials

3. Discuss plate disposal
and recycling methods

4. Relate the flow of events
bearing out the fact that
resources are needed to
promote the flow of commu-
nications (via plate
produced media) which
very directly dictate
man's values & attitudes
toward his environment.

II. Outside Resource and
Community Activities

1. Have speaker from
local printing firm
talk about what they
are doing about plate-
making wastes, resource
control, etc.

2. Have 3-M representative
speak on availability
of plate-making mater-
ials and other related
areas.
Resource and Reference Materials

Publications:

Audio-Visual:
Transparencies on plate-making

Continued and Additional Suggested Learning Experiences

1. Have students find other examples of programs and resources affecting society's way of life and study how resource conservation and waste materials are handled.

Local Printing firm rep.
3M rep.
1. Have students find other examples of progress and resources affecting society's way of life, and study how resource conservation and waste materials are handled.
Man has the ability to manage, manipulate, and change his environment.

**BEHAVIORAL OBJECTIVES**

**Cognitive:** The student will identify the machines and/or areas that cause excess noise & select appropriate noise control safety equipment. The student will appreciate and understand how noise affects the physiological system.

**Affective:** The student will appreciate and understand how noise affects the physiological system.

**Skills to be Learned**
1. Offset press operation
2. Design for noise control
3. Noise protection

**Subject**
- Offset press operation
- Design for noise control
- Noise protection

**Activity**
- Lecture-discussion by the teacher or industrial commission rep. on effective noise control & its effect on working conditions.
- Research activity -- report on noise provisions of the occupational safety & health act.
- How are local plants handling noise pollution?

**Problem Orientation Noise Management & Control**

**III. Graphic**

**Graphic Area**

**Discipline Area**

**Problem Orientation Noise Management & Control**

**Subject**

- Offset press operation
- Design for noise control
- Noise protection

**Activity**
- Lecture-discussion by the teacher or industrial commission rep. on effective noise control & its effect on working conditions.
- Research activity -- report on noise provisions of the occupational safety & health act.
- How are local plants handling noise pollution?
as the ability to manage, distribute, and change his

**General Objectives**

- The student will identify the machines that cause noise and will appropriate equipment.
- The student will integrate and understand the effects of noise on the psychological system.

- The student will learn press operation or noise control protection.

**Suggested Learning Experiences**

**I. Student-Centered In-Class Activity**

- A lecture-discussion by the teacher or industrial session rep. on effective noise control & its effect on working conditions.
- Factors to consider:
  1. Frequency
  2. Overall level
  3. Time distribution of noise exposure
  4. Duration of exposure
  5. Total work life exposure
  6. Susceptibility to noise
  7. Noise classification
     A. Auditory
     B. Non-auditory
- B. Research activity--report on noise provisions of the occupational safety & health act.
- C. How are local plants handling noise pollution?

**II. Outside Resource and Community Activities**

- A. Representative from a large printing co. who works in the press room to discuss noise control in his area.
- B. Psychiatrist--noise control & its effect on the psychological system.
- C. Students volunteer to interview local plant representatives to find and/or tape-record the answers to in-class activity. Students will set up appointments and have questions approved by the teachers before any interview.
## Resource and Reference Materials

### Publications:

- **Graphic Arts Tech. Found.**, 4615 Forbes Ave., Pittsburgh, Pa. 14213
- **Environmental Controls State: Occupational Safety & Health Act**

### Audio-Visual:

- #80067 Noise & Health, Univ. of Ill.
- #53497 Noise is Pollution, Too, Univ. of Ill.

## Continued and Additional Suggested Learning

1. Have students design & install noise devices on school machines.

## Community:

1. Local safety engineer
2. Industrial Commission rep.
<table>
<thead>
<tr>
<th>Reference Materials</th>
<th>Continued and Additional Suggested Learning Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Have students design &amp; install noise suppression devices on school machines.</td>
</tr>
</tbody>
</table>

- Found.,
- Scroll,
- Health, Univ. of
- Pollution, Too,
- Engineer
- Commission rep.
10. Short-term economic gains may produce long-term environmental losses.

Discipline Area: Industrial
Subject: Graphic Art
Problem Orientation: Depletion of Resources

<table>
<thead>
<tr>
<th>BEHAVIORAL OBJECTIVES</th>
<th>SUGGESTED LEARNING EXPERIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cognitive:</strong> The student will list the natural resources used in paper making. The student will list the ways paper manufacturing is depleting our natural resources.</td>
<td>I. Student-Centered in class activity</td>
</tr>
<tr>
<td><strong>Affective:</strong> The student will learn to appreciate the aesthetic value of natural resources used in paper manufacturing.</td>
<td>II. Out activity</td>
</tr>
<tr>
<td><strong>Skills to be Learned:</strong> 1. Paper composition 2. How to replenish natural resources used in paper manufacturing.</td>
<td>A. View film on papermaking.</td>
</tr>
<tr>
<td></td>
<td>B. List paper companies in your area and the natural resources they use.</td>
</tr>
<tr>
<td></td>
<td>C. List what each company is doing to replenish the resources they use.</td>
</tr>
</tbody>
</table>

Note: The table is cut off at the bottom and the text continues on the next page.
Discipline Area: Industrial Arts

Subject: Graphic Arts

Problem Orientation: Depleting Natural Grade 7-12 Resources.

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
   A. View film on papermaking.
   B. List paper companies in your area and the natural resources they use.
   C. List what each company is doing to replenish the resources they use.

II. Outside Resource and Community Activities
   1. Visit local papermill.
   2. Visit tree farm.
   4. Forester from a paper company.
   5. Public relations dept. of a local paper mill.
### Resource and Reference Materials

<table>
<thead>
<tr>
<th>Continued and Additional Suggested Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
</tr>
<tr>
<td>Printing Views for the Midwest</td>
</tr>
<tr>
<td>Printer &amp; Lithographer, Feb. 1972</td>
</tr>
<tr>
<td>Pulp &amp; Paper</td>
</tr>
<tr>
<td>500 Howard St.</td>
</tr>
<tr>
<td>San Francisco, Calif. 94105</td>
</tr>
<tr>
<td>American Paper Industry, 2570 Devon Ave.</td>
</tr>
<tr>
<td>Des Plaines, Ill. 60018</td>
</tr>
</tbody>
</table>

| **Audio-Visual:**                           |
| Film: Blue Sky Thinking,                    |
| Hammermill Paper Co.                        |
| Erie, Pa.                                   |

| **Community:**                              |
| Public relations dept. of a local paper mill. |
| Forester from local paper mill.             |
Individual acts, duplicated or compounded, produce significant environmental alterations over time.

**Behavioral Objectives**

<table>
<thead>
<tr>
<th>Cognitive: The student will be able to list the ways of cylinder disposal &amp; their environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective: The student will be made aware of the tremendous use of resources in cyl. products &amp; the eventual disposition of materials, and the ultimate results.</td>
</tr>
</tbody>
</table>

**Skills to be Learned**

1. Plastic etchings
2. Printing from an engraved surface

**Suggested Learning Experience**

<table>
<thead>
<tr>
<th>I. Student-Centered in class activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Intaglio printing</td>
</tr>
<tr>
<td>1. Principles of rotogravure printing</td>
</tr>
<tr>
<td>a. Examples of work &amp; plates</td>
</tr>
<tr>
<td>b. Uses for this process</td>
</tr>
<tr>
<td>c. Plastic etchings</td>
</tr>
<tr>
<td>1. Production</td>
</tr>
<tr>
<td>2. Use</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Have students research the types of metals used in Rotogravure cylinder making and the mining impact of their origin.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(More cylinders—more impact)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Have students research the disposition of dead cylinders (more cylinders—more waste?)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>D. Possible alternatives (brain storm) Can they be used for colleges, sculptures, abstract design, mobiles, odd furniture, bric a brac.</th>
</tr>
</thead>
</table>
significant Discipline Area: Industrial Arts

Subject: Graphic Arts

Problem Orientation: Disposal of Rotogravure Plates

Grade 10-12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
   A. Intaglio printing
      1. Principles of rotogravure printing.
         a. Examples of work & plates
         b. Uses for this process
         c. Plastic etchings
            1. Production
            2. Use
   B. Have students research the types of metals used in Rotogravure cylinder making and the mining impact of their origin. (More cylinders-more impact)
   C. Have students research the disposition of dead cylinders (more cylinders-more waste?)
   D. Possible alternatives (brain storm) Can they be used for colleges, sculptures, abstract design, mobiles, odd furniture, bric a brac.

II. Outside Resource and Community Activities
   A. Tour a local gravure printing plant.
   B. Tour an engraving plant.
   C. Rotogravure specialist
      1. Metals used
      2. Cylinder usage & disposal
   D. Engraver
      1. Types of engraving
### Resource and Reference Materials

<table>
<thead>
<tr>
<th>Publications:</th>
<th>Continued and Additional Suggested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphic Arts Monthly</td>
<td>1. Develop a collection of roto</td>
</tr>
<tr>
<td></td>
<td>2. Develop a cost analysis of a</td>
</tr>
</tbody>
</table>

### Audio-Visual:
- Teacher made slide series
- and/or trans. visualizing
- intaglio & rotogravure process.

### Community:
- Local engraver
- Local rotogravure specialist.
Continued and Additional Suggested Learning Experiences

2. Develop a cost analysis of a roto plate.
Cognitive: The student will list 10 instances where taking all liberties because a person is an owner of a publication may have negative effects.

Affective: The student will realize that ownership of a printing establishment does not overrule rights and feelings of others.

**Behavioral Objectives**

**Skills to be Learned**
1. Concepts behind "free speech" cliche.
2. "Unwritten" rights of others.

**Suggested Learning Experiences**

I. Student-Centered in class activity

A. Openly-lead discussion--
   1. Question: What is the difference between reporting and editorializing?
      a. What are the good and bad points of the two types of writing?

B. Relate-through discussion: Just because a person is the owner of a publication, he doesn't have the right to write anything he wishes, just as a person or persons doesn't have the right to do anything he wishes with his property, materials, etc.

