DOCUMENT RESUME

ED 190 363 SE 031 307

AUTHOR Bonar, John R., Ed.: Hathway, James A., Ed.
TITLE Probing the Natural World, Level III, Record Book, Teacher's Edition: Environmental Science. Intermediate Science Curriculum Study.
INSTITUTION Florida State Univ., Tallahassee. Dept. of Science Education.
SPONS AGENCY National Science Foundation, Washington, D.C.: Office of Education (DHEW), Washington, D.C.
PUB DATE 72
NOTE 79p.: For related documents, see SE 031 300-330, ED 035 559-560, ED 049 032, and ED 052 940. Contains colored print which may not reproduce well.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Answer Sheets: Environmental Education: Grade 9: Individualized Instruction: Industry: Instructional Materials: Junior High Schools: *Laboratory Manuals: Laboratory Procedures: *Natural Resources: Records (Forms): *Science Activities: Science Course Improvement Projects: Science Education: Secondary Education: Secondary School Science
IDENTIFIERS *Intermediate Science Curriculum Study

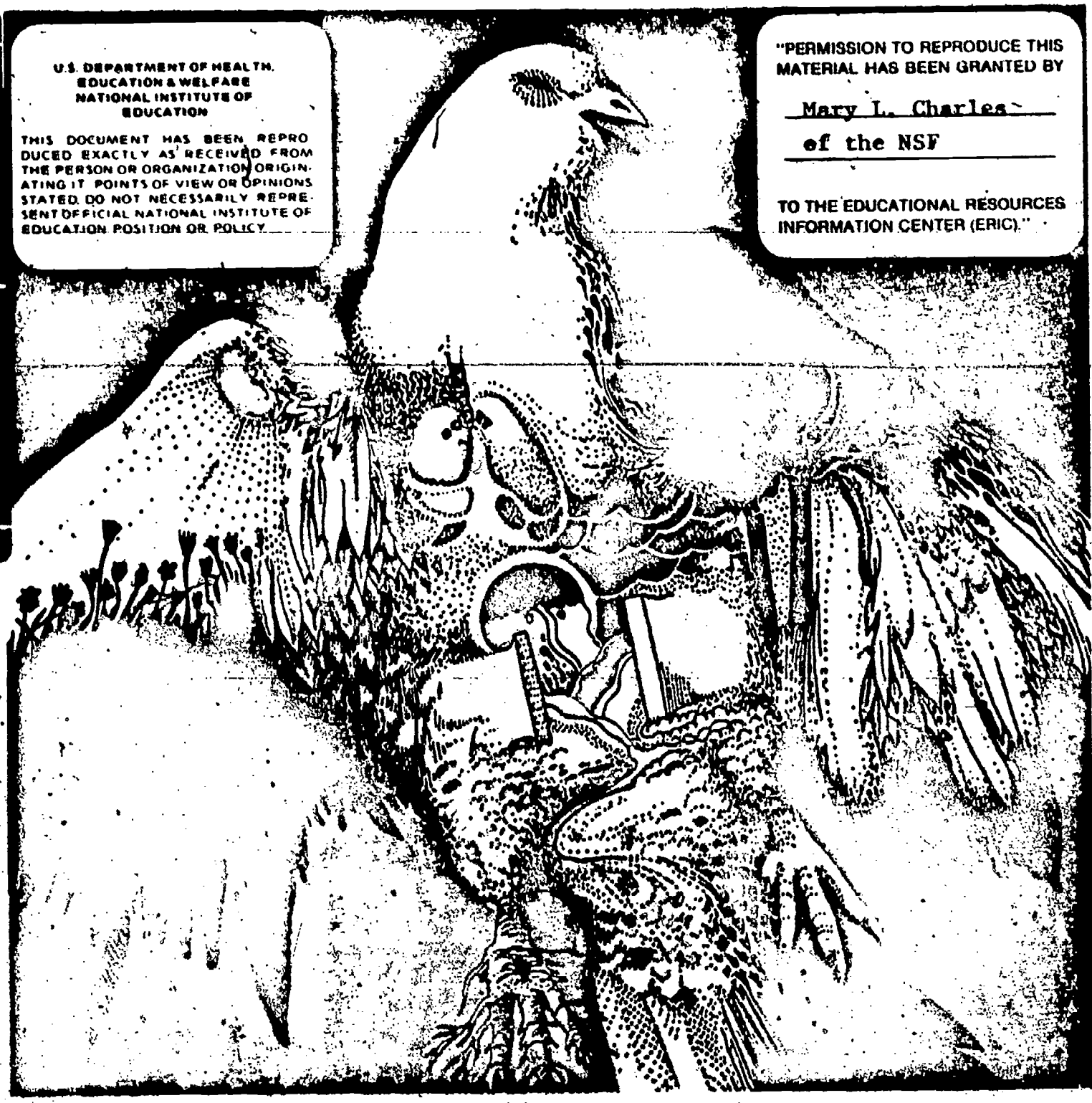
ABSTRACT

This is the teacher's edition of the Record Book for the unit "Environmental Science" of the Intermediate Science Curriculum Study (ISCS) for level III students (grade 9). The correct answers to the questions from the student text are recorded. An introductory note to the teacher explains how to use the book. Answers are included for the activities and excursions. A self evaluation section is followed by its answer key. (SA)

Record Book

TEACHER'S EDITION

Environmental Science



Probing the Natural World/3

INTERMEDIATE SCIENCE CURRICULUM STUDY

THIS BOOK IS THE PROPERTY OF:

STATE _____
PROVINCE _____
COUNTY _____
PARISH _____
SCHOOL DISTRICT _____
OTHER _____

Book No. _____
Enter information in spaces to the left as instructed

ISSUED TO	Year Used	CONDITION	
		ISSUED	RETURNED

PUPILS to whom this textbook is issued must not write on any page or mark any part of it in any way, consumable textbooks excepted.

1. Teachers should see that the pupil's name is clearly written in ink in the spaces above in every book issued.
2. The following terms should be used in recording the condition of the book: New; Good; Fair; Poor; Bad.

INTERMEDIATE SCIENCE CURRICULUM STUDY TEACHER'S EDITION

Record Book

Environmental Science

Probing the Natural World / Level III

SILVER BURDETT
GENERAL LEARNING CORPORATION
Morristown, New Jersey · Park Ridge, Ill. · Palo Alto · Dallas · Atlanta

ISCS PROGRAM

LEVEL I

Probing the Natural World / Volume 1 / with Teacher's Edition
Student Record Book / Volume 1 / with Teacher's Edition
Master Set of Equipment / Volume 1
Test Resource Booklet

LEVEL II

Probing the Natural World / Volume 2 / with Teacher's Edition
Record Book / Volume 2 / with Teacher's Edition
Master Set of Equipment / Volume 2
Test Resource Booklet

LEVEL III

Why You're You / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Environmental Science / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Investigating Variation / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
In Orbit / with Teacher's Edition,
Record Book / with Teacher's Edition / **Master Set of Equipment**
What's Up? / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Crusty Problems / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Winds and Weather / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Well-Being / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**

ACKNOWLEDGMENTS

The work presented or reported herein was performed pursuant to a Contract with the U. S. Office of Education, Department of Health, Education, and Welfare. It was supported, also, by the National Science Foundation. However, the opinions expressed herein do not necessarily reflect the position or policy of the U. S. Office of Education or the National Science Foundation, and no official endorsement by either agency should be inferred.

ISCS STAFF

David D. Redfield, *Co-Director*
William R. Snyder, *Co-Director*
Ernest Burkman, *Steering Committee Chairman*

*Laura M. Bell, *Artist*
*John R. Bonar, *Editor*
Drennen A. Browne, *Artist*
*Harold L. Buell, *Administration*
Robert L. Cocanougher, *Art Director*
*Betsy Conlon Balzano, *Evaluation*
Stewart P. Darrow, *Field Trial-Teacher Education*
George O. Dawson, *Teacher Education*
James A. Hathway, *Editor*
*John S. Hutchinson, *Field Trial Teacher Education*
*Sally Diana Kaicher, *Art Director*
*Jane Larsen, *Art Director*
Adrian D. Lovell, *Administration*
*Audley C. McDonald, *Administration*
*W. T. Myers, *Administration*
Lynn H. Rogers, *Artist*
Stephen C. Smith, *Artist*
Lois S. Wilson, *Assistant Editor*

ISCS ADVISORY COMMITTEE

J. Myron Atkin, *University of Illinois*
Betsy Conlon Balzano, *State University of New York at Brockport*
Werner A. Baum, *University of Rhode Island*
Herman Branson, *Lincoln University*
*Martha Duncan Camp, *The Florida State University*
Clifton B. Clark, *University of North Carolina at Greensboro*
Steve Edwards, *The Florida State University*
Robert M. Gagné, *The Florida State University*
Edward Haenisch, *Wabash College*
*Michael Kasha, *The Florida State University*
Russell P. Kropp, *The Florida State University*
J. Stanley Marshall, *The Florida State University*
William V. Mayer, *University of Colorado*
Herman Parker, *University of Virginia*
Craig Sipe, *State University of New York at Albany*
*Harry Sisler, *University of Florida*
Clifford Swartz, *State University of New York at Stony Brook*
Claude A. Welch, *Macalester College*
Gates Willard, *Manhasset Junior High School, Manhasset, N.Y.*
Herbert Zim, *Science Writer, Tavernier, Florida*

**Former member*

MATERIALS DEVELOPMENT CONTRIBUTORS

This list includes writing-conference participants and others who made significant contributions to the materials, including text and art for the experimental editions.