C. Role-play situation of editor or publication owner vs. Other journalist
   Community citizen
   Judge, Lawyer
I. Student-Centered in class activity
   A. Openly-lead discussion—
      1. Question: What is the difference between reporting and editorializing?
         a. What are the good and bad points of the two types of writing?
   B. Relate-through discussion:
      Just because a person is the owner of a publication, he doesn't have the right
to write anything he wishes, just as a person or persons doesn't have the right to
do anything he wishes with his property, materials, wastes, etc.
   C. Role-play situation of editor or publication owner vs. other journalist
      Community citizen
      Judge, Lawyer

II. Outside Resource and Community Activities
   Local journalist or English (journalism) teacher.
## Resource and Reference Materials

### Publications:

1. Develop list of all "ships rights" definitions.
2. Study further into "check" from doing what.

### Audio-Visual:

- Community:
- Local journalist
Continued and Additional Suggested Learning Experiences

1. Develop list of all possible areas where "ownership rights" definitely harm others.
2. Study further into the ways owners are "held in check" from doing what they want in industry.
1. Energy from the sun, the basic source of all energy, is converted through plant photosynthesis into a form all living things can use for life processed.

**Behavioral Objectives**

**Cognitive:** The student will produce a flow chart of 3 types of plastics showing sun energy to be the basic source.

**Affective:** The student will realize the importance of the sun energy to plastics.

**Skills to be Learned**

1. Types of plastics
2. Flow charts
3. Researching

**Suggested Learning Activities**

I. Student-Centered in class activity

A. Have on hand a number of examples of different types of plastics, with type written on.

B. What do these plastics have in common?

C. Divide students into small groups & have them back trace their particular type. (see origin of plastics chart) attach.

D. With class discussion emphasize importance of "sun energy" as it relates to life processes.

1. What role does the sun play in the origin of plastics?

2. Would it be possible to have plastics without the sun? Why?

3. What effects does the sun have in plastics?
SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
A. Have on hand a number of examples of different types of plastics, with type written on.
B. What do these plastics have in common?
C. Divide students into small groups & have them back trace their particular type. (see origin of plastics chart) attach.
D. With class discussion emphasize importance of "sun energy" as it relates to life processes.
   1. What role does the sun play in the origin of plastics?
   2. Would it be possible to have plastics without the sun? Why?
   3. What effects does the sun have in plastics?

II. Outside Resource and Community Activities
1. School chemistry teacher.
2. Representative from plastics industry.
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
<td>1. Develop method of simplifying burning - smelling-scraping of plastics</td>
</tr>
<tr>
<td>Woodworker Annual, Volume 73,</td>
<td>PG. 70 Woodworker Annual</td>
</tr>
<tr>
<td>V. J. Taylor, Drake Publishers,</td>
<td></td>
</tr>
<tr>
<td>440 Park Ave. South, New York, N.Y. 10016</td>
<td></td>
</tr>
<tr>
<td>Plastics Technology, Robert S. Swanson, McKnight &amp; McKnight Bloomington, Ill.</td>
<td></td>
</tr>
<tr>
<td>General Plastics Proj &amp; Proc.</td>
<td></td>
</tr>
<tr>
<td>Raymond Cherry, McKnight &amp; McKnight, Bloomington, Ill.</td>
<td></td>
</tr>
<tr>
<td><strong>Audio-Visual:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Community:</strong></td>
<td>1. Chemistry instructor</td>
</tr>
<tr>
<td></td>
<td>2. Rep. plastic industry</td>
</tr>
</tbody>
</table>
Continued and Additional Suggested Learning Experiences

1. Develop method of simple tests composed of burning - smelling - scratching to identify types of plastics

PG.70 Woodworker Annual Vol 73
ORIGIN OF PLASTICS

- Oil
- Methane
- Ethylene
- Acetylene
- PVC
- Ethyl Cellulose
- Celluloid
- Cellulose
- Molasses
- Alcohol
- Butadiene
- Ethylene
- Polyether PVC
- Phenol
- Urea
- Formaldehyde
- Thermosetting Plastics
- UF
- Mel
- Bakelite
- Calcium Carbide
- Acetylene
- PVC
ORIGIN OF PLASTICS

Olefins' Aromatics'

Oil

Methane

Ethylene

Acetylene

PVC

Thermo Plastics

Lucite

Ethyl Cellulose -flash lt.case

Cellulose Acetate-toothbrush

Cellulose Nitrate-eyeglass frames

Cellulose Acetate Butyrate- irrigat.

Cellulose Propionate- ball point pen

Synthetic Rubbers -Nylon

Neoprene

Acrilian

Bakelite

UF

Melmac table ware

Plexiglas

Plastics

Benzine

Styrene

Pólystyrene- Tupperware

Cellulose→Celluloid→Celluloic

Molasses→Alcohol→Butadiene

Ethylene→Polyether PVC

Ethylene

Phenol

Urea

Formaldehyde

Benzine

Coal

Natural Gas

Oxygen

Acetylene

PVC
### BEHAVIORAL OBJECTIVES

#### Subject Discipline

<table>
<thead>
<tr>
<th>Problem Orientation</th>
<th>Activity Type</th>
<th>Suggested Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.</td>
<td>Student-Centered in classroom</td>
<td>1. Define polymerization. 2. Diagram how many parts of monomers link together to form new materials. 3. Relate polymerization to an ecosystem.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Compare individual molecules to individuals working together. 2. Compare linking of molecules to people working together in an ecosystem, in an industry, or job fields.</td>
</tr>
</tbody>
</table>

#### Cognitive

The student will be able to define polymerization. The student will be able to diagram the polymerization process. The student will be able to visualize how people working together can be compared to polymerization.

**BEHAVIORAL OBJECTIVES**

1. Define polymerization
   - "Poly"—many parts
   - "meroen"—parts

2. Diagram how many parts of monomers link together to form new materials.

3. Relate polymerization to an ecosystem.
   - Compare individual molecules to individuals working together. Compare linking of molecules to people working together in an ecosystem, in an industry, or job fields.
ganisms interact
and their
izing an intricate
osystem.

<table>
<thead>
<tr>
<th>IVES</th>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Student-Centered in class activity</td>
<td>II. Outside Resource and Community Activities</td>
</tr>
<tr>
<td>A. Define polymerization &quot;Poly&quot;-many &quot;Meros&quot;-parts</td>
<td>Chemistry teacher.</td>
</tr>
<tr>
<td>B. Diagram how many parts of monomer link together to form new material.</td>
<td>Counselor-Job opportunities</td>
</tr>
<tr>
<td>C. Relate polymerization to an ecosystem.</td>
<td></td>
</tr>
<tr>
<td>1. Compare individual molecules to individual people.</td>
<td></td>
</tr>
<tr>
<td>2. Compare linking of molecules to people working together, in ecosystem, in an economic system.</td>
<td></td>
</tr>
<tr>
<td>3. Compare links to careers which affect other careers or job fields, related industries.</td>
<td></td>
</tr>
</tbody>
</table>
Resource and Reference Materials | Continued and Additional Suggested
--- | ---
Publications:  
Cope's Plastics Book, Dwight Cope  
Goodheart-Willcox  
General Plastics, Raymond Cherry  
McKnight & McKnight  
Job Opportunities Handbook

Audio-Visual:  
Chemistry chart showing polymerization.

Community:  
Chemistry teacher
Environmental factors are limiting on the numbers of organisms living within their influence. Thus, each environment has a carrying capacity.

C. Environmental factors are limiting on the numbers of organisms living within their influence, thus, each environment has a carrying capacity.

<table>
<thead>
<tr>
<th>BEHAVIORAL OBJECTIVES</th>
<th>SUGGESTED LEARNING ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive: The student will develop a chart listing the methods of joining plastics, examples of these methods, and breaking points of the joints.</td>
<td>I. Student-Centered in class activity</td>
</tr>
<tr>
<td>Affective: The student will realize that each joining method or system has a definite load limit that it can handle before failing.</td>
<td>A. Demonstrate methods of joining plastics. (Show, tell, &amp; do)</td>
</tr>
<tr>
<td>Skills to be learned</td>
<td>1. Cohesion</td>
</tr>
<tr>
<td>1. Types and methods of plastic joinery</td>
<td>a. Solvent cementing</td>
</tr>
<tr>
<td>2. Joint testing and evaluation</td>
<td>b. Thermal welding</td>
</tr>
<tr>
<td>3. Chart making</td>
<td>2. Adhesion</td>
</tr>
<tr>
<td></td>
<td>a. Adhesive (different from either of materials)</td>
</tr>
<tr>
<td></td>
<td>3. Mechanical linkage</td>
</tr>
<tr>
<td></td>
<td>a. Screws</td>
</tr>
<tr>
<td></td>
<td>b. Rivets</td>
</tr>
<tr>
<td></td>
<td>c. Bolts &amp; nuts</td>
</tr>
<tr>
<td></td>
<td>d. Spring clips</td>
</tr>
<tr>
<td></td>
<td>B. Using equipment available, test to determine how much of a load each joint will carry before failing.</td>
</tr>
<tr>
<td></td>
<td>C. By brainstorming, relate carrying capacity of joints to carrying capacity of examples in our environment.</td>
</tr>
<tr>
<td></td>
<td>1. Street--can handle only so much before problems (Con't)</td>
</tr>
</tbody>
</table>
Students are

Years of:  

Discipline Area:  Industrial Arts

within their:  Subject:  Plastics

Problem Orientation:  Fastening of Grade 10-12 Plastics

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity

A. Demonstrate methods of joining plastics. (Show, tell, & do)
   1. Cohesion
      a. Solvent cementing
      b. Thermal welding
   2. Adhesion
      a. Adhesive (different from either of materials)
   3. Mechanical linkage
      a. Screws
      b. Rivets
      c. Bolts & nuts
      d. Spring clips

B. Using equipment available, test to determine how much of a load each joint will carry before failing.

C. By brainstorming, relate carrying capacity of joints to carrying capacity of examples in our environment.
   1. Street--can handle only so much before problems (Con't)

II. Outside Resource and Community Activities

A. Chemistry teacher
B. Representative of plastics industry (ie, DuPont, etc.)
C. Various local people discussing area job possibilities.
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggested Learning Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
<td>(Con't from I.)</td>
</tr>
<tr>
<td>1. Plastics Technology,</td>
<td>occur.</td>
</tr>
<tr>
<td>Robert E. Swanson</td>
<td></td>
</tr>
<tr>
<td>McKnight &amp; McKnight</td>
<td>2. Water main--(same)</td>
</tr>
<tr>
<td>2. General Plastics,</td>
<td>3. Job opportunities--load limit</td>
</tr>
<tr>
<td>Raymond Cherry</td>
<td>1. Create larger chart for class</td>
</tr>
<tr>
<td>McKnight &amp; McKnight</td>
<td>a. Types of joints</td>
</tr>
<tr>
<td></td>
<td>b. Methods of making them</td>
</tr>
<tr>
<td></td>
<td>c. Breaking points</td>
</tr>
</tbody>
</table>
| **Audio-Visual:**               | 2. Have students find samples of different types of joints and use these
case studies (from #1) to produce multi-me |
| 1. Actual Samples of joints      | 3. Have students perform same type of work with other materials used in the industry and present their results. |
| 2. Transparency series          | 4. Prepare list of standard fasteners and other      |
|                                 | materials used in industry as well as other          |

| Community:                      |                                                     |
| Plastics Industry Rep. (ie, DePort): |                                                     |
| A. Schwichtenberg- Polyfoam   |                                                     |
| Lester Irarie, Minn.          |                                                     |
Continued and Additional Suggested Learning Experiences

(Con't from I.)

occur.

2. Water main--(same)

3. Job opportunities--load limit in local community.

1. Create larger chart for class room use of
   a. Types of joints
   b. Methods of making them
   c. Breaking points

2. Have students find samples of different
   types of joints and use these to supplement
   chart (#1) to produce multi-media display

3. Have students perform same type of research with
   other materials used in industrial arts and
   present their results.

4. Prepare list of standard fasteners that are used
   for plastics as well as other materials.
ESEA Title III - 59-70-0135-2 Project I-C-E

Behavioral Objectives

Cognitive: The student will be able to list and demonstrate the various methods of mold release, selecting the simplest and best method for the item he is producing.

Skills to be learned:
- Methods of mold release
- Water used in the mold release process

Methods to reclaim water used in the mold release process:
- Distillation
- Secondary treatment

A. Student-centered in-class activity: The student will list the pollutants added to water by this process, and plan to reclaim water used in the mold release process.

B. In the study of mold release, the student will present debates or defend their plans to the class or teacher.

Affective: The student will select the simplest and best method of mold release for the item he is producing.
Discipline Area: Industrial Arts
Subject: Plastics
Problem Orientation: Mold Release
Grade: 9-12

SUGGESTED LEARNING EXPERIENCES

I. Centered in class
   - Study methods of mold release
   - Study of water mold release, the student will identify the pollutants added to water by this process.
   -examine the liquid polyvinyl alcohol plastic particles.
   -Students will develop a plan to reclaim water used in the mold release process.
   -Distillation
   -Secondary treatment
   -Students will present de- or defend "their plan" to the class or teacher.

II. Outside Resource and Community Activities
   - Rep. from an area plant that does plastic molding.
   - Engineer from local sewage treatment plant.
Continued and Additional Materials

**Publications:**

Fiber Glass Projects and Procedures
Gerald L. Steele
McKnight & McKnight

**Audio-Visual:**
Teacher developed slides

**Community:**
Rep. from an area plastic molding plant.
Engineer from local sewage treatment plant.
An adequate supply of clean air is essential because most organisms depend on oxygen, through respiration, to release the energy in their food.

**BEHAVIORAL OBJECTIVES**

**Cognitive:** Given a specific air cleaning task, the student will be able to select a "plastic" that best suits the job & explain how it will clean the air.

**Affecitve:** The student will understand the qualities a "plastic" must possess to remove particulates from dirty air.

**Skills to be Learned**
1. Filtration principles
2. Uses of plastic products for air filtration
3. Limitations of plastics & filtration
4. Research techniques

**SUGGESTED LEARNING EXP**

I. Student-Centered in class activity
   B. Research the above applications & discover what properties must the plastic fibers have?
   C. Develop charts using the researched properties. Each group assigned or volunteer to research one type of filter.
   D. Given a specific air cleaning task select from chart or research & select a plastic that would best suit the job. (Con't)
of clean air is most organisms. Discipline Area: Industrial Arts
through respiration, Subject: Plastics

Energy in their food. Problem Orientation: Plastic and Air Grade 9-12

Treatement

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity

A. Bean bag discussion:
   How are plastics used to purify air—give a specific example
   1. Furnace filters
   2. Vacuum cleaner filter
   3. Cigarette filters
   4. Respirator masks
   5. Air filter on car
   6. Glass PAC mufflers
   7. Exhaus fan hoods

B. Research the above applications & discover what properties must the plastic fibers have?

C. Develop charts using the researched properties. Each group assigned or volunteer to research one type of filter.

D. Given a specific air cleaning task select from chart or research & select a plastic that would best suit the job. (Con't)

II. Outside Resource and Community Activities

A. Selected students will interview local industries to discover what particular filtration (both liquid & air) devices they use, and obtain examples where possible. Sample questions for the interview:
   1. What particular air pollution do you have at this plant?
   2. How are you controlling this problem?
   3. How successful have your efforts been?

B. Air filtration specialist (heat, & vent, contractor)
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggested Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Literature from various filter manufacturers. | E. Presentation by "air filtration plastics can clean the air."
|                                  | 1. Develop a collection of plastic.      |
|                                  | 2. The students will organize a clean filter drive, to promote better filter results: |
|                                  | A. Efficiency increased                  |
|                                  | B. Shorter burn time-less air pollution |
|                                  | C. Cost reduction in operation.          |
|                                  | 3. Develop test to measure amount of particulate removed by various "air devices" |
| **Audio-Visual:**               |                                          |
| Teacher developed transparency set. |                                          |
| **Community:**                  |                                          |
| 1. Heat & vent contractor       |                                          |
Lied and Additional Suggested Learning Experiences

1. On presentation by "air filtration" expert how plastics can clean the air.
2. Develop a collection of plastic filtration media. The students will organize a clean your furnace filter drive, to promote better furnace operation.
3. Results:
   a. Efficiency increased
   b. Shorter burn time-less air pollution.
   c. Cost reduction in operation.
   d. Develop test to measure amount or % of particulate removed by various "air filtering devices"
C 6. Natural resources are not equally distributed over the earth or over time and greatly affect the geographic conditions and quality of life.

**BEHAVIORAL OBJECTIVES**

<table>
<thead>
<tr>
<th>Cognitive:</th>
<th>SUGGESTED LEARNING OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student will list 10 products which are now made of plastic (previously made of another material) and project 4 possible reasons why the change was made.</td>
<td>I. Student-Centered in class activity</td>
</tr>
<tr>
<td>Affective: The student will realize that changing the material a product is made of also changes in many instances, the geographic area in which it is produced.</td>
<td>A. Brainstorm list of products now made of plastic formerly made of other natural resources.</td>
</tr>
<tr>
<td>Skill to be Learned</td>
<td>1. Types &amp; uses of plastic products.</td>
</tr>
<tr>
<td>2. Composition of plastics.</td>
<td>2. Metal--Desks, auto bodies, engine &amp; auto, parts, window wash frames</td>
</tr>
<tr>
<td>4. Geographic locations of raw materials used in the manufacture of plastics.</td>
<td>B. Develop flow chart, &amp; compare geog. locations of plastic raw products and natural resources.</td>
</tr>
<tr>
<td>C. Research plant locations producing various plastic products, &amp; map them in contrast to locations of plastic raw materials</td>
<td>C. Study results of work in portion C.</td>
</tr>
<tr>
<td>D. Study results of work in portion C.</td>
<td>E. Relate results and conclusions of study (part D) to (Con't)</td>
</tr>
</tbody>
</table>
resources are not equally
over the earth or over
ly affect the geographic
quality of life.

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>student products</td>
<td>I. Student-Centered in class activity</td>
</tr>
<tr>
<td>student changing product changes</td>
<td>A. Brainstorm list of products now made of plastic formerly made of other natural resources.</td>
</tr>
<tr>
<td>turned on</td>
<td>1. Wood--counter&amp;table tops, paneling, bldg. exteriors</td>
</tr>
<tr>
<td>of plastic</td>
<td>2. Metal--Desks, auto bodies engine &amp; auto, parts, window wash frames</td>
</tr>
<tr>
<td>locations of</td>
<td>B. Develop flow chart, &amp; compare geog. locations of plastic raw products and natural resources.</td>
</tr>
<tr>
<td>used in</td>
<td>C. Research plant locations producing various plastic products, &amp; map them in contrast to locations of plastic raw materials</td>
</tr>
<tr>
<td>re of plas-</td>
<td>D. Study results of work in portion C.</td>
</tr>
<tr>
<td>to (Con't)</td>
<td>E. Relate results and conclusions of study (part D) to</td>
</tr>
</tbody>
</table>

Discipline Area: Industrial Arts
Subject: Plastics
Problem Orientation: Plastic Products
Grade: 8-12
Serving as Conservers of Natural Resources
Resource and Reference Materials

Publications:
Wisconsin Geography
Dept. of Public Instruction
126 Langdon St.
Madison, Wis.

Audio-Visual:
Film Basic Elements of Production
#60196, U. of Ill. Champaign, Ill.

Continued and Additional Suggested Learning

1. Have students find information on a ghost-town, and try to retrace the steps which led to it's becoming a ghost town:
   a. Commercial factors
   b. Accessability
   c. Natural resources, etc.

Community:
1. Plastics manufacturing personnel (if possible)
2. Chamber of Commerce individual to explain in-coming or outgoing industries and their effect on the community and quality of life.
Continued and Additional Suggested Learning Experiences

1. Have students find information on a given ghost-town, and try to retrace the steps which led to it’s becoming a ghost town.
   a. Commercial factors
   b. Accessibility
   c. Natural resources, etc.
Factors such as facilitating transportation, ecological conditions, population growth, and increased leisure time have a great influence on changes in land use and centers of population density.

### Behavioral Objectives

<table>
<thead>
<tr>
<th>Discipline Area</th>
<th>Subject</th>
<th>Problem Orientation</th>
<th>Suggested LAB or Problem Oriented Book Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

#### Cognitive

- **The student will be able to list ten plastic products used in leisure time vehicles.**

#### Affective

- **The student will understand how plastic has changed the leisure time industry.**

#### Skills to be Learned

- **Uses of plastic in transportation.**
- **How the plastic industry has changed the economy.**

#### Activity

1. Snowmobile bodies
2. Boats
3. Snowmobile bodies
4. Dune buggy vehicles

**B. Students will study those items listed which are produced in their area and how they have changed population and economic conditions.**
The student will learn to list plastic industry products used in leisure time vehicles.