Janet Anderson, *Nyack, N.Y.* Gerald R. Bakker, *Earlham College.* Frank Balzano, *F.S.U.* Harald N. Bliss, *Mayville State College.* Olaf A. Boedtker, *Oregon State Univ.* Calvin E. Bolin, *F.S.U.* Earl Brakken, *Two Harbors, Minn.* Bobby R. Brown, *F.S.U.* Robert J. Callahan, Jr. (*deceased*). Brian W. Carss, *University of Illinois.* Lois H. Case, *Lombard, Ill.* Clifton B. Clark, *University of North Carolina at Greensboro.* Sara P. Craig, *F.S.U.* John D. Cunningham, *Keene State College.* David H. Dasenbrock, *F.S.U.* Doris Dasenbrock, *F.S.U.* Jeff C. Davis, *University of South Florida.* Alan D. Dawson, *Dearborn Public Schools, Mich.* George O. Dawson, *F.S.U.* Gerrit H. DeBoer, *F.S.U.* Howard E. DeCamp, *Glenn Ellyn, Ill.* James V. DeRose, *Newtown Square, Pa.* William A. Deskin, *Cornell College.* William K. Easley, *Northeast Louisiana State College.* Donald C. Edinger, *University of Arizona.* Camillo Fano, *University of Chicago Laboratory School.* Ronald A. Fisher, *Maquoketa, Iowa.* Edwin H. Flemming, *F.U.S.* Paul K. Flood, *F.S.U.* Harper W. Frantz, *Pasadena City College (Emeritus).* Earl Friesen, *San Francisco State College.* Bob Galati, *Fullerton, Calif.* J. David Gavenda, *The University of Texas.* Charles A. Gilman, *Winchester, N.H.* Robert J. Goll, *Jacksonville University.* Ralph H. Granger, Jr., *Walpole, N.H.* H. Winter Griffith, *F.S.U.* William Gunn, *Miami, Florida.* John Hart, *Xavier University.* John R. Hassard, *Georgia State University.* J. Dudley Herron, *Purdue University.* Father Francis Heyden, S.J., *Georgetown University.* Leonard Himes, *Sarasota, Florida.* Evelyn M. Hurlburt, *Montgomery Junior College.* John R. Jablonski, *Boston University.* Bert M. Johnson, *Eastern Michigan University.* Roger S. Jones, *University of Minnesota.* Leonard A. Kalal, *Colorado School of Mines.* Theodore M. Kellogg, *University of Rhode Island.* Elizabeth A. Kendzior, *University of Illinois.* F. J. King, *F.S.U.* David Klasson, *Millville, Calif.* Ken Kramer, *Wright State University.* Willian H. Long, *F.S.U.* Robert Lepper, *California State College.* Harold G. Liebherr, *Milwaukee, Wis.* William D. Larson, *College of St. Thomas.* Mable M. Lund, *Beaverton, Oregon.* H. D. Luttrell, *North Texas State University.* Maxwell Maddock, *F.S.U.* Solomon Malinsky, *Sarasota, Florida.* Eloise A. Mann, *Sarasota, Florida.* Harleen W. McAda, *University of California at Santa Barbara.* Auley A. McAuley, *Michigan State University.* E. Wesley McNair, *F.S.U.* Marilyn Miklos, *F.S.U.* Floyd V. Monaghan, *Michigan State University.* Rufus F. Morton, *Westport, Conn.* Tamson Myer, *F.S.U.* Gerald Neufeld, *F.S.U.* James Okey, *University of California.* Lawrence E. Oliver, *F.S.U.* Larry O'Rear, *Alice, Texas.* Herman Parker, *University of Virginia.* Harry A. Pearson, *Western Australia.* James E. Perham, *Randolph-Macon Woman's College.* Darrell G. Phillips, *University of Iowa.* Howard Pierce, *F.S.U.* David Poché, *F.S.U.* Charles O. Pollard, *Georgia Institute of Technology.* Glenn F. Powers, *Northeast Louisiana State College.* Ernest Gene Preston, *Louisville, Ky.* Edward Ramey, *F.S.U.* Earl R. Rich, *University of Miami.* John Schaff, *Syracuse University.* Carroll A. Scott, *Williamsburg, Iowa.* Earle S. Scott, *Ripon College.* Thomas R. Spalding, *F.S.U.* Michael E. Stuart, *University of Texas.* Sister Agnes Joseph Sun, *Marygrove College.* Clifford Swartz, *State University of New York.* Thomas Teates, *F.S.U.* Bill W. Tillery, *University of Wyoming.* Ronald Townsend, *University of Iowa.* Mordecai Treblow, *Bloomsburg State College.* Henry J. Triezenberg, *National Union of Christian Schools.* Paul A. Vestal, *Rollins College.* Robert L. Vickery, *Western Australia.* Frederick B. Voight, *F.S.U.* Claude A. Welch, *Macalester College.* Paul Westmeyer, *F.S.U.* Earl Williams, *University of Tampa.* G. R. Wilson, Jr., *University of South Alabama.* Harry K. Wong, *Atherton, California.* Charles M. Woolheater, *F.S.U.* Jay A. Young, *King's College.* Victor J. Young, *Queensborough Community College.*

The genesis of some of the ISCS material stems from a summer writing conference in 1964. The participants were:

Frances Abbott, *Miami-Dade Junior College.* Ronald Atwood, *University of Kentucky.* George Assousa, *Carnegie Institute.* Colin H. Barrow, *University of West Indies.* Peggy Bazzel, *F.S.U.* Robert Binger (deceased). Donald Bucklin, *University of Wisconsin.* Martha Duncan Camp, *F.S.U.* Roy Campbell, *Broward County Board of Public Instruction, Fla.* Bruce E. Cleare, *Tallahassee Junior College.* Ann-cile Hall, *Pensacola, Florida.* Charles Holcolmb, *Mississippi State College.* Robert Kemman, *Mt. Prospect, Ill.* Gregory O'Berry, *Coral Gables, Florida.* Elra Palmer, *Baltimore.* James Van Pierce, *Indiana University Southeast.* Guenter Schwarz, *F.S.U.* James E. Smeland, *F.S.U.* C. Richard Tillis, *Pine Jog Nature Center, Florida.* Peggy Wiegand, *Emory University.* Elizabeth Woodward, *Augusta College.* John Woolever, *Sarasota, Florida.*

Foreword

A pupil's experiences between the ages of 11 and 16 probably shape his ultimate view of science and of the natural world. During these years most youngsters become more adept at thinking conceptually. Since concepts are at the heart of science, this is the age at which most students first gain the ability to study science in a really organized way. Here, too, the commitment for or against science as an interest or a vocation is often made.

Paradoxically, the students at this critical age have been the ones least affected by the recent effort to produce new science instructional materials. Despite a number of commendable efforts to improve the situation, the middle years stand today as a comparatively weak link in science education between the rapidly changing elementary curriculum and the recently revitalized high school science courses. This volume and its accompanying materials represent one attempt to provide a sound approach to instruction for this relatively uncharted level.

At the outset the organizers of the ISCS Project decided that it would be shortsighted and unwise to try to fill the gap in middle school science education by simply writing another textbook. We chose instead to challenge some of the most firmly established concepts about how to teach and just what science material can and should be taught to adolescents. The ISCS staff have tended to mistrust what authorities believe about schools, teachers, children, and teaching until we have had the chance to test these assumptions in actual classrooms with real children. As conflicts have arisen, our policy has been to rely more upon what we saw happening in the schools than upon what authorities said could or would happen. It is largely because of this policy that the ISCS materials represent a substantial departure from the norm.

The primary difference between the ISCS program and more conventional approaches is the fact that it allows each student to travel

at his own pace, and it permits the scope and sequence of instruction to vary with his interests, abilities, and background. The ISCS writers have systematically tried to give the student more of a role in deciding what he should study next and how soon he should study it. When the materials are used as intended, the ISCS teacher serves more as a "task easer" than a "task master." It is his job to help the student answer the questions that arise from his own study rather than to try to anticipate and package what the student needs to know.

There is nothing radically new in the ISCS approach to instruction. Outstanding teachers from Socrates to Mark Hopkins have stressed the need to personalize education. ISCS has tried to do something more than pay lip service to this goal. ISCS' major contribution has been to design a system whereby an average teacher, operating under normal constraints, in an ordinary classroom with ordinary children, can indeed give maximum attention to each student's progress.

The development of the ISCS material has been a group effort from the outset. It began in 1962, when outstanding educators met to decide what might be done to improve middle-grade science teaching. The recommendations of these conferences were converted into a tentative plan for a set of instructional materials by a small group of Florida State University faculty members. Small-scale writing sessions conducted on the Florida State campus during 1964 and 1965 resulted in pilot curriculum materials that were tested in selected Florida schools during the 1965–66 school year. All this preliminary work was supported by funds generously provided by The Florida State University.

In June of 1966, financial support was provided by the United States Office of Education, and the preliminary effort was formalized into the ISCS Project. Later, the National Science Foundation made several additional grants in support of the ISCS effort.

The first draft of these materials was produced in 1968, during a summer writing conference. The conferees were scientists, science educators, and junior high school teachers drawn from all over the United States. The original materials have been revised three times prior to their publication in this volume. More than 150 writers have contributed to the materials, and more than 180,000 children, in 46 states, have been involved in their field testing.

We sincerely hope that the teachers and students who will use this material will find that the great amount of time, money, and effort that has gone into its development has been worthwhile.

Tallahassee, Florida
February 1972

The Directors
INTERMEDIATE SCIENCE CURRICULUM STUDY

Contents

SELF-EVALUATIONS

Notes to the Student

This Record Book is where you should write your answers. Try to fill in the answer to each question as you come to it. If the lines are not long enough for your answers, use the margin, too.

Fill in the blank tables with the data from your experiments. And use the grids to plot your graphs. Naturally, the answers depend on what has come before in the particular chapter or excursion. Do your reading in the textbook and use this book only for writing down your answers.

Notes to the Teacher

In almost every instance, variable answers are of a quantitative nature and are based on measurements the students themselves make. In these cases, other answers may also be accepted.

Chapter 1
The Black Death

☐1-1. General trend should be similar to that shown below.

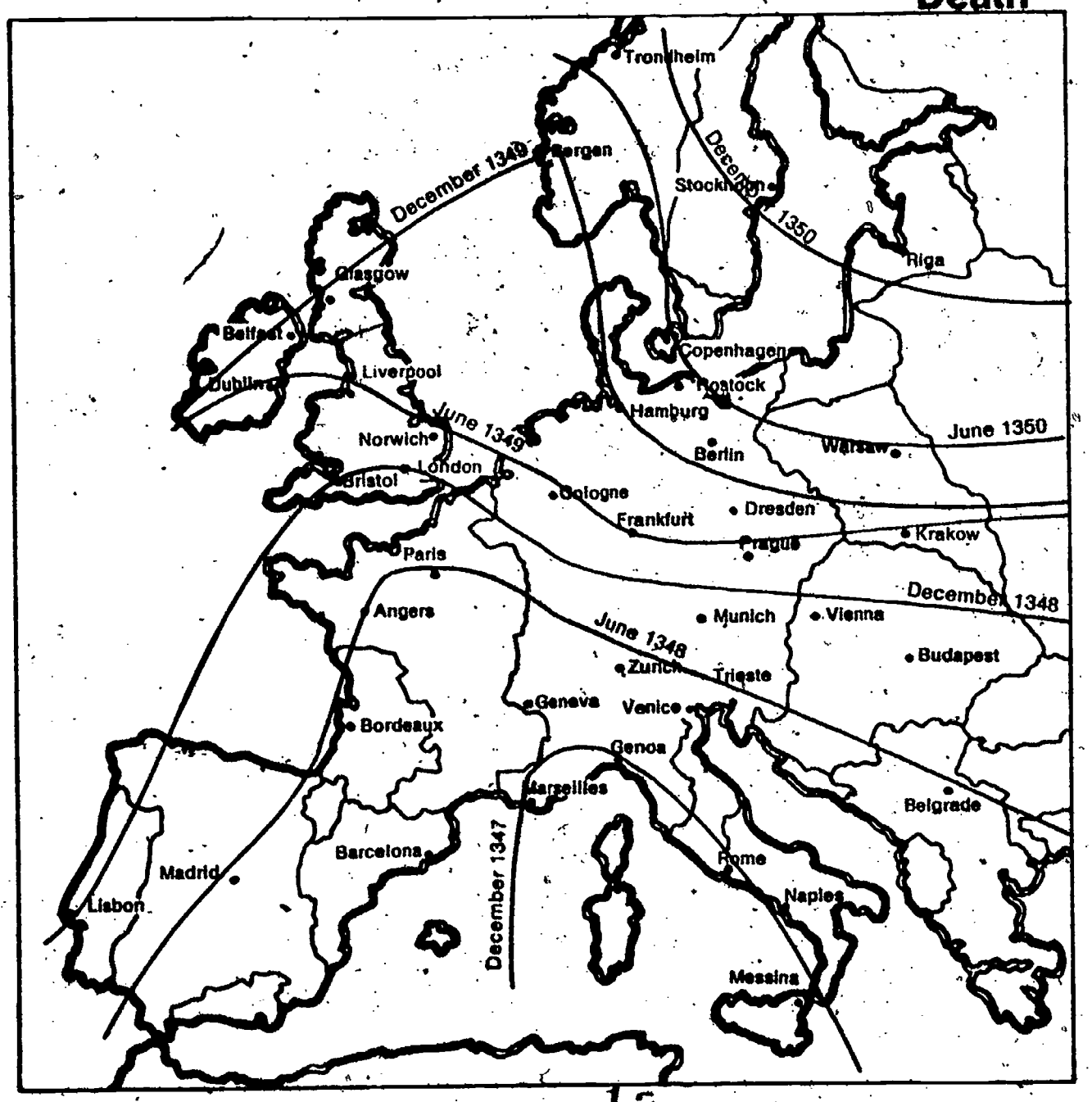


Figure 1-1

Chapter 2 Can You Match It?

☐2-1. No, except that it takes up space

☐2-2. It changed the surroundings by adding heat, light, and other products such as smoke and ash.

☐2-3. Yes; I could smell the smoke, see the light, and feel the heat (if I tried).

☐2-4. Answers will vary depending on knowledge of the meaning of "chemical change." Probable answer for those who have concept: New products were formed as reactants were used up.

CHECKUP

1.	a. ✓	b. ✓	c. ✓	d. ___
2.	a. ✓	b. ___	c. ✓	d. ✓
3.	a. ___	b. ✓	c. ✓	d. ___

☐2-5. Had to strike it (rub it on the sandpaper)

☐2-6. Heat

☐2-7. Heat, light, ash, smoke (hot gases and solids)

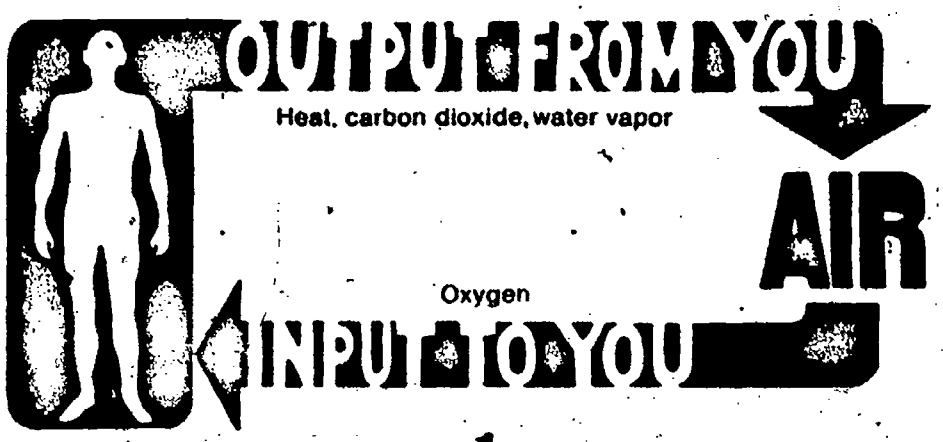
☐2-8. Water (H_2O or HOH)

☐2-9. Heat and light

☐2-10. Oxygen

☐2-11. Yes; answers will vary: may include adding heat, carbon dioxide, water vapor, or moisture, and taking away oxygen.

Figure 2-6 ☐2-12.



☐2-13. Yes

☐2-14.

2-14. Answers will vary. *If familiar with the photosynthetic process

Corn Plant	Rat	"Bug"	Fox
*Carbon dioxide	Oxygen	Oxygen	Oxygen
*Oxygen	Water	Water	Water
Water	Food	Food	Food
Other chemical nutrients			
Sunlight			

☐2-15.

2-15. Answers will vary. *If familiar with photosynthetic process **If familiar with transpiration in green plants

Corn Plant	Rat	"Bug"	Fox
*Oxygen	Carbon dioxide	Carbon dioxide	Carbon dioxide
**Water vapor (from leaves)	Waste products (including its own body after death	Waste products (including its own body after death	Waste products (including its own body after death)
Seeds			
Waste products (including its own body after death)			

☐2-16. The corn plant may provide food for the rat. The rat may serve as food for the fox. In other words, the rat may eat the grain or the plant, and the fox may eat the rat. So also, the bug may eat the corn and be eaten by the fox.

☐2-17. The plant releases oxygen to the atmosphere.* The fox, rat, and "bug" may then use some of that oxygen. The body wastes of the fox, rat, and "bug" may be added to the soil. The plant may be fertilized by these waste products, or by the decaying animal bodies after their death.

2-17. *If familiar with photosynthetic process

☐2-18. Oxygen

☐2-19. Carbon dioxide

☐2-20.

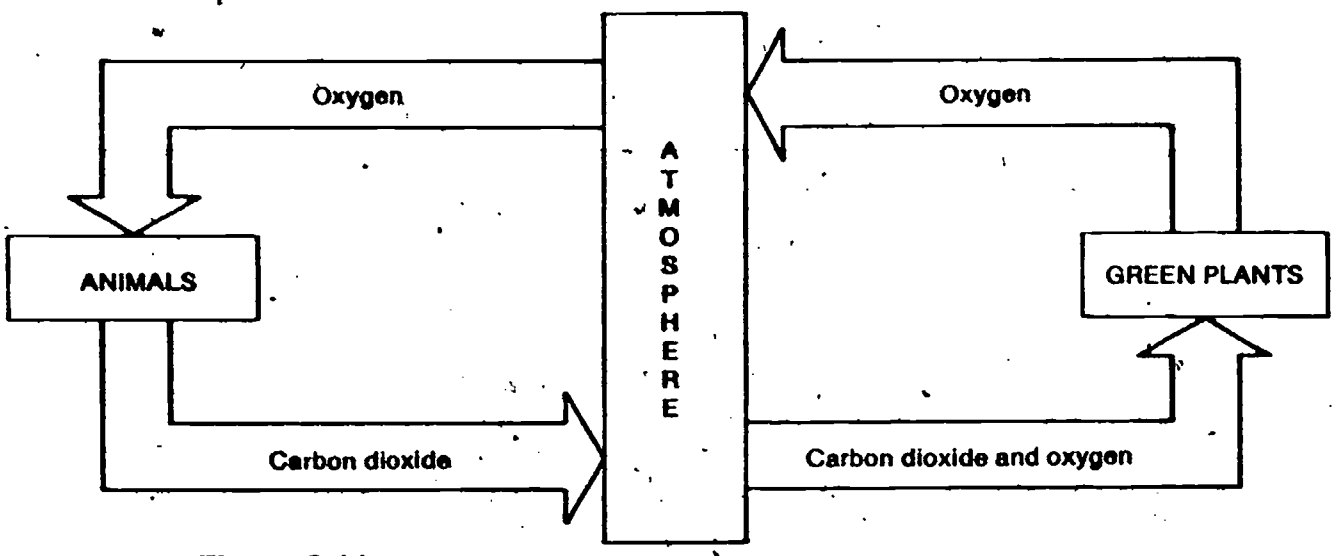


Figure 2-11

☐2-21. The amount of oxygen would decrease, and the amount of carbon dioxide would increase.

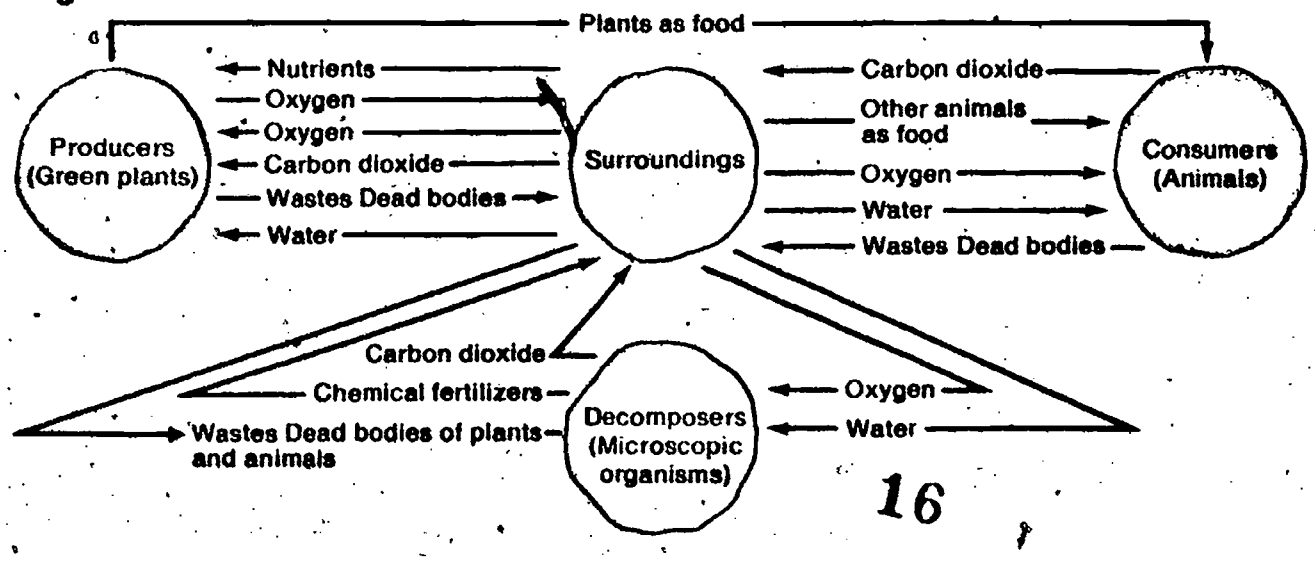
☐2-22. The amount of oxygen would be reduced. (The amount of carbon dioxide would also increase.)

☐2-23. Carbon dioxide gas and the animal's waste products. Dead bodies of animals can also benefit plants by serving as a source of plant food (fertilizer).

2-24. Answers will vary.

Figure 2-13

☐2-24.



☐2-25. The plants might increase in number. Animals that ordinarily live on the plant consumer might be without a source of food.

☐2-26. Breakdown of animal and plant wastes could not occur. Plants would not be able to use these wastes as fertilizer. Weakened plants provide less food, and all animals would be affected.

☐2-27. There would probably be a rapid decline in the population of the animals being consumed. (This would reduce the food supply for the other animals and would probably reduce their number.)

Chapter 3 Water, Water Everywhere . . . But . . .

☐3-1. From the water (Oxygen from the air dissolves in the water.)

☐3-2. Green plants

☐3-3. It should increase the size of the population.

☐3-4. It would increase the B.O.D. because the increased food supply would increase the population. The larger population would need more oxygen.

☐3-5. 6.0 ml

☐3-6. Tube 3

☐3-7. Tube 1

☐3-8. Some of the oxygen in the air near the surface of the liquid would dissolve. It would then react with the dissolved methylene blue.

☐3-9. Yes

☐3-10. The blue color will disappear (except at the surface of the liquid).

☐3-11. Answers will vary.

☐3-12. Answers will vary, depending on prediction (should be Yes).

☐3-13. Answers will vary, depending on prediction.

☐3-14. The oxygen must have been used up faster in tube 3 than in tube 2, and faster in tube 2 than in tube 1.

☐3-15. The oxygen would be used up faster and therefore there would be less oxygen in the water after the sewage is added to it.

☐3-16. It increases.

☐3-17. The B.O.D. would increase.

Test Tube	Time for Change to Occur		
	Time of Mixing	Time of Change	Total Time for Change
1			
2			
3			

Table 3-2

☐3-18. It would reduce the amount of oxygen available for the other populations.

☐3-19. 4; 8

☐3-20. 64

☐3-21.