1. Snowmobile bodies
2. Boats
3. ALT vehicles
4. Dune buggy

B. Students will study those items listed which are produced in their area and how they have changed population and economic conditions.

II. Outside Resource and Community Activities

A. Rep. from area plant which produces plastic products used in leisure time vehicles.
B. Students interview local businessmen in companies recently affected.
C. Students contact local and nearby Chambers of Commerce for population & economic changes per products developed.
Resource and Reference Materials

Continued and Additional Suggested Learning Experiences

Publications:
Fiber Glass Projects and Procedures,
Gerald L. Steele
McKnight & McKnight
Plastics Technology,
Robert S. Swanson
McKnight & McKnight

Audio-Visual:
Plastics and Fiberglass:
University of Ill.
Champaign, Ill.

Community:
Rep. from area plastics plant.
Cultural, economic, social, and political factors determine the status of man's values and attitudes toward his environment.

**BEHAVIORAL OBJECTIVES**

**Cognitive:**
- Given a sample mixture of furniture parts made of wood and plastic, the student will be able to separate the plastic parts from the wood parts.
- The student will realize the place of plastic in the furniture industry and change his attitudes to accept them.

**Affective:**
- The student will realize the place of plastic in the furniture industry and change his attitudes to accept them.

**Skills to be Learned**
- How to distinguish between furniture parts made of wood and plastic.
- How plastic is used in furniture.
- How the use of plastic affects the cost of furniture.

**SUGGESTED LEARNING OBJECTIVES**

**I. Student-Centered in class activity**

- A. Students will develop a list of ways plastic is used in furniture.
  - 1. Tops
  - 2. Finish
  - 3. Drawers
  - 4. Doors
  - 5. Legs
  - 6. Applique.

- B. From the list developed in A, students will develop a list of reasons for the use of plastic in furniture and individual furniture parts.
  - 1. Cost
  - 2. Durability
  - 3. Appearance

- C. Students will be shown examples of identical furniture parts made of wood or plastic. Students discuss: (Con't)
### Economic, Social, Factors Determine Values and Attitudes

#### Discipline Area
Industrial Arts

#### Subject
Plastics

#### Problem Orientation
Plastics in Furniture

#### Grade
9-12

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<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
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<tbody>
<tr>
<td>en a of</td>
<td>I. Student-Centered in class activity</td>
</tr>
<tr>
<td>made of</td>
<td>A. Students will develop a list of ways plastic is used in furniture.</td>
</tr>
<tr>
<td>able to</td>
<td>1. Tops</td>
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<tr>
<td>elastic wood parts.</td>
<td>2. Finish</td>
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<td>student place of</td>
<td>3. Drawers</td>
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<tr>
<td>and change</td>
<td>4. Doors</td>
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<tr>
<td>to accept</td>
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<td>used in plastic</td>
<td>2. Durability</td>
</tr>
<tr>
<td>another</td>
<td>3. Appearance</td>
</tr>
<tr>
<td>plastic</td>
<td>C. Students will be shown examples of identical furniture parts made of wood or plastic. Students discuss: (Con't)</td>
</tr>
<tr>
<td>Resource and Reference Materials</td>
<td>Continued and Additional Suggested Learning</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td><strong>Publications:</strong></td>
<td>(Con’t from I.)</td>
</tr>
<tr>
<td>Advanced Woodworking and</td>
<td>1. How can you recognize plastic parts,</td>
</tr>
<tr>
<td>Furniture Making,</td>
<td>marks, etc.)</td>
</tr>
<tr>
<td>John I. Feirer &amp; Gilbert Hutchings</td>
<td>2. How does the use of plastic change</td>
</tr>
<tr>
<td>Chas. A. Bennett Co.</td>
<td>furniture?</td>
</tr>
<tr>
<td>Fiber Glass Projects and</td>
<td>D. Students will be given several furn</td>
</tr>
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<td>Procedures,</td>
<td>and asked to identify the material of.</td>
</tr>
<tr>
<td>Gerald L. Steele</td>
<td></td>
</tr>
<tr>
<td>McKnight &amp; McKnight</td>
<td></td>
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</tbody>
</table>

| **Audio-Visual:**              |                                            |
| Plastics: Industrial Processes  |                                            |
| and Products, #86000            |                                            |
| U. of Ill., Champaign, Ill      |                                            |

| **Community:**                |                                            |
| Rep. from area plastic molding |                                            |
| plant.                        |                                            |
| Local furniture dealer.       |                                            |
Continued and Additional Suggested Learning Experiences

(Con't from I.)

1. How can you recognize plastic parts? (By mold marks, etc.)
2. How does the use of plastic change our values of furniture?
D. Students will be given several furniture parts and asked to identify the material they are made of.
**BEHAVIORAL OBJECTIVES**

<table>
<thead>
<tr>
<th>Cognitive: The student will test 4 samples &amp; correctly identify them; recycle the thermoplastics, suggest at least 2nd lives for the thermoses &amp; explain how his actions relate to his environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afffective: The student will realize that the cost of injection &amp; thermoforming projects can be held down by the addition of recyclable plastics.</td>
</tr>
</tbody>
</table>

**Skills to be Learned**
1. Testing plastics
2. Recycling procedure
3. Letter writing
4. Brainstorming

**SUGGESTED LEARNING EXPERIENCE**

I. **Student-Centered in class activity**

A. Each student will bring a sample of three different disposable plastic containers & if possible discover who manufactures them.

B. Test the samples in class to determine if the plastic is:
1. Thermoplastic (Recyclable)
2. Thermoset (Non-Recyclable)
3. Identify-specific type.

C. Since the thermoplastic is recyclable it presents no problem.

D. Thermosetting plastic does present a problem
1. Why does the manufacturer use this type? Write & ask.
   (Con't)
Discipline Area: Industrial Arts
Subject: Plastics
Problem Orientation: Plastic Identification & Recycling

Grade 7-12

OBJECTIVES

I. Student-centered in class activity
A. Each student will bring a sample of three different disposable plastic containers & if possible discover who manufactures them.
B. Test the samples in class to determine if the plastic is:
   1. Thermoplastic (Recycleable)
   2. Thermoset (Non-Recycleable)
   3. Identify-specific type.
C. Since the thermoplastic is recycleable it presents no problem.
D. Thermo-setting plastic does present a problem
   1. Why does the manufacturer use this type? Write & ask.
   (Con't)

SUGGESTED LEARNING EXPERIENCES

I. Outside Resource and Community Activities
   1. Art teacher
   2. Representative from plastics industry to discuss their particular recycling efforts.

II. Outside Resource and Community Activities
   1. Art teacher
   2. Representative from plastics industry to discuss their particular recycling efforts.
### Resource and Reference Materials

**Publications:**
- Woodworkers Annual Vol. 73, V.J. Taylor Drake Pub. Ltd.
- General Plastics, Raymond Cherry, McKnight & McKnight, Bloomington, ILL.

**Audio-Visual:**
- Teacher/student developed charts-displays-transparencies

### Continued and Additional Suggested Learning (Con't from I.)

2. Brainstorm alternative 2ndlives.
   - A. Birdhouses
   - B. Art forms
   - C. Household uses

E. In groups define specific reasons why we be concerned about the problem presented. (Results should relate directly to concept)

F. Recycle thermoplastics in shop procedure

Test design—see attached sheet
Continued and Additional Suggested Learning Experiences

(Con't from I.)

2. Brainstorm alternative 2ndlives.
   A. Birdhouses
   B. Art forms
   C. Household uses

E. In groups define specific reasons why we should be concerned about the problem presented in D-2? (Results should relate directly to concept #9)

F. Recycle thermoplastics in shop procedure

Test design--see attached sheet
FIELD TESTED
TEST DESIGN

From Sample Cut Off Thin Sliver

If The Result is Powdery
Chips it is a Thermosetting Plastic
Attempt to Light The Sliver

If the Smell is Phenolic & The Sliver Turns Dark Brown/Black=Phenoformaldehyde

If The Smell Is Fishy & The Sliver Is White Or Brightly Colored=Urea/Melamine Formaldehyde

If The Noise Is Dull
Place The Sliver In Soapy Water

Floats It Is A Polyolefin Type
Scratch With Fingernail

Sinks, Burn A Small Piece & Observe The Flame & Ease Of Burning

Burns With A Yellow Flame-Blow Out the Flame & Smell

Note Color Ignited

If It Is Hot, Shown
Drop A Hard Object Of A Turn & Observe Its Behavior

If The Single Smell Of Styrene=Polystyrene
If the smell is fishy &
the sliver is white or
brightly colored=Urea/ 
Melamine-Formaldehyde
If the noise is dull
place the sliver in soapy 
water. Sink, burn a small 
piece & observe the 
flame & ease of burning.
If the sliver burn smoothly
it is a thermoplastic (to verify, place a piece of 
hot metal on the sliver. it should melt or go soft).
Drop the sliver on a hard surface from a height of about 2 to 3 ft. If the noise is metallic
then it is styrene base. 
Burn the sliver & smell the smoke. If the smell is rubber=
Styrene with a styrene smell. As styrene melts well
and is of rubber.
Burns with difficulty 
Note color of flame while 
ignited.
If the noise is metallic
It is a thermostatic (to verify, place a piece of 
hot metal on the sliver. it should melt or go soft).
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Drop the sliver on a hard surface from a height of about 2 to 3 ft. If the noise is metallic
then it is styrene base. 
Burn the sliver & smell the smoke. If the smell is rubber=
Styrene with a styrene smell.
If It Will Not Scratch = Polypropylene

Scratches A Little = H.D. Polyethylene

Scratches Easily = C.D. Polyethylene

A Smell Like Methylated Spirits = Acrylic

A Smell Of Burning Paper = Cellulose Acetate

Acidic Plus A Smell Of Rancid Butter = Cellulose Acetate Butyrate

Greenish

Acrid Smell

Soft Sample

Acrid Smell

Hard Sample

PVC or E Polymer

Yellow Flame

Smell Smoke. Smell Hair Plus Threads From A Piece Of Cold Meat To The Hot Surface

Nylon
A Smell Like Methylated Spirits = Acrylic

A Smell Of Burning Paper = Cellulose Acetate

Acidic Plus A Smell Of Rancid Butter = Cellulose Acetate Butyrate

Greenish Flame

Acrid Smell With Soft Sample = PVC

Acrid Smell With Hard Sample = Rigid PVC or PVC/PVA Co-Polymer

Yellow Flame

Smell Smoke. Smell Of Burning Hair Plus Threads Forming When A Piece Of Cold Metal Is Touched To The Hot Surface & Drawn Away = Nylon

Pel 7/72
10. Short-term economic gains may produce long-term environmental losses.