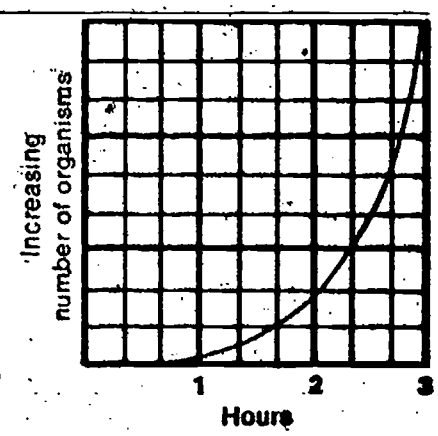


Figure 3-3

☐3-22. It should decrease the amount.

PROBLEM BREAK 3-1

Plan:

Results:

Conclusions:

PROBLEM BREAK 4-1

Chapter 4
The Undesirables

Initial appearance of vials:
Vial 1:
Vial 2:
Vial 3:
Vial 4:

Appearance after 1 day
Vial 1:
Vial 2:
Vial 3:
Vial 4:

Conclusions

1. _____

2. _____

3. _____

Table 4-1

Day Observed	Hours Elapsed	DISH C (Control): % Germinated	1% Detergent Solution: % Germinated	5% Detergent Solution: % Germinated
1				
2				
3				

4-1. The description will vary somewhat from student to student. There should be quite a noticeable difference between the seedlings in the control dish and those in the 5% solution.

☐**4-1.**

Day Observed	Description of Seedlings in Control Dish	Description of Seedlings in 1% Detergent Solution	Description of Seedlings in 5% Detergent Solution
1			
2			
3			

Table 4-2

PROBLEM BREAK 4-2

The function of root hairs on a plant is:

☐**4-2.** Yes

☐**4-3.** Yes; fewer seeds germinated in the detergent solution.

☐4-4. Numbers will vary from student to student.

☐4-5. Descriptions will vary slightly from student to student.

☐4-6. Answers will vary somewhat, but in general they should expect lower crop yields.

☐4-7. The amount of oxygen available decreases when the B.O.D. of an organism increases rapidly.

☐4-8. Other oxygen-using organisms would suffer from this decrease in oxygen available. They may leave the area or they may die.

☐4-9.

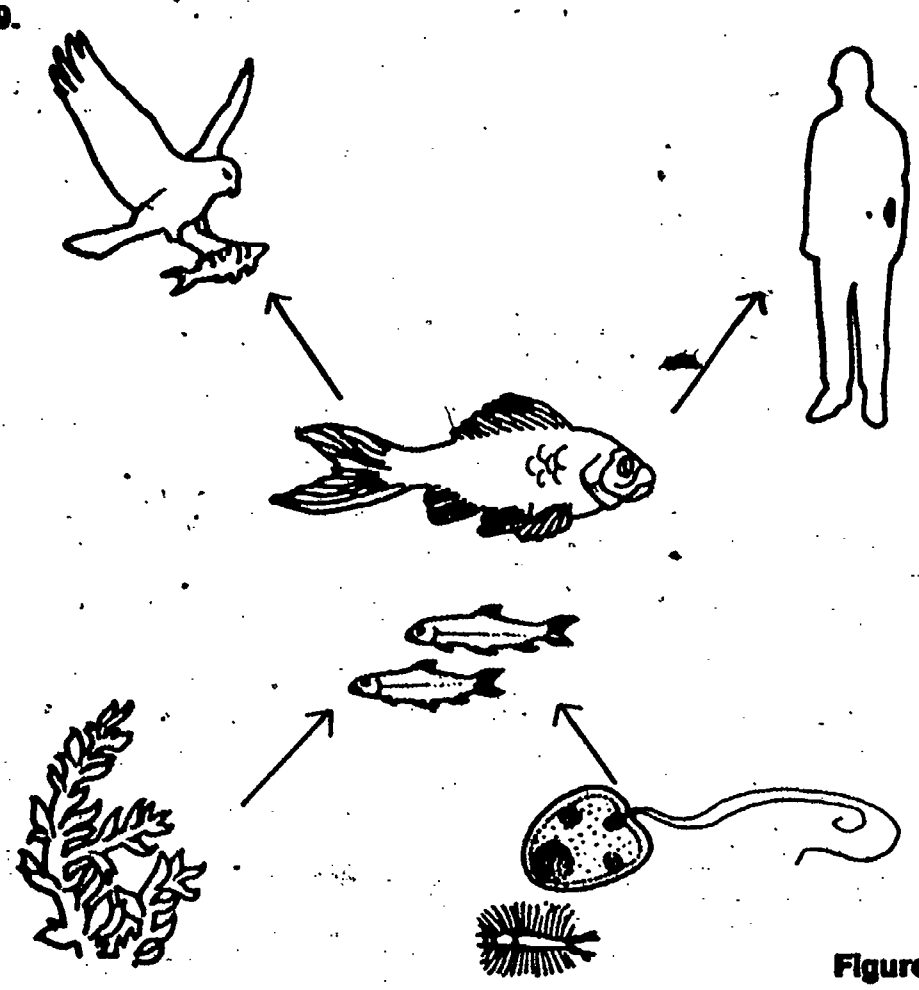


Figure 4-4

☐4-10. The nonbiodegradable wastes could kill organisms that accumulate the wastes in their bodies. The wastes could also decrease the oxygen content of the water if they accumulate on the surface of the water. They could harm plants and animals if they accumulate on the bottom of the lakes and rivers.

☐4-11. The larger the animal, the more it eats, and the more non-degradable chemicals it can store in its body.

☐4-12. The pesticides would be passed on and stored in our bodies.

☐4-13. Any animals that have come in contact in some way with pesticides could transfer the pesticides to the human body.

☐4-14. Answers will vary.

PROBLEM BREAK 4-4

Arguments for banning pesticides:

Arguments against banning pesticides:

PROBLEM BREAK 4-5

Arguments for plant fertilizers:

Arguments against plant fertilizers:

☐5-1. Increasing temperature increases the rate of a chemical change.

Table 5-1

Container	Temperature	Activity (respiration for 20 sec.)	Average Count	Other Observations
A		1. 2. 3.		
B		1. 2. 3.		

☐5-2. The breathing rate of the fish increased in the warmer water.

☐5-3. The fish seemed more active in the warmer water.

☐5-4. Warm-blooded

☐5-5. The fish's temperature would decrease in the cooler water. The fish would probably become less active.

☐5-6. The student will probably predict a decrease in breathing rate.

OPTIONAL ACTIVITY

Plan:

Equipment:

Observations:

Conclusions:

Teacher's Initials_____

☐5-7. It probably would have died.

☐5-8. Goldfish can be kept in water at room temperature. Brook trout would have to be kept in cold water.

PROBLEM BREAK 5-1

Conclusions:

☐5-9. Increased water temperature would probably cause an increase in the rate of chemical reactions inside the fish.

Table 5-3

Test Tube No.	Temperature (C°)	Starting Time from Activity 5-12	Time When Color Disappears	Total Time for Decolorization (minutes)
1	Room temperature (24-26°)			
2	Warm (35-40°)			
3	Warm (35-40°)			

☐5-10. Yes; the higher the temperature of the water, the faster the oxygen was used.

☐5-11. Yes

☐5-12. A control

☐5-13. No

☐5-14. Yes

☐5-15. Yes

☐5-16. The amount of oxygen gas that will dissolve in water decreases with increasing temperature.

☐5-17. You'd expect him to be in cold water, where there was more oxygen.

☐5-18. Since oxygen is more abundant in cold water, you would expect more life in cold water.

☐5-19. Heat pollution would cause a decrease in the oxygen, and therefore could cause a decrease in the number of living organisms.

PROBLEM BREAK 5-2

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Material Burned	Color and Odor of Smoke Produced	Description of Other Products of Burning	Other Observations
Cotton			
Turpentine and cotton			
Wool cloth			
Styrofoam			

Table 6-1

☐6-1. Answers will vary.

☐6-2. Answers will vary.

☐6-3. Water vapor

☐6-4. CO_2

☐6-5. Yes

☐6-6. Transportation

☐6-7. Transportation

☐6-8. All of them, particularly electrical power plants and heating, and industry

☐6-9. Electrical power plants and heating, and industry

☐6-10. All of them

6-5. This should help sensitize the student to the personal contribution we all make to air pollution. Air pollution is not something done by "bad guys" only.

PROBLEM BREAK 6-1

Source of Smoke	Material Being Burned	Kind of Smoke Produced

☐6-11. 55.5 million

☐6-12. 18.5 million

PARTICULATE POLLUTION

Results of your investigation:

Conclusions:

Sources of particles:

☐ 6-13. Predictions will vary.

☐ 6-14. Predictions will vary.

☐ 6-15. Carbon monoxide, nitrogen oxides, and hydrocarbons

☐ 6-16. Hydrocarbons, solid particulates, and nitrogen oxides

☐ 6-17. Diesel engine

☐ 6-18. 21, 652, 400g

6-19. These are approximate values that can be read from the graph.

☐ 6-19. 2½ hours; 1½ hours; 1 hour

☐ 6-20. $64.20

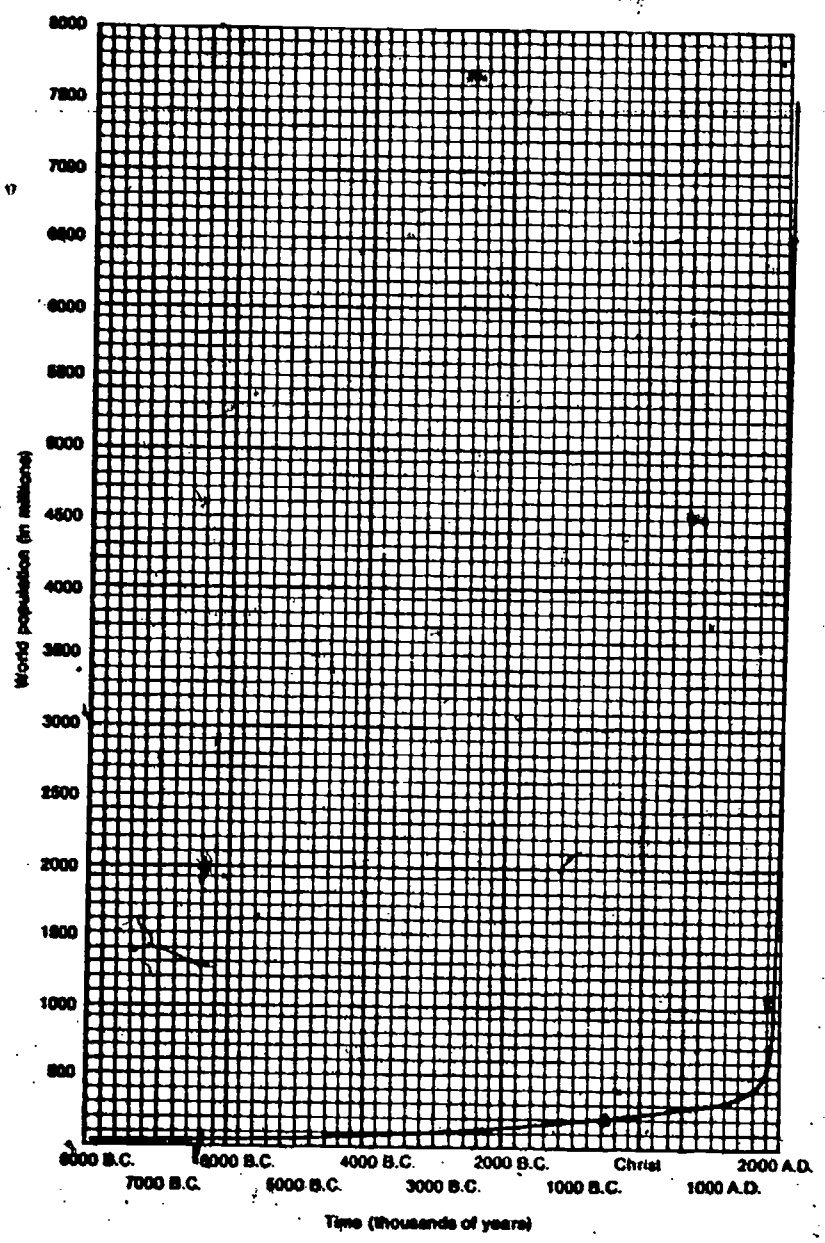
☐ 6-21. Answers will vary.