**BEHAVIORAL OBJECTIVES**

**Cognitive:**
- The student will list the ways plastic has replaced wood, metal, and glass due to economic factors. The student will list the problems of plastic disposal.
- The student will buy products made of recyclable materials rather than thermoplastics.

**Affective:**
- The student will buy products made of recyclable materials rather than thermoplastics.

**Skills to be Learned**
- Methods of disposal of used wood, metal, glass, and plastic products.

**SUGGESTED LEARNING EXPERIENCES**

I. Student-Centered in class activity

A. Students will develop a list of products once made of metal, wood or glass and now, because of economic factors, made of plastic.

B. Students will study methods of disposing of used products made of wood, metal, glass, & plastic.
   1. Metal-recycle
   2. Glass-recycle
   3. Wood-burn, salvage
   4. Plastic
      A. Thermoset
      B. Thermoplastic-recycle

C. Students will study the problem of disposal of thermosetting plastics.
   1. Study current problems of disposal
      A. Can not burn in normal fire
      B. Does not decay
      C. Non-recyclable (Cont)
I. Student-Centered in class activity
A. Students will develop a list of products once made of metal, wood or glass and now, because of economic factors, made of plastic.
B. Students will study methods of disposing of used products made of wood, metal, glass, & plastic.
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   4. Plastic
      A. Thermoset
      B. Thermoplastic-recycle
C. Students will study the problem of disposal of thermosetting plastics,
   1. Study current problems of disposal
      A. Can not burn in normal fire.
      B. Does not decay
      C. Non-recyclable (Con't)

II. Outside Resource and Community Activities
Operator of Recycling center.
Visit a hammer mill.
Resource and Reference Materials

Publications:
Plastics Technology,
Robert S. Swanson
McKnight & McKnight

Audio-Visual:
Plastics: Industrial Processes
and Products #86000 U. of
Ill. Champaign, Ill

Community:
Operator of recycling center

Continued and Additional Suggested Learning

2. Develop possible methods of disposal.
Continued and Additional Suggested Learning Experiences

2. Develop possible methods of disposal.
Individual acts, duplicated or compounded, produce significant environmental alterations over time.

**Behavioral Objectives**

**Cognitive:** The student will list 4 advantages of recycling thermoplastics & how his actions affect the environment.

**Affective:** The student will understand the cause-effect relationship utilized in recycling thermoplastics.

**Skill to be Learned**

1. Preparing material for recycling
2. Operation of the granulator
3. Testing plastics
4. Record keeping

**Suggested Learning Experience**

1. Student-Centered in class activity
   - This activity is a continuation of class activity from concept #10.
   - A. Students will wash & remove all labels, metal rings, etc from plastic articles collected from school, home & community periodic collection.
   - B. Separate according to type of plastic & prepare them for the granulator & granulate
   - C. Weight material & enter weight & date on chart
   - D. At the end of the year add total weight column & compute cost of mat'rl recycled. Find per pupil input.
   - E. Class discussion of concept #11 as it relates to class recycling effort

   a. Money saved (con't)
II. Outside Resource and Community Activities

1. Sanitary engineer
2. Chemistry teacher
4. Set up collection stations for "throw away" plastic articles & maintain same.
Resource and Reference Materials

Publications:
- Woodworkers Annual Vol 73
  V. J. Taylor Drake Pub. Ltd.
  440 Park Ave. South, N.Y. 10016
- General Elastics, Raymond Cherry McKnight & McKnight
  Bloomington, Ill.

Community:
1. Sanitary engineer
2. Chemistry teacher
3. Rep. from plastics industry

Continued and Additional Suggested Reading:
- Carbage, Project I-C-E

Audio-Visual:
- "Garbage, Project I-C-E"

I. Do long term record keeping of material saved,
   land fill effect.

II. Be sure to point out the greater impact value (from I.)
Continued and Additional Suggested Learning Experiences

(Con't from I.)

b. Mat'rl saved
C. Land fill effect
d. Conservation of natural resources

1. Do long term record keeping over the years so that a greater impact value is developed.
12. Private ownership must be regarded as a stewardship and should not encroach upon or violate the individual right of others.

**Cognitive:**
- The student will list 3 consequences that might result if the previous "owner" encroached on his rights. List cause & effect.
- The student will realize that his actions determine not only project & work of all of his classmates.

**Affective:**
- The student will realize that when a person is working in an individual effort, the materials, machines, tools etc. he is using are "his" to use until he is finished. He is also responsible for these materials. Thus, the student is the "owner" of items or materials being used.

**Skills to be Learned**
1. Proportions
2. Accuracy in measuring
3. Set-up times of resins
4. Responsibility of own actions.

**SUGGESTED LEARNING EXPERIENCE**

I. **Student-Centered activity**

- Understanding should be realized that when a person is working in an individual effort, the materials, machines, tools etc. he is using are "his" to use until he is finished. He is also responsible for these materials. Thus, the student is the "owner" of items or materials being used.

A. **Demonstration & explanation by teacher on fiberglass resin-mix preparation**
   1. Ingredients (simple)
      a. Resin
      b. Hardener

B. **Discussion of failures as a result of improper preparation.**
   1. If "owner" is not careful and gets resin or hardener into main storage of other, the (Con't)
must be

Discipline Area  Industrial Arts

Subject  Plastics

Problem Orientation Rights Of Others  Grade 10-12

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
   Understanding should be realized that when a person is working in an individual effort, the materials, machines, tools etc. he is using are "his" to use until he is finished. He is also responsible for these materials. Thus, the student is the "owner" of items or materials being used.
   A. Demonstration & explanation by teacher on fiberglass resin-mix preparation
      1. Ingredients (simple)
         a. Resin
         b. Hardener
   B. Discussion of failures as a result of improper preparation.
      1. If "owner" is not careful and gets resin or hardener into main storage of other, the (Con't)

II. Outside Resource and Community Activities
Continued and Additional Suggested Learning:

(Con't from I.)

1. Entire mass will be worthless, & no other will be able to use it.

2. If batch of resin is not thoroughly resin & resulting product will be wo...

Stress--each person's project or work is upon past performances of other student.

3. Discover as many areas as possible which by one individual will affect many o...
Continued and Additional Suggested Learning Experiences

(Cont'd from I.)
entire mass will be worthless, & no other student will be able to use it.
2. If batch of resin is not thoroughly mixed, the resin & resulting product will be worthless.
Stress--each person's project or work is dependent upon past performances of other students or "owners"
3. Discover as many areas as possible where neglect by one individual will affect many others.
**Behavioral Objectives**

Cognitive: The student will develop an experiment using sun energy and explain how his results can be applied to our technological society.

Affective: The student will describe several problems in using sun energy.

Skills to be Learned:
1. Experiment design
2. Cause-effect thinking
3. Testing
4. Brainstorming
5. Circuitry & wiring

**Suggested Learning Experiences**

1. **Student-Centered in class activity**
   - A. Telephone company rep., presentation "uses of sun energy"
   - B. Film/presentation
     - 1. Electrical sources
     - 2. Production
   - C. Read related text units
   - D. The students will write a philosophical (dream) paper on sun energy use & its application to our society.

2. **Out-of-class activity**
   - E. By individuals or small groups develop sun energy experiments
   - F. Suggest several environmental problems associated with construction & operations of solar energy power generators as described in July 1972 Popular Science
   - G. Review use of Solar energy on space probe vehicles by NASA
Energy from the sun, the basic source of all energy, is converted through plant photosynthesis into a form all living things can use in their life processes.

Discipline Area: Industrial Arts
Subject: Electricity-Electronic
Problem Orientation: Application of Sun Energy
Grade: 7-12

Behavioral Objectives

To be learned:
- Experiment design
- De-effect thinking
- Brainstorming
- Circuitry & wiring

Suggested Learning Experiences

I. Student-Centered in Class Activity
   A. Telephone company rep. presentation "uses of sun energy"
   B. Film presentation
      1. Electrical sources
      2. Production
   C. Read related text units
   D. The students will write a philosophical (dream) paper on sun energy use & its application to our society.
   E. By individuals or small groups develop sun energy experiments
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   G. Review use of Solar energy on space probe vehicles by NASA

II. Outside Resource and Community Activities
   1. Telephone Co.
   2. Local power co.
   3. Weather man
   4. Physics teacher
   5. In the community the students will locate direct uses of sun energy
Resource and Reference Materials

Publications:
Modern General Shop, Walter Brown
Goodheart-Willcox Co.
Popular Science, July 1972

Audio-Visual:
$53623$ Electricity: Electrical Sources
$62900$ Electricity: Production
Univ. Of Ill, Champaign, Ill.

Community:
1. Telephone Co.
2. Local power co.
3. Weather co.
4. Physics teacher

Bell telephone educational representatives 1-922-5211
Collect call Miss A. Hoey
Fond Du Lac for available supplies & films

Continued and Additional Suggested Learning Experiences:

1. Continue developing experiments that show the greatest potential & possible patent and/or sales. Solar generation will require large amounts of radiation regularly available. Agricultural industrial development in this (desert type) can cause climatic change that reduces the energy conversion capacity of the solar generation.
Continued and Additional Suggested Learning Experiences

1. Continue developing experiments that show the greatest potential & possible patent and/or copyright.

Solar generation will require large amounts of solar radiation regularly available. Agricultural or industrial development in this (desert type) area can cause climatic change that reduces the efficient conversion capacity of the solar generation bank.
1. Energy from the sun, the basic source of all energy, is converted through plant photosynthesis into a form all living things can use, for life processes.

**Behavioral Objectives**

Cognitive: The student will develop an experiment using sun energy and explain how his results can be applied to our technological society. Affective: The student will describe several problems in using sun energy.

Skills to be Learned
1. Experiment design
2. Cause-effect thinking
3. Testing
4. Brainstorming
5. Circuitry & wiring

**Suggested Learning Experiences**

I. Student-Centered in class
A. Telephone company rep. presentation "uses of sun energy"
B. Film/presentation
C. Read related text units
D. The students will write a philosophical (dream) paper on sun energy use & its application to our society.
E. By individuals or small groups develop sun energy experiments
F. Suggest several environmental problems associated with construction & operations of solar energy power generators as described in July 1972 Popular Science
G. Review use of Solar energy on space probe vehicles by NASA

Discipline Area: Industrial Arts
Subject: Electricity/Photovoltaics
Problem Orientation: Application of Energy
the sun, the basic energy, is converted by photosynthesis into basic things can use. 

Discipline Area: Industrial Arts 
Subject: Electricity-Electronic 
Problem Orientation: Application of Sun Energy 
Grade: 7-12 

SUGGESTED LEARNING EXPERIENCES 

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<tr>
<th>I. Student-Centered in class activity</th>
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<tbody>
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<td>A. Telephone company rep. presentation &quot;uses of sun energy&quot;</td>
</tr>
<tr>
<td>B. Film (presentation)</td>
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</table>

II. Outside Resource and Community Activities 
1. Telephone Co. 
2. Local power co. 
3. Weather man 
4. Physics teacher 
5. In the community the students will locate direct uses of sun energy 

Preparation: 
Reading 
Thinking 
Researching
Continued and Additional Suggestions:

1. Continue developing experimental solar energy projects.

Solar generation will require the development of energy conversion capacity of the solar cell on a regular basis.

Audio-Visual:

J53623 Electricity: Electrical Sources
62900 Electricity: Production
Univ. Of Ill, Champaign, Ill.

Community:

1. Telephone Co.
2. Local power co.
3. Weather co.
4. Physics teacher

Bell telephone educational representatives 1-922-5211
Collect call Miss A. Hoey
Fond Du Lac for available supplies & films
Continued and Additional Suggested Learning Experiences

1. Continue developing experiments that show the greatest potential, possibly a patent and/or copyright.

Solar generation will require large amounts of solar radiation regularly available. Agricultural or industrial development in this (desert type) area can cause climatic change that reduces the efficient conversion capacity of the solar generation bank.
2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.

### BEHAVIORAL OBJECTIVES

| Cognitive: The student will in writing compare a community to an electrical circuit and explain what happens if one part stops, changes, etc. |
| Affective: The student will realize the interaction of the electrical circuit and the effects if one or more fail. |

### Skills to be Learned:

1. Principles of an electrical circuit
2. Systems analysis
3. Primary circuit elements
   - A. Volts
   - B. Amps
   - C. Ohms

### SUGGESTED LEARNING EXPERIENCES

<table>
<thead>
<tr>
<th>I. Student-Centered in class activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Film presentations:</td>
</tr>
<tr>
<td>1. Flow of electricity</td>
</tr>
<tr>
<td>2. Elementals of electrical circuits</td>
</tr>
<tr>
<td>B. Using components develop &amp; explain a simple electrical circuit. Teacher or student.</td>
</tr>
<tr>
<td>C. Have students identify circuit components</td>
</tr>
<tr>
<td>1. Power</td>
</tr>
<tr>
<td>2. Load</td>
</tr>
<tr>
<td>3. Return wire</td>
</tr>
<tr>
<td>4. Gauges</td>
</tr>
<tr>
<td>5. Protection</td>
</tr>
<tr>
<td>D. Evaluate circuit Test - Result</td>
</tr>
<tr>
<td>1. Design - Works</td>
</tr>
<tr>
<td>2. Vary Load - Blow fuse</td>
</tr>
<tr>
<td>3. Vary power - Load doesn't work</td>
</tr>
<tr>
<td>4. Break circuit - Won't work</td>
</tr>
<tr>
<td>E. Compare circuits to a community class discussion groups, or homework (Con't)</td>
</tr>
</tbody>
</table>

Discipline Area: Industrial
Subject: Electricity
Problem Orientation Relation: The Electrical Circuit
Discipline Area: Industrial Arts

Subject: Electricity-Electronic

Problem Orientation: Relationship of Grade 7-12

The Electrical Circuit to an Ecosystem

SUGGESTED LEARNING EXPERIENCES

I. Centered in class

Presentations:
- Flow of electricity
- Elements of electrical circuits
- Components develop
- Explain a simple electrical circuit. Teacher or student identify

- Power
- Load
- Return wire
- Switch
- Protection
- Gate circuit
- Result
- Sign - Works
- Dry load - Blow fuse
- Burn wire
- Dry power - Load doesn't work
- Break circuit - Won't work

II. Outside Resource and Community Activities

A. Sociologist
B. Have students find examples in the community & relate them to the basic circuit & its function.

(Cont.)
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggested</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Interior Electric Wiring</strong></td>
<td>1. Power=Food, fuel, etc.</td>
</tr>
<tr>
<td>Kennard C. Graham</td>
<td>(Con't from previous page)</td>
</tr>
<tr>
<td>American Tech. Society</td>
<td>2. Load=People, demand</td>
</tr>
<tr>
<td>Chicago, Ill.</td>
<td>3. Return wire=Waste disposal</td>
</tr>
<tr>
<td><strong>Electrical Construction Wiring</strong></td>
<td>4. Gauges=Communication</td>
</tr>
<tr>
<td>Walter N. Alerich</td>
<td>5. Protection=Limiting factors avai</td>
</tr>
<tr>
<td>American Tech. Society</td>
<td>food, etc.</td>
</tr>
<tr>
<td>Chicago, Ill.</td>
<td></td>
</tr>
</tbody>
</table>

**Audio-Visual:**
- Flow of Electricity, BAVI
- #29800 Elements of Electrical Circuits,
  Univ. of Ill. Champaign, Ill.

**Community:**
- I. Sociologist
and Additional Suggested Learning Experiences

Food, fuel, etc. (Con't from I. E.)

- People, demand
- Waste disposal
- Communication

- Limiting factors: available land, housing, etc.
Environmental factors are limiting the numbers of organisms living within their influence, thus, each environment has a carrying capacity. Discipline Area: Industrial, Subject: Electrical, Problem Orientation: Determining carrying capacity.

**BEHAVIORAL OBJECTIVES**

**Cognitive:** Given a fixed power source, the student will experiment to find its maximum capacity, and then compute this capacity using mathematics.

**Affective:** The student will realize that there is a limit to the load a circuit or system can handle.

**Skills to be Learned**
1. Electrical computations
2. Load capacities
3. Function of fuses

**SUGGESTED LEARNING EXPERIENCES**

I. Student-Centered in class activity
   A. Have each student load a fused (20Amp) circuit with household appliances until it becomes overloaded.
      1. Toaster
      2. Coffee pot
      3. Electric fry pan, etc.
   B. Discuss circuit handling capacity, and how to compute Amps.
      1. Amps = Watts/volts
      2. Sum of amps drawn by each appliance cannot be larger than supply amperage.
   C. Have students design and set up different appliance combinations which will not overload circuit.
   D. Discuss safety factors concerning electrical house circuits.
      1. Nat. elec. code-80% of amperage maximum
      2. Fire hazards (Con't)
SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class activity
   A. Have each student load a fused (20Amp) circuit with household appliances until it becomes overloaded.
      1. Toaster
      2. Coffee pot
      3. Electric fry pan, etc.
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      2. Sum of amps. drawn by each appliance cannot be larger than supply amperage.
   C. Have students design and set up different appliance combinations which will not overload circuit.
   D. Discuss safety factors concerning electrical house circuits
      1. Nat. elec. code-80% of amperage maximum
      2. Fire hazards
         (Con't)

II. Outside Resource and Community Activities
   A. Electrician
   B. Have students survey neighborhood for hazardous electrical wiring situations, start a drive to re-work or have something done about inferior wiring facilities
   C. Public Service rep.
   D. Underwriters lab.
<table>
<thead>
<tr>
<th>Resource and Reference Materials</th>
<th>Continued and Additional Suggested Learning Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
<td>(Con't from 1.)</td>
</tr>
<tr>
<td>Electricity, Goodheart-Wilcox</td>
<td>E. Relate overloading problems to problems of overcrowding and over-use of overloaded products.</td>
</tr>
<tr>
<td>Howard H. Gerrish</td>
<td></td>
</tr>
<tr>
<td>Basic Electricity, McGaw Hill</td>
<td></td>
</tr>
<tr>
<td>Paul B. Zbar</td>
<td></td>
</tr>
<tr>
<td>Introduction to Electricity &amp;</td>
<td></td>
</tr>
<tr>
<td>Electronics, Delmar Loper &amp;</td>
<td></td>
</tr>
<tr>
<td>A.H.R.</td>
<td></td>
</tr>
<tr>
<td><strong>Audio-Visual:</strong></td>
<td></td>
</tr>
<tr>
<td>Transparencies to Aid</td>
<td></td>
</tr>
<tr>
<td>Explanation of Ampere Computation</td>
<td></td>
</tr>
<tr>
<td><strong>Community:</strong></td>
<td></td>
</tr>
<tr>
<td>1. Electrician</td>
<td></td>
</tr>
<tr>
<td>2. Public service rep.</td>
<td></td>
</tr>
<tr>
<td>3. Possibly rep. from Underwriters laboratory</td>
<td></td>
</tr>
</tbody>
</table>

1. Conduct community wide drive to inform area about overloading circuits, get old local people (especially in older age groups) to update their electrical wiring systems.
AdDITIONAL SUGGESTED LEARNING EXPERIENCES

To address overloading problems in today's problems of overcrowding and over-use of resources &

In a community-wide drive to inform persons in crises, of overloading circuits, and try to get
durable (especially in older homes) to
synergize electrical wiring systems.
An adequate supply of pure water is essential for life. (also can apply to concept P)

BEHAVIORAL OBJECTIVES:

1. The student will be able to list 6 environmental losses caused by the production of electricity.
2. The student will gain knowledge of environmental loss due to the production of electricity.
3. How to develop a questionnaire to reduce pollution caused by the production of electricity.
4. The student will gain knowledge of environmental losses due to the production of electricity.

Skills to be Learned:
- How electricity is produced.
- How the production of electricity affects our environment.

Affective:
The student will gain knowledge of environmental losses caused by the production of electricity.

Skills to be Learned:
- How to develop a questionnaire to reduce pollution caused by the production of electricity.

Cognitive: The student will be able to list 6 environmental losses caused by the production of electricity.

Problem of the Day:
- How the production of electricity affects our environment.