☐ 6-22. Answers will vary.

Chapter 7
The Environment Throws a Curve

☐7-1. There are more people now than ever before.

☐7-2. Answers will vary.



☐7-3. Student should indicate that it is not possible to tell exactly from the graph.

☐7-4. Answers will vary.

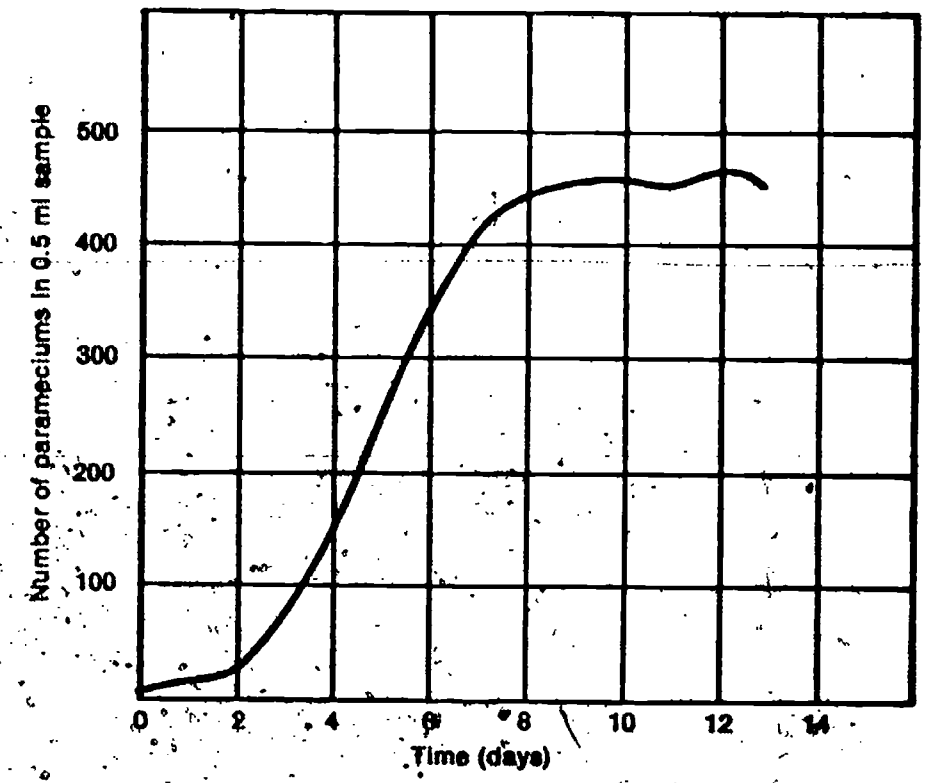


Figure 7-3

☐7-5. No

☐7-6. Answers will vary slightly.

☐7-7. Students will probably indicate day 9 or 10. The important thing is for them to explain how they know this—the fact that there is no increase in the population.

☐7-8. It slowly increased.

☐7-9. It rapidly increased.

☐7-10. It leveled off.

☐7-11. Availability of food, oxygen, and space, and presence of disease and wastes are among those the student may list.

☐7-12. It has not leveled off yet (still rapidly increasing).

☐7-13. No

☐7-14. No

☐7-15. Yes

☐7-16. Answers will vary.

Chapter 8 Facing Real Problems

☐8-1. Answers will vary.

☐8-2. 60; 3,600

☐8-3. 86,400

☐8-4. 86,400 × 365, or 31,536,000

☐8-5. 86,400 × 365 × 60, or 1,892,160,000

☐8-6. **Table 8-1**

WORLD POPULATION	
Birthrate	= 311,000 per day
Death rate	= 138,200 per day
Gain in population	= 172,800 per day

☐8-7. 172,800

PROBLEM BREAK 8-1

PROBLEM BREAK 8-2

PROBLEM BREAK 8-3

PROBLEM BREAK 8-4

PROBLEM BREAK 8-5

PROBLEM BREAK 8-6

SKETCH OF PROPOSED CITY

Excursions

Excursion 1-1
A Real Killer

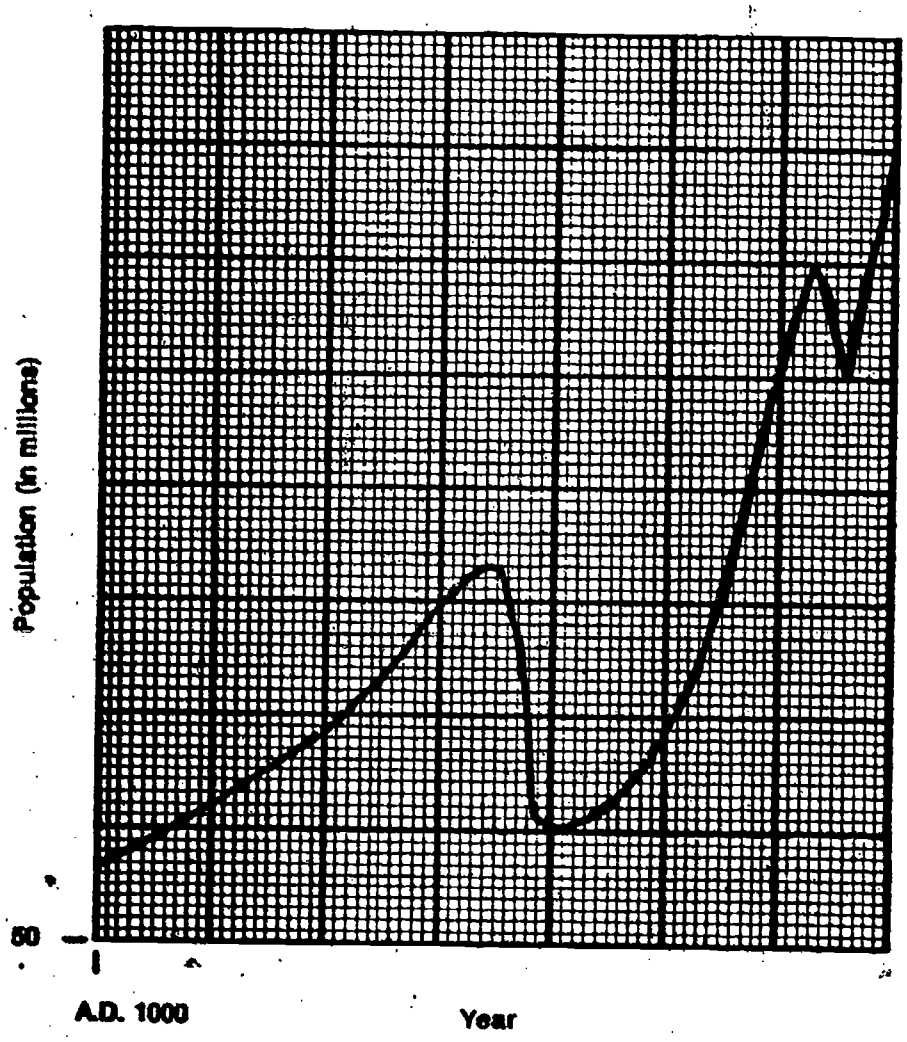


Figure 1

☐1. 10 years; 100 years

☐2. Answers will vary.

☐3. Between 1350 and 1400

☐4. About 200 years

☐5. Answers will vary.

☐6. The student should suggest some way to check his answer.

Excursion 2-1 Rearranging Particles

☐1. Elements

☐2. 100 or so

☐3. Compounds

☐4. No

☐5. Reaction A, decrease; reaction B, increase

☐6. It would be the same amount.

Excursion 2-2 Bounty Hunters

☐1. $\frac{125}{250} = \frac{1}{2}$ cow could be fed, based on cottontails.

$\frac{15}{75} = \frac{1}{5}$ cow could be fed, based on jackrabbits.

☐2. 25,000 × 125 = 3,125,000 cottontails

25,000 × 15 = 375,000 jackrabbits

☐3. 3,125,000 cottontails/50 cottontails per sheep = 62,500 sheep

375,000 jackrabbits/15 jackrabbits per sheep = 25,000 sheep

62,500 + 25,000 = 87,500 sheep

☐4. 3,125,000 cottontails/250 cottontails per cow = 12,500 cows

375,000 jackrabbits/75 jackrabbits per cow = 5,000 cows

12,500 + 5,000 = 17,500 cows

☐5. More grazing land would be needed.

☐6. 17,500 cows × $25 per cow = $437,500

☐7. Answers will vary.

Excursion 3-1
A Drink of the Nile

☐0. Answers will vary.

☐1. Answers will vary.

☐2. Evaporation

☐3. (Readings from the map)

☐4. (Readings from the map)

☐5. (Readings from the map)

☐6. Answers will vary.

☐7. Answers will vary.

☐8. 120,750,000,000 liters.

☐9. It's increasing.

☐10. Agriculture; industry and steam electric utilities

☐11. Industry and steam electric utilities

☐12. The increase in water usage is much greater than the increase in population.

Excursion 4-1
Clean Vegetables?

Table 1

		Average Height of Seedlings	General Conditon of Roots	Additional Observations
1 day after planting	Container A			
	Container B			
	Container C			
2 days after planting	Container A			
	Container B			
	Container C			
3 days after planting	Container A			
	Container B			
	Container C			
4 days after planting	Container A			
	Container B			
	Container C			
5 days after planting	Container A			
	Container B			
	Container C			
6 days after planting	Container A			
	Container B			
	Container C			
7 days after planting	Container A			
	Container B			
	Container C			

☐1. Answers will vary.

☐2. Answers will vary.

☐3. Answers will vary.