Subject:
- Science
- Social Studies

Problem:
- How the production of electricity affects our environment.

Skills to be Learned:
- How to develop a questionnaire to reduce pollution caused by the production of electricity.
- How much of the environment is affected by the production of electricity.

A. Class discussion of the production of electricity
1. What kinds of electricity are produced by the production of electricity?
2. How much of the environment is affected by the production of electricity?
3. What are the environmental losses caused by the production of electricity?

B. Students will make a bulletin board showing environmental losses caused by the production of electricity.
1. Burning fossil fuels
2. Nuclear power

C. Students develop a questionnaire and conduct a survey on the following question:
To reduce pollution caused by the production of electricity, which would rather (cont)
Concept #5)

**Discipline Area** Industrial Arts

**Subject** Electricity-Electronics

**Problem Orientation** Production of Electricity

**Grade 7-12**

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**SUGGESTED LEARNING EXPERIENCES**

<table>
<thead>
<tr>
<th>I. Student-Centered in class activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Class discussion on how electricity is produced:</td>
</tr>
<tr>
<td>1. What kinds of pollution are produced by the production of electricity?</td>
</tr>
<tr>
<td>2. How much of this pollution is produced?</td>
</tr>
<tr>
<td>3. What are the environmental effects of this pollution?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. Outside Resource and Community Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Speaker from local power company.</td>
</tr>
<tr>
<td>B. Field trips to hydro-plant, nuclear plant, and fossil fuel plant.</td>
</tr>
</tbody>
</table>

| C. Students develop questionnaire and conduct community survey on the following question: |
| To reduce pollution caused by the production of electricity which would rather do, |
| (Con't) |
Resource and Reference Materials

Publications:
Environmental Cost of Electric Power,
Scientists Institute for Public Information
30 E. 68th St. N. Y., N. Y. 10021
National Wildlife,
National Wildlife Federation
April-May, 1972 P. 18

Audio-Visual;
Electricity: How It Is Generated.
#01136 U. of Ill. Champaign, Ill.

Community:
Rep. from local power company.

Continued and Additional Suggested
(Con't from I.)
pay 1/5 more for electricity each required to reduce use of electri each month?
D. Construction of models of the of generating stations for pla table display with environment associated with construction a
Continued and Additional Suggested Learning Experiences
(Con't from I.)

pay 1/5 more for electricity each month, be required to reduce use of electricity by 1/5 each month?

D. Construction of models of the various types of generating stations for placement in sand table display with environmental impact effects associated with construction and operation of same.
6. Natural resources are not equally distributed over the earth or over time and greatly affect the geographic conditions and quality of life. (Also can apply to Concept 9)

BEHAVIORAL OBJECTIVES

Cognitive: The student will be able to list 3 problems in moving electricity from production plant to consumer. The student will be able to list the natural resources used to produce electricity.

Affective: The student will realize how the production of electricity has changed the environment.

Skills to be learned: How electricity is produced, how the production of electricity affects our environment, how electric power is transmitted.

SUGGESTED LEARNING EXPERIENCES

I. Student-Centered in class

II. Out-of-Class

A. Students will study how natural resource distribution affects methods of electricity production. How is electricity produced in states that have large supplies of water?

2. How is electricity produced in states that have large supplies of coal?

3. How is electricity produced in states that have large supplies of oil or natural gas?

4. How is electricity produced in areas that have none of the resources used to produce electricity?

B. Students will study how man has manipulated his environment to produce and transmit electric power.

(Cont.)
Discipline Area: Industrial Arts
Subject: Electricity-Electronics
Problem Orientation: Transmission of Electrical Energy

SUGGESTED LEARNING EXPERIENCES

I. Activity-Centered in Class
   Students will study how natural resource distribution affects methods of electricity production.
   - How is electricity produced in states that have large supplies of water?
   - How is electricity produced in states that have large supplies of coal?
   - How is electricity produced in states that have large supplies of oil or natural gas?
   - How is electricity supplied in areas that have none of the resources used to produce electricity?

II. Outside Resource and Community Activities
   - Rep. from local power company.
   - Field trip to electric power plants of different types.

Students will study how man has manipulated his environment to produce and transmit electric power.
Resource and Reference Materials

<table>
<thead>
<tr>
<th>Continued and Additional Suggested Learning Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publications:</td>
</tr>
<tr>
<td><em>Environmental Cost of Electric Power</em>,</td>
</tr>
<tr>
<td>Scientists Institute for Public Information,</td>
</tr>
<tr>
<td>30 E. 68th St. N.Y., N.Y.</td>
</tr>
<tr>
<td><em>National Wildlife</em>,</td>
</tr>
<tr>
<td><em>National Wildlife Federation</em></td>
</tr>
<tr>
<td>April-“a”, 1972 p. 18</td>
</tr>
<tr>
<td>Audio-Visual:</td>
</tr>
<tr>
<td>#50774 Dams</td>
</tr>
<tr>
<td>University of Ill, Champaign, Ill.</td>
</tr>
<tr>
<td>Community:</td>
</tr>
<tr>
<td>Rep. from local power company.</td>
</tr>
</tbody>
</table>
### Continued and Additional Suggested Learning Experiences

<table>
<thead>
<tr>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Building of dams to produce electricity. (Con't from I.)</td>
</tr>
<tr>
<td>2. Building power transmission lines.</td>
</tr>
</tbody>
</table>
7. Factors such as facilitating transportation, economic conditions, population growth, and increased leisure time have a great influence on changes in land use and centers of population density.

<table>
<thead>
<tr>
<th>BEHAVIORAL OBJECTIVES</th>
<th>SUGGESTED LEARNING EXPERIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cognitive</strong></td>
<td><strong>I. Student-Centered in class activity</strong></td>
</tr>
<tr>
<td>The student will list 7 considerations and their involvement in hydroelectric dam building.</td>
<td>A. Have selected students read book. (Manic 5)</td>
</tr>
<tr>
<td>The student will realize the complexity of involvements in developing hydroelectric power.</td>
<td>B. Panel discussion about the hydroelectric dam's environmental impact on the following areas.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Skills to be Learned</strong></th>
<th><strong>II. Outside activity</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Production of hydroelectric power.</td>
<td>A. Field trip to local hydroelectric dam (Peshtigo River has 5)</td>
</tr>
<tr>
<td>2. A project's impact on the environment</td>
<td>1. Evaluate dam's environmental impact &amp; relate to Manic 5</td>
</tr>
<tr>
<td>3. Planning of a project</td>
<td>A. Changes in wildlife</td>
</tr>
</tbody>
</table>

Subject: Electricity-Electricity
Problem Orientation: Factors in the Production of New Hydroelectric Power
Factors in The Grade 7-12 Eduction of New Hydroelectric Power

II. Outside Resource and Community Activities
A. Field trip to hydroelectric dam.
B. Representative from power co.
Resource and Reference Materials

Publications:
- Manic 5
- Modern General Shop,
  Goodheart-Wilcox

Audio-Visual:
- #82045 The Dam Builders
- #50774 Dams
- #53537 Man Changes the Nile
- #05800 Water Power

Uni of Ill., Champaign, Ill.

Community:
1. Representative from power co.
2. Fox River, 2 power dams near Kaukauna, 1 at Appleton,
3. Peshtigo River
4. Menominee River, Wolf River,

Continued and Additional Suggestions
1. What other uses does a hydroelectric system besides producing power
Continued and Additional Suggested Learning Experiences

1. What other uses does a hydroelectric dam have besides producing power?
8. Cultural, economic, social, and political factors determine status of man's values and attitudes toward his environment.

**BEHAVIORAL OBJECTIVES**

Cognitive: The student will research a specific thermal pollution alternative and write an opinion paper.

Affective: The student will realize the factors related to thermal pollution from atomic energy production.

Skills to be Learned
1. How electricity is produced by atomic energy.
2. What is thermal pollution & how do you handle it?
3. Brainstorming

**SUGGESTED LEARNING ACTIVITY**

I. Student-Centered in class activity
   A. After discussing the production of power using atomic energy, tackle the following problem: Since the water used in cooling an atomic reactor is considered thermal pollution what alternatives are available?
      1. It is not a problem
      2. Use a cooling tower
      3. Pipe it for residential heating
      4. Put pipes in road for snow & ice removal
      5. Various industrial uses
      6. Fish pond culture/cooling
      7. Brainstorm other uses
   B. Debate aforementioned class developed list on pros & cons
   C. What effect will warming Lake Mich. have on drinking water quality of city water (eg. Green Bay), from blue-green algae tastes?
OBJECTIVES

1. Student-centered activity

SUGGESTED LEARNING EXPERIENCES

IT. Outside Resource and Community Activities

A. After discussing the production of power using atomic energy, tackle the following problem:

Since the water used in cooling an atomic reactor is considered thermal pollution, what alternatives are available?

1. It is not a problem
2. Use a cooling tower
3. Pipe it for residential heating
4. Put pipes in road for snow & ice removal
5. Various industrial uses
6. Fish pond culture/cooling
7. Brainstorm other uses

B. Debate aforementioned ideas developed list on pros & cons.

C. What effect will warming Lake Michigan have on drinking water quality of city water (e.g., Green Bay), from blue-green algae taste?

DISCIPLINE AREA

Subject: Electricity-Electronics

Grade: 7-12

Problem Orientation: The Alternatives

To Thermal Pollution

The alternatives for handling thermal pollution are discussed.
Resource and Reference Materials

Publications:
Literature from AEC
Address below.

Audio-Visual:
Power & Promise
AEC Chicago Operations Office
Office of Information
9800 S. Cass Ave.
Argonne, Ill., 60439

Community:
1. AEC -(Atomic Energy Commission
2. Marine biologist -U.W. Green Bay
3. DNR Fishery division
   Appleton, Wis (co-operators of Point Beach Nuclear Reactor.
5. Wisconsin Public Service (operator of Carlton Nuclear Reactor)

Continued and Additional Suggested Literature

1. With 2 aquariums set up with fish induce thermal pollution & obs

Technical note: Temperatures above & become damaging to most warm water fish above 70-75 degrees become damaging to warm water fish such as trout & white fish
1. With 2 aquariums set up with fish & vegetation, induce thermal pollution & observe results.

Technical note: Temperatures above 85-90 degrees become damaging to most warm water fish. Temperature above 70-75 degrees become damaging to most cold water fish such as trout & white fish.
Short-term economic gains may produce long-term environmental losses.

Behavorial Objectives

Cognitive: The student will list 3 areas in house wiring where meeting code minimums may prove insufficient over a period of time, & why.

Affective: The student will realize the need for planning ahead in house wiring and using proper materials even though the cost may be higher.

Skills to be Learned
1. Cost analysis sheets
2. Electrical codes

Suggested Learning Experiences

I. Student-centered in class activity
   A. Presentation on local electrical building codes and requirements by building inspector or local electrician.
   B. Discuss why these codes should be met and even exceeded.
      1. Added appliances in future.
      2. Failure of minimum facilities
   C. Introduce and discuss flat-rate book for electrical work-new work vs. remodeling.
      (Minimal equipment & facilities will have to be replaced as time goes on & other appliances are added, etc.)
      1. Install outlet-new-$15.00
      2. Install Outlet-remodel work-$30.00
   D. Brainstorm wastes brought about by necessity of re-wiring (Cont')
**SUGGESTED LEARNING EXPERIENCES**

<table>
<thead>
<tr>
<th><strong>ORAL OBJECTIVES</strong></th>
<th><strong>I. Student-Centered in class activity</strong></th>
<th><strong>II. Outside Resource</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The student areas in</td>
<td>A. Presentation on local electrical building codes and requirements by building inspector or local electrician.</td>
<td>Community Activities</td>
</tr>
<tr>
<td>where minimums are insufficient</td>
<td>B. Discuss why these codes should be met and even exceeded.</td>
<td>1. Building inspector</td>
</tr>
<tr>
<td>od of time, the student</td>
<td>1. Added appliances in future.</td>
<td>2. Local electrician</td>
</tr>
<tr>
<td>has the need to plan and buy materials</td>
<td>2. Failure of minimum facilities</td>
<td>3. Local contractor</td>
</tr>
<tr>
<td>for the cost</td>
<td>C. Introduce and discuss flat-rate book for electrical work-new work vs. remodeling.</td>
<td>(Minimal equipment &amp; facilities will have to be replaced as time goes on &amp; other appliances are added, etc.)</td>
</tr>
<tr>
<td>Learned from analysis sheets</td>
<td>1. Install outlet-new-$15.00</td>
<td>1. Install outlet-new-$15.00</td>
</tr>
<tr>
<td>all codes</td>
<td>2. Install Outlet-remodel work-$30.00</td>
<td>2. Install Outlet-remodel work-$30.00</td>
</tr>
<tr>
<td></td>
<td>D. Brainstorm wastes brought about by necessity of re-wiring (Con't)</td>
<td></td>
</tr>
<tr>
<td>Resource and Reference Materials</td>
<td>Continued and Additional Suggested Learning</td>
<td></td>
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<tr>
<td>----------------------------------</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Publications:</strong></td>
<td>(Con’t from 1. D)</td>
<td></td>
</tr>
<tr>
<td>1. Contractors Flat-Rate Manual</td>
<td>1. Natural resources in building materials</td>
<td></td>
</tr>
<tr>
<td>2. National Electrical Code</td>
<td>must be dismantled.</td>
<td></td>
</tr>
<tr>
<td>National Fire Protection Assoc.</td>
<td>2. Copper from wire which must be discarded.</td>
<td></td>
</tr>
<tr>
<td>Public Service Commission</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Audio-Visual:**

**Community:**

1. Local electrician
2. Local contractor
3. Building inspector

1. Set up model or mock-up of wall section, students actually install an outlet (i.e., have students install outlet in finished wall). Now put in inside wall covering (i.e., plaster, etc.). Note difference in time & effort involved.
Continued and Additional Suggested Learning Experiences

1. Natural resources in building materials of walls must be dismantled.
2. Copper from wire which must be discarded & replaced
3. Time needed to make necessary changes

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Set up model or mock-up of wall section &amp; have students actually install an outlet (in bare framing). Now put in inside wall covering (ie. paneling) and have students install outlet in finished wall. Note difference in time &amp; effort involved.</td>
</tr>
<tr>
<td>Concept</td>
<td>Event</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
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</tr>
</tbody>
</table>

**Behavioral Objectives**

<table>
<thead>
<tr>
<th>Cognitive</th>
<th>Affective</th>
<th>Skills to be Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student will be able to construct an electromagnet, and vary its carrying capacity.</td>
<td>The student will realize that every individual act changes the system of which it is a part.</td>
<td>How to make an electromagnet. How to increase the force of an electromagnet. How individual acts compound.</td>
</tr>
</tbody>
</table>

**Suggested Learning Activity**

I. Student-Centered in class activity

A. Students will study the methods of increasing the strength of an electromagnet.
   1. Increase current
   2. Increase turns of wire.
   3. Increase size of core
   4. Change core material

B. Students will make an electromagnet and keep adding turns of wire until current flow is too low and system fails.

C. Discuss how A & B relate to environmental problems:
   1. Throwing paper on streets.
   2. Too many taps on water line.
   3. Overloading sewage plants
   4. Overloading power supply.
Individual acts, duplicated

Suggested Learning Experiences
I. Student-Centered in class activity
   A. Students will study the methods of increasing the strength of an electromagnet.
      1. Increase current
      2. Increase turns of wire.
      3. Increase size of core
      4. Change core material
   B. Students will make an electromagnet and keep adding turns of wire until current flow is too low and system fails.
   C. Discuss how A. & B. relate to environmental problems.
      1. Throwing paper on streets.
      2. Too many taps on water line.
      3. Overloading sewage plants
      4. Overloading power supply.

II. Outside Resource and Community Activities
   Rep. from telephone co. to speak on electromagnetism.
<table>
<thead>
<tr>
<th>Resource and Reference Materials Continued and Additional Suggested</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Publications:</strong></td>
</tr>
<tr>
<td>Modern General Shop,</td>
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<tr>
<td>Walter C. Brown</td>
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<tr>
<td>Goodhearth-Willcox</td>
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<tr>
<td>Introduction To Electricity,</td>
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<tr>
<td>and Electronics,</td>
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<tr>
<td>Loper and AFR</td>
</tr>
<tr>
<td>Delmar Publisher</td>
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<tr>
<td><strong>Audio-Visual:</strong></td>
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<tr>
<td>Electromagnets: How They Work #01153</td>
</tr>
<tr>
<td>University of Ill., Champaign, Ill.</td>
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<td>Ferromagnetic Domain Unit</td>
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<tr>
<td>Bell Telephone Co.</td>
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<td><strong>Community:</strong></td>
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<tr>
<td>Rep. from telephone co.</td>
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</tbody>
</table>
12. Private ownership must be regarded as a stewardship and should not encroach upon or violate the individual right of others.

BEHAVIORAL OBJECTIVES

Cognitive: The student will show in writing the relationship of the FCC-OPER-BCI-TV & give 3 specific examples.

Affective: The student will become aware that transmitter operation carries responsibilities to others.

Skills to be Learned
1. Transmitter design, tuning & operation.
2. FCC rules & regs. (rights of others)
3. Licensing procedures.

SUGGESTED LEARNING ACTIVITIES

I. Student-Centered in class activity
   A. What effects are produced by an improperly tuned R.F. transmitter/antenna.
      1. Inefficiency
      2. Improper coupling
      3. Chirping
      4. R.F. shift
      5. Over/under modulation
      6. Harmonics

   B. Why must BCI & TVI be curtailed.
      1. Rights of others
      2. Pride of operation
      3. FCC Rules & regulations (The FCC monitors to protect rights of others & to insure proper operation of the station)

   C. Discuss cause & effect between A & B.

   D. What can be done to cure BCI & TVI
      1. Tune & design trans. equip. properly (discuss various stages of tran
Membership must be stewardship and each upon or violate right of others.

Discipline Area: Industrial Arts
Subject: Electricity-Electronics
Problem Orientation: BCI & TVI & Rights of Others
Grade: 11-12

<table>
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<th>CTIVES</th>
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<td></td>
<td>II. Outside Resource and Community Activities</td>
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<tr>
<td></td>
<td>1. Local first class radio-TV engineer</td>
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<td></td>
<td>2. Rep. from FCC (U.S. Courthouse, 219 S. Clark St., Chicago, Ill.)</td>
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<td></td>
<td>3. Radio &amp; TV repairmen</td>
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Community Activities
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<tr>
<td>Introduction to Electricity &amp;</td>
<td>1. Establish &amp; operate a &quot;ham station&quot; &amp; encourage</td>
</tr>
<tr>
<td>Electronics, Loper &amp; AHR</td>
<td>students to earn &quot;ham tickets&quot;</td>
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<tr>
<td>Delmar Pub., Albany, N.Y.</td>
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<tr>
<td>Radio Amateurs Handbook</td>
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<tr>
<td>American Radio Relay League</td>
<td></td>
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<tr>
<td>Electronic Communication</td>
<td></td>
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<tr>
<td>Robert L. Strader</td>
<td></td>
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<tr>
<td>McGraw-Hill Book Co.</td>
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**Audio-Visual:**

**Community:**

1. Radio-TV eng-1st class
2. Radio-TV repairman
3. FCC rep.
Continued and Additional Suggested Learning Experiences

1. Establish & operate a "ham station" & encourage students to earn "ham tickets"
PROJECT I-C-E Episode Evaluation Form (Reproduce or copy as needed)

Please fill in:
Subject: ________________________
Grade: _________________________
Concept No. Used: ______________

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<th>Poor</th>
<th>Good</th>
<th>Exc.</th>
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I. Behavioral Objectives
   A. Cognitive:
      E. Affective:

II. Skills Developed

III. Suggested Learning Experiences
   A. In Class:

   B. Outside & Community Activities:

IV. Suggested Resource & Reference Materials
   (specific suggestions & comments)

In commenting on each episode use the form. Feel free to adapt it and add your critiques and comments - negative and positive. In the hand column, please rate (poor, good, excellent) and make specific comments or suggestions provided to help us make this a more useful tool.
CT I-C-E Episode Evaluation Form (Reproduce or duplicate as needed)

In commenting on each episode used in your class, please use this form. Feel free to adapt it and add more pages. Let us know all your critiques and comments - negative and positive. In the left-hand column, please rate (poor, good, excellent) each item. Also, make specific comments or suggestions if possible in the space provided to help us make this a more usable guide. Thank you.

I. Behavioral Objectives
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   B. Outside & Community Activities:

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