Excursion 6-1
Smoggy London Town

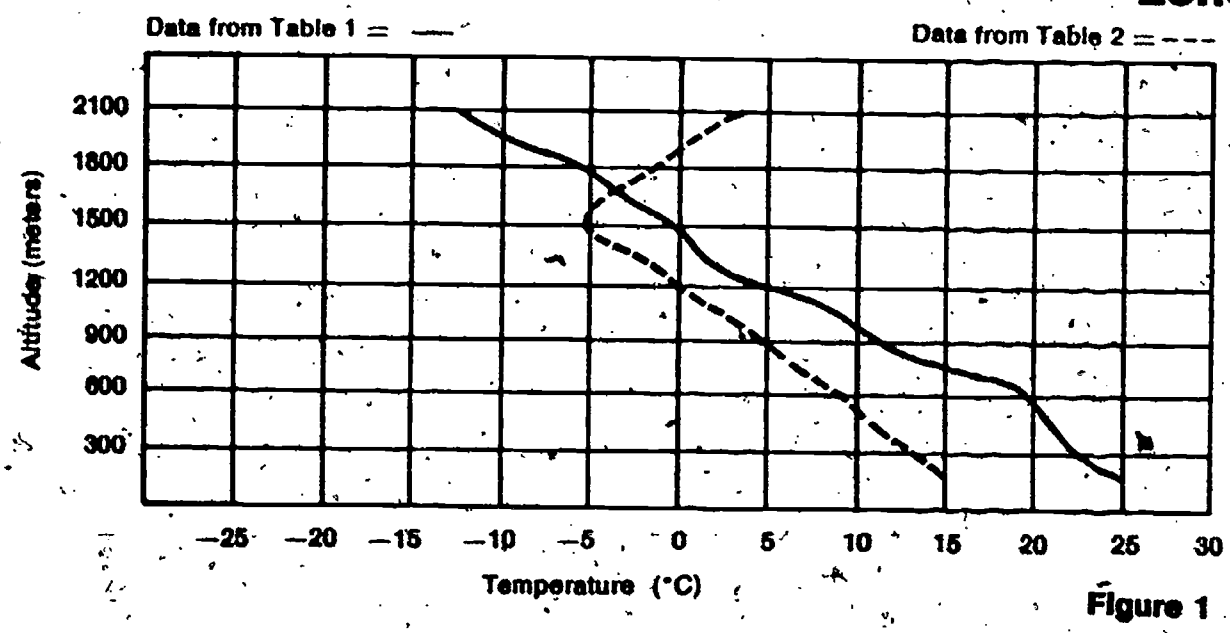


Figure 1

☐1. As height above ground increases, temperature decreases.

☐2. Cold air is denser and stays closer to the ground, while the lighter, warmer air is pushed up.

☐3. The line is not straight; the air is not gradually colder at higher altitudes. Warm air lies floating on cold, dense air below.

☐4. Predictions may vary.

☐5. Near the ground

Questions 6 through 10. Student responses will be variable and unique. Some of the factors they should try to evaluate are these:

1. Is the cost of the practice reasonable, or prohibitive?
2. How much will air pollution be reduced by this practice?
3. Will industry, commerce, and labor be seriously hurt by the costs of the practice?
4. Is it possible to produce enough power to operate anti-air-pollution devices as needed?
5. Will it be safe to do without transportation services during air-pollution crises?
6. Will it be safe to do without home furnaces during air-pollution crises?
7. Can any particular practice be put into effect immediately, or will its effect be years in coming?

☐6. _____

☐7. _____

☐8. _____

☐9. _____

☐10. _____

☐11. Answers will vary.

☐12. Answers will vary.

☐13. Answers will vary.

☐14. Answers will vary.

Excursion 7-1 The More the Merrier?

☐1. Since the number of mice increased and the amount of food was constant, there was less food per mouse available.

☐2. When there is abundant food, the population will tend to increase. When a food shortage develops, the size of the population will have to adjust somehow.

☐3. Yes. If mice can leave to find food elsewhere, this will leave more food for those who remain behind. This could allow the size of the remaining population to stay fairly constant. This is true for an "open system."

☐4. Emigration rate increases when food shortage increases. Evidence lies in Experiment A.

☐5. Birthrate declines and remains constant when food supply is low.

☐6. Crowding leads to other means of population control (fighting, cannibalism, increased infant death rate).

☐7. By the means mentioned in the answer to question 6

☐8. The experimental conditions varied.

☐9. Answers will vary.

☐10. Answers will vary.

Your population study

Excursion 7-2
Escape into Space

☐1. None

☐2. None

☐3. Venus

☐4. Venus

☐5. About 10½ years

☐6. 253 pounds

☐7. None of them have free oxygen.

☐8. 100,000 hours from Earth to Neptune

☐9. Jupiter

☐10. Mercury has no moons.

☐11. About $\frac{1}{40}$ the size of Earth, or about $\frac{1}{10}$ the size of the moon

2,800,000,000 ± 3,500,000 miles from the sun

2,707,000,000 ± 3,500,000 miles from Earth

About 100,000 hours

About $27,000,000

☐12. Earth and Mars

☐13. None

☐14. Probably will say No

☐15. More than 190,000

☐16. More than 1,900

Excursion 7-3
Birthday Control

☐1. Sets 3, 4, and 5

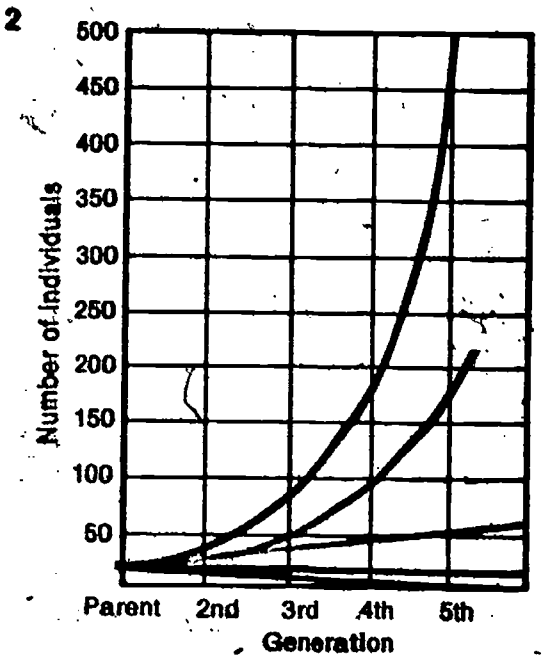
☐2. Set 2

☐3. Set 1

Table 1

POPULATION CHANGES					
	Generation				
Parent Set	Parent	2nd	3rd	4th	5th
1	12	6	3	1	0
2	12	12	12	12	12
3	12	18	27	39	57
4	12	24	48	96	192
5	12	30	75	185	460

Figure 2



☐4. Set 5

☐5. 2

☐6. The population would decrease.

☐7. Around 310 million

☐8. About 250 million

☐9. About 60 million

☐10. Answers will vary.

☐11. Answers will vary.

☐12. Answers will vary.

☐13. Answers will vary.

Excursion 8-1 Ssh! You're Polluting the Environment

☐1. Definitions will vary.

☐2. Probably 25–50 on decibel scale

☐3. Personal preference

☐4. 130 or higher

☐5. 43-decibel hearing loss

☐6. 6-decibel hearing gain

☐7. High

☐8. Slower

☐9. Examples will vary.

☐10. 28-decibel hearing loss

☐11. Noise production increases with increased speed.

☐12. They are about the same.

How Well Am I Doing?

You probably wonder what you are expected to learn in this science course. You would like to know how well you are doing. This section of the book will help you find out. It contains a Self-Evaluation for each chapter. If you can answer all the questions, you're doing very well.

The Self-Evaluations are for your benefit. Your teacher will not use the results to give you a grade. Instead, you will grade yourself, since you are able to check your own answers as you go along.

Here's how to use the Self-Evaluations. When you finish a chapter, take the Self-Evaluation for that chapter. After answering the questions, turn to the Answer Key that is at the end of this section. The Answer Key will tell you whether your answers were right or wrong.

Some questions can be answered in more than one way. Your answers to these questions may not quite agree with those in the Answer Key. If you miss a question, review the material upon which it was based before going on to the next chapter. Page references are frequently included in the Answer Key to help you review.

On the next to last page of this booklet, there is a grid, which you can use to keep a record of your own progress.

Notes for the Teacher

The following sets of questions have been designed for self-evaluation by your students. The intent of the self-evaluation questions is to inform the student of his progress. The answers are provided for the students to give them positive reinforcement. For this reason it is important that each student be allowed to answer these questions without feeling the pressures normally associated with testing. We ask that you do not grade the student on any of the chapter self-evaluation questions or in any way make him feel that this is a comparative device.

The student should answer the questions for each chapter as soon as he finishes the chapter. After answering the questions, he should check his answers immediately by referring to the appropriate set of answers in the back of his Student Record Book.

There are some questions that require planning or assistance from the classroom teacher or aide. Instructions for these are listed in color on the pages that follow. You should check this list carefully, noting any item that may require your presence or preparation. Only items which require some planning or assistance are listed.

You should check occasionally to see if your students are completing the progress chart on page 68.

Circle the excursion for this chapter if you completed it.
1-1

☐ **1-1.** Write a definition for plague.

☐ **1-2.** Circle the answer that best describes the proportion of Europeans who died of the plague in the 14th century.

a. 1 out of 10
b. 3 out of 10
c. 5 out of 10
d. 7 out of 10
e. 9 out of 10

☐ **1-3.** Circle the answer that best describes the movement of the plague across Europe in the 14th century. The plague started in the

a. west and moved east.
b. east and moved west.
c. south and moved north.
d. north and moved south.
e. central portion and spread out in all directions.

☐ **1-4.** An oil tanker spilled oil during a storm in the Gulf of Mexico. The ocean currents quickly moved the oil in a southerly direction. For each half-hour period, show how far the oil had spread by sketching a line across the map on page 40. (Notice that a line has already been drawn for the 2:00 P.M. information.)

Time (P.M.)	Distance of Oil from Ship (m)
2:00	500
2:30	1500
3:00	1750
3:30	2250
4:00	3000

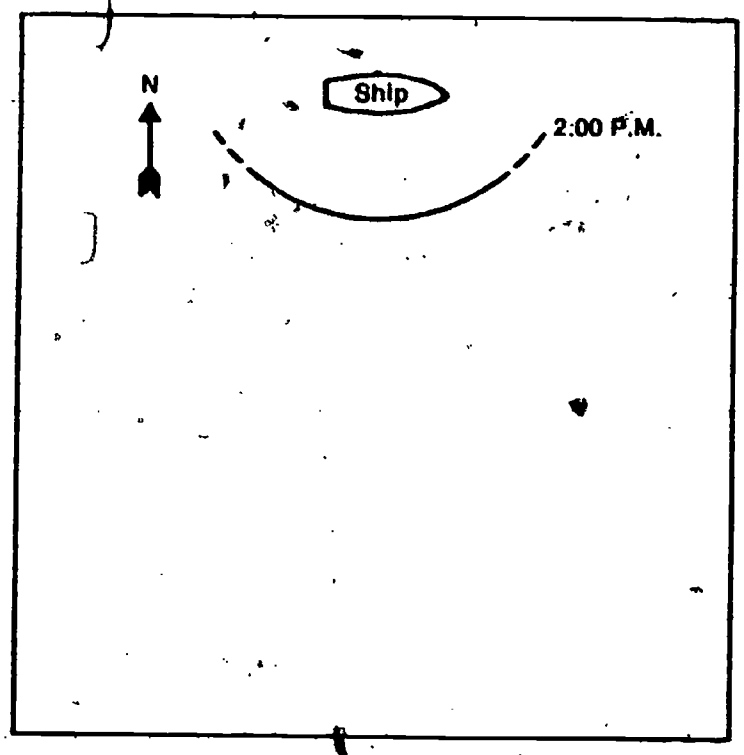


Figure 1-1

☐**1-5.** The nature of disease was little known in the 14th century. List two or more of the ideas offered at the time to explain the plague and its spread.

☐**1-6.** We now know much more about the nature of disease than was known in the 14th century. List two or more of the conditions that we now know helped the plague spread so quickly.

SELF-EVALUATION 2 Circle any of the excursions for this chapter that you completed.
2-1; 2-2

☐**2-1.** Name two factors that are necessary for a match to burn.

☐**2-2.** What is the main input from the surroundings to a burning match?

☐**2-3.** Is oxygen an input to, or an output from, a burning match?

☐**2-4.** List the outputs from a burning match to its surroundings.

☐**2-5.** Define the word *system* as used in this unit.

☐**2-6.** Describe how the following terms are related: *component, system, input,* and *output.*

☐**2-7.** Many people have pets and house plants in their homes. Figure 2-1 shows a cat–geranium–human air system. Complete the figure by drawing input-output arrows for the exchange of gases between the animals and the plant.

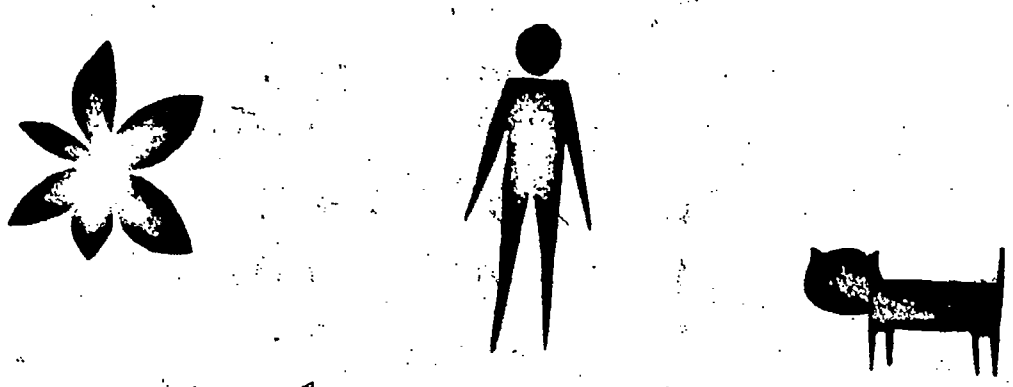


Figure 2-1

☐**2-8.** Name the gas output of the geranium that is an input for humans and cats.

_____

☐**2-9.** Name the gas output of humans and cats that is an input for geraniums.

_____

☐**2-10.** A system that includes several kinds of organisms is shown in Figure 2-2. Place each organism in the appropriate category below:

Producer(s) _____

_____

Decomposer(s) _____

_____

Consumer(s) _____

_____

_____

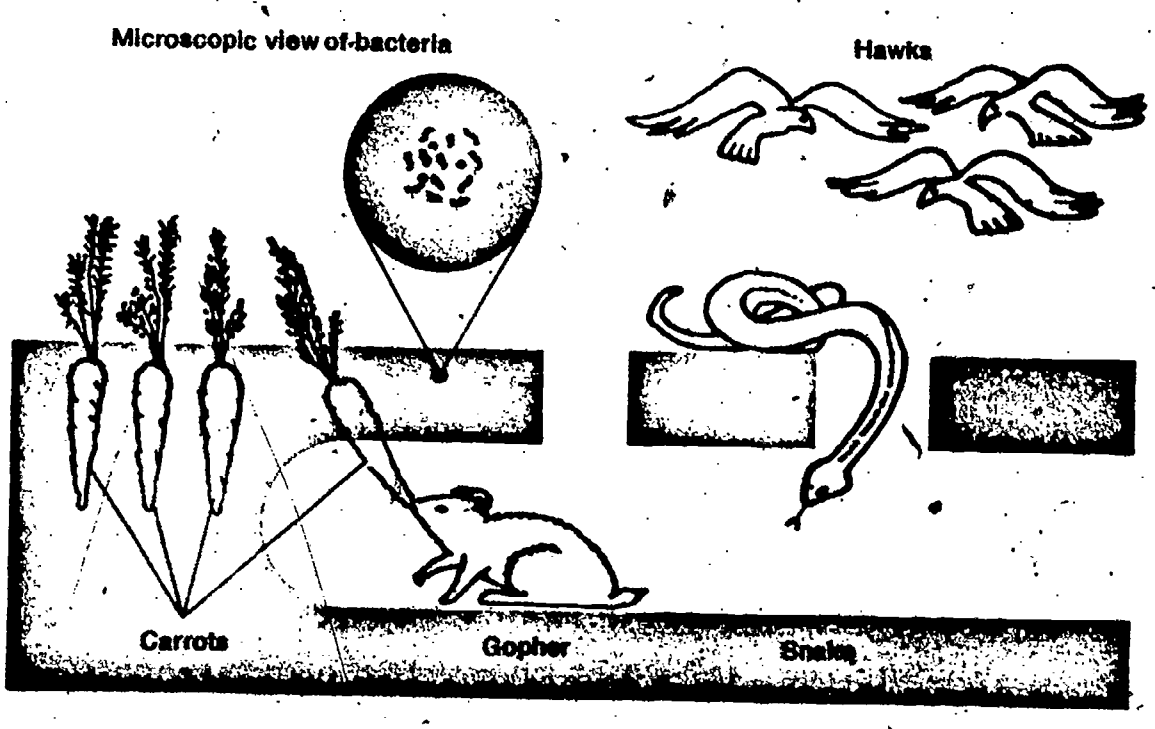


Figure 2-2

☐**2-11.** Figure 2-3 includes each of the organisms shown in Figure 2-2. Complete the diagram by drawing input-output arrows labeled "Food," "Oxygen," "CO_2," and "Wastes."

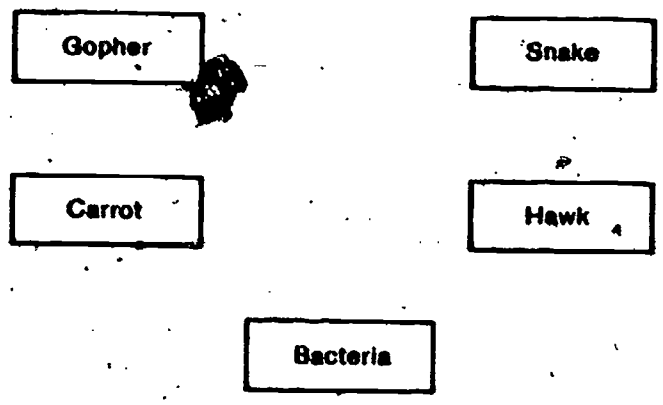


Figure 2-3

☐**2-12.** Suppose a combination of poisoning and trapping removed all the gophers from the system shown in Figure 2-3. Describe the effect this might have on the

a. number of carrots. _____

_____

b. number of snakes. _____

_____

c. number of hawks. _____

_____

d. kinds of bacteria. _____

_____

☐**2-13.** Explain why green plants in a food-chain system are called producers. (Oxygen is not to be considered as a food.

_____

_____

_____

_____

☐**2-14.** Construct a diagram using labeled arrows to show the input and output of a green plant in sunlight.

☐**2-15.** In what way or ways do living things change their surroundings?

☐**2-16.** What kinds of effects do you have on your environment in just one day's time?

SELF-EVALUATION 3 Circle the excursion for this chapter if you completed it.
3-1

☐**3-1.** Most organisms require oxygen. Aquatic organisms (those living in water) get their oxygen from the oxygen gas dissolved in the water. What type of organisms supply oxygen to the water?

☐**3-2.** Define biochemical oxygen demand (B.O.D.).

☐**3-3.** In Chapter 3, you did various experiments with yeast and milk in order to study some of the changes that take place in surface waters. What organisms did the yeast represent in those investigations?

_____

What did the milk represent in those investigations?

_____

☐**3-4.** Methylene blue solution may be added to water as an indicator for what substance?

_____

☐**3-5.** A scientist has three test tubes (A, B, and C) of clear solutions. He adds a little methylene blue solution to each of the tubes, shakes them, and looks for a color change. He observes that tubes A and C become colorless, while tube B remains blue. Circle the statement below that would be a logical conclusion from the experiment.

a. Oxygen is present in tubes A and C but not in B.
b. CO_2 is present in tubes A and C but not in B.
c. Oxygen is present in tube B but not in A and C.
d. CO_2 is present in tube B but not in A and C.
e. Oxygen is present in all tubes, but only tube B has CO_2.

☐**3-6.** Circle the statement that best describes what happens to the biochemical oxygen demand when the concentration of sewage is increased in surface waters.

a. It remains the same because microorganisms take in the oxygen released by sewage.
b. It remains the same because sewage takes in the oxygen released by microorganisms.
c. It increases because microorganisms use up oxygen when decomposing sewage.
d. It decreases because microorganisms release oxygen when decomposing sewage.

☐**3-7.** For years, the same amount of sewage has been dumped into a river daily. Now the people want to dump less sewage. As the amount of sewage is reduced in the river, what will happen to the

a. population of microorganisms that are decomposers?

_____

_____

b. biochemical oxygen demand of the living organisms?

_____

_____

☐**3-8.** An organism called "glug" reproduces every 30 seconds by dividing into two glugs. If you start out with one glug, how many glugs will there be at the end of three minutes if all glugs live?

_____

☐**3-9.** Define *pollution.*

_____

_____

_____

SELF-EVALUATION 4

Circle the excursion for this chapter if you completed it.
4-1

_____

☐**4-1.** Detergents, while better than soap for washing clothes, create pollution problems. What are three pollution problems caused by detergent use?

_____

_____

_____

☐**4-2.** For animals, the most important gas output from plants is

_____

☐**4-3.** For plants, the most important gas output from animals is

_____

☐**4-4.** What is meant when a substance is called "biodegradable"?

_____

_____

☐**4-5.** Below is a list of organisms. Complete the table by writing the name of each organism next to the concentration of DDT you predict it would have in its body.

Concentration of DDT	Organism
0.3	Minnow
0.9	Bigger fish
2.4	Algae and nucroscopic organisms
21.6	Fish-eating bird

☐**4-6.** Phenol red is used as an indicator for

_____

☐**4-7.** Is the gas exchange of germinating seeds with their environment most like the gas exchange between green plants and air, or between animals and air?

_____

☐**4-8.** A student placed 24 radish seeds on a damp paper towel in a small dish. Three days later he observed that 18 of the seeds had germinated. What percentage of the radish seeds had germinated at that time?

_____

☐**4-9.** Rearrange the following list of organisms in the order of their relative numbers in an area. That is, list the most abundant organism first, and the least abundant organism last: Rabbits—Green Plants—Coyotes.

_____

_____

_____

_____

_____

☐**4-10.** There is no farming anywhere near Antarctica. Yet DDT has been found in the fish-eating birds that live there. DDT is used to control pests on land many thousands of miles away. Explain how DDT can get from the area where it is used, into fish-eating birds in Antarctica.

☐**4-11.** List three causes of pollution problems.

☐**4-12.** Circle one of the following characteristics of a certain substance that cannot cause pollution problems.

a. Serves as food for microorganisms.
b. Is nonbiodegradable.
c. Has poisonous effect when present in large amounts.
d. Changes phenol red color to yellow.

☐**4-13.** List three foods from which *you* might pick up nonbiodegradable pesticides such as DDT.

SELF-EVALUATION 5

☐**5-1.** According to the graph in Figure 5-1, which one of the following statements best describes the relationship between the concentration of dissolved gas in water and the temperature of that water? Circle the answer you select.

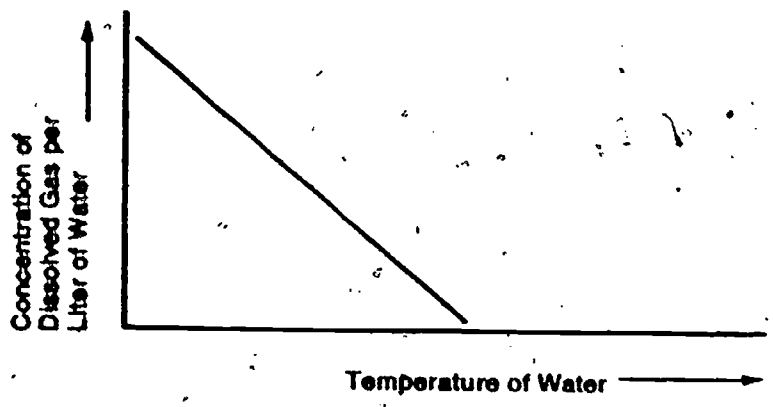


Figure 5-1

The graph indicates that the amount of dissolved gas

a. increases with increasing temperature.
b. decreases with increasing temperature.
c. decreases with decreasing temperature.
d. doesn't change with changes in temperature.

☐**5-2.** Study Table 5-1. It shows possible relationships between water temperature and the amount of dissolved gas.

Which column best describes the relationship of temperature and dissolved oxygen?

_____

Table 5-1

Temperature (°C)	Amount of Dissolved Gas (gm/100 ml)			
	A	B	C	D
0	.0029	.0065	.0061	.0000
20	.0008	.0049	.0042	.0011
40	.0052	.0030	.0028	.0023
60	.0012	.0019	.0014	.0035
80	.0043	.0008	.0031	.0054
100	.0019	.0000	.0068	.0069

☐**5-3.** Circle the statement that best describes the relationship between temperature and the rate of chemical change.

a. As the temperature increases, the rate of chemical change decreases.
b. As the temperature increases, the rate of chemical change increases.
c. As the temperature decreases, the rate of chemical change increases.
d. The rate of chemical change is not affected by temperature.

☐**5-4.** The water temperature in a river is being increased because of thermal pollution. This increased temperature would cause the rates of the chemical reactions of photosynthesis in aquatic plants to

a. increase.
b. decrease.
c. stop.
d. remain the same.

Explain your answer.

_____

_____

☐**5-5.** Circle the statement that best describes the meaning of *cold-blooded.*

The temperature of a cold-blooded animal

a. is lower than that of a warm-blooded animal.
b. is always close to the freezing point of water.
c. changes as the environmental temperature changes.
d. stays the same even if the temperature of the environment changes.

☐**5-6.** What is meant by saying that animals are temperature sensitive?

_____

_____

_____

☐**5-7.** Name a common source of thermal pollution.

_____

☐**5-8.** In terms of temperature sensitivity, why are goldfish good household pets?

_____

☐**5-9.** Why are trout likely to die in thermally polluted rivers?

_____

_____

☐**5-10.** Using Figure 5-2, select the numbered part of the graph that best represents each of the following:

a. Highest oxygen concentration _____

b. Lowest oxygen concentration _____

c. Lowest water temperature _____

d. Highest B.O.D. _____

e. Lowest B.O.D. _____

f. Highest water temperature _____

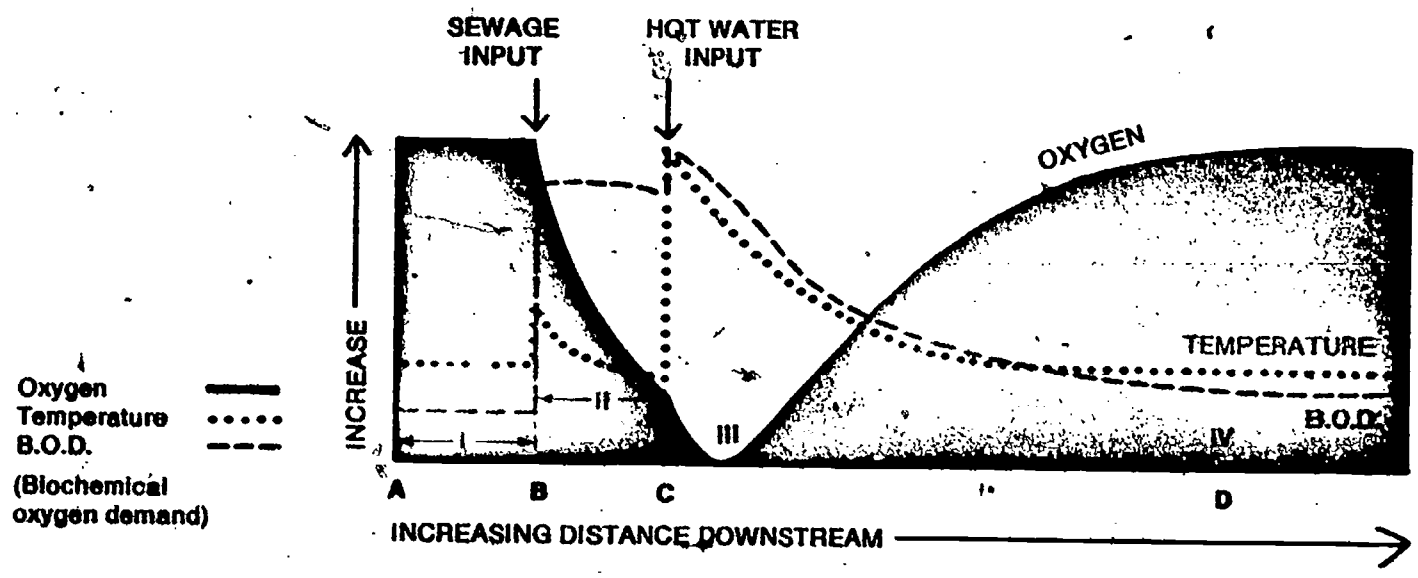


Figure 5-2

☐**5-11.** A study was made of the oxygen content of two areas of a river. One area is near a power-generating plant that adds warm water to the river. In this area it was observed that the oxygen content was much less than in the colder water area. What are two factors that can explain this difference?

_____

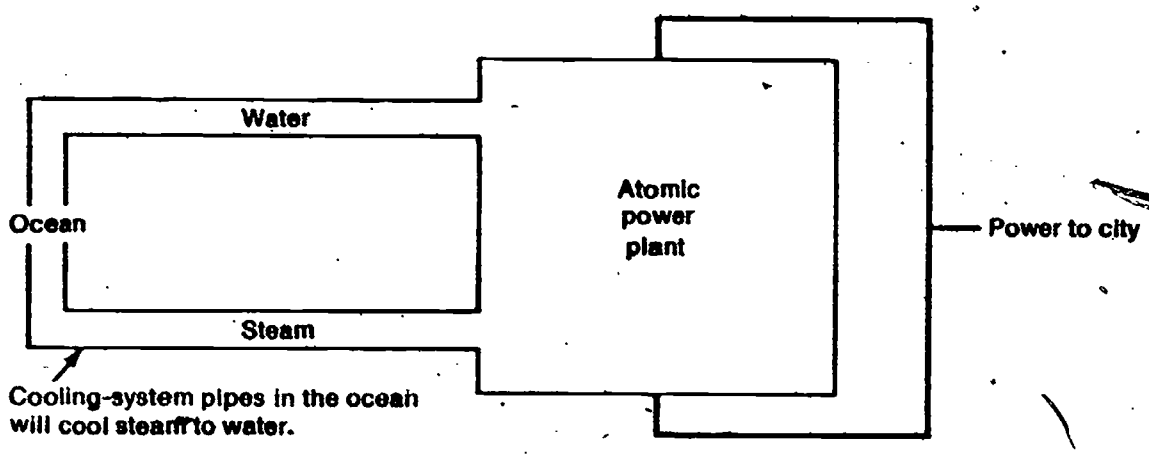
_____

☐**5-12.** Describe in your own words what you think is harmful about thermal pollution.

☐**5-13.** In what way do you contribute to sources of thermal pollution?

☐**5-14.** The diagram below shows the proposed plans for an atomic power plant.

If you had to vote on whether or not the plant could be built at the location suggested, would you vote Yes, or No? Explain your answer.



SELF-EVALUATION 6 Circle the excursion for this chapter if you completed it.

6-1

☐**6-1.** Define *air pollution.*

☐**6-2.** Circle one of the following statements that will not be true if present trends continue.

a. The number of motor vehicle registrations will increase.
b. The number of families owning only one automobile will increase.
c. The number of families owning two or more automobiles will increase.
d. The number of families owning automobiles will increase.

☐**6-3.** Describe why carbon monoxide is so dangerous to human health.

☐**6-4.** List three ways in which air pollutants may injure human health.

☐**6-5.** List three other ways in which air pollutants create problems for humans.

☐**6-6.** How might you reduce smog in a city?

☐**6-7.** The automobile is considered by some to be the single most important contributor to air pollution in the U.S. How can you explain this? (Or why is this possible?)

☐**6-8.** What recommendations do you have for reducing air pollution due to automobile exhaust?

_____

_____

_____

SELF-EVALUATION 7 Circle any of the excursions for this chapter that you completed.
7-1; 7-2; 7-3

☐**7-1.** Draw a typical population curve on the blank graph in Figure 7-1.

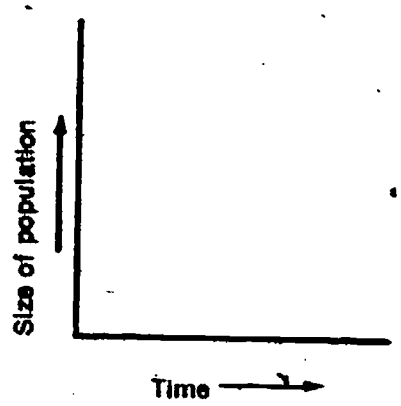


Figure 7-1

☐**7-2.** On the blank graph in Figure 7-2, draw the general shape of the human population curve as it presently looks.

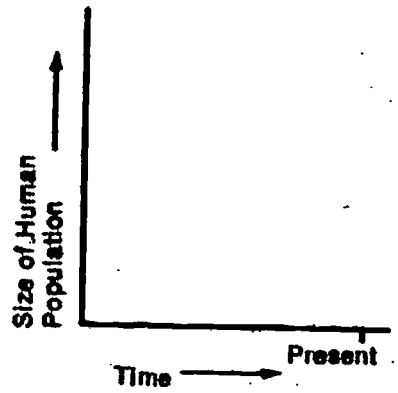


Figure 7-2

☐**7-3.** A number of variables may contribute to the leveling off of a population. Describe at least three of these variables.

_____

_____

_____

☐**7-4.** Give two reasons why early settlers in the western United States were not bothered by pollution problems.

☐**7-5.** Define *population explosion.*

☐**7-6.** Can the present human population growth rate continue indefinitely? Explain your answer.

☐**7-7.** What effects could pollution have on the human population growth?

☐**7-8.** The curve in the graph of Figure 7-3 represents a population curve.

Label the following two points on the curve.

A. The point at which the number of deaths about equals the number of births

B. The point of the most rapid population increase

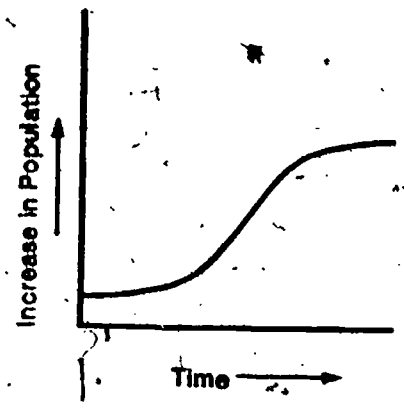


Figure 7-3

SELF-EVALUATION 8 Circle the excursion for this chapter if you completed it.
8-1

☐**8-1.** Write a word formula that could be used in calculating the daily population change for a city.

☐**8-2.** Circle one of the following statements that will not be true if present trends continue in the United States.

a. The population will continue to grow as fast as it has in the past, at least for some time.

b. Human birthrate will equal human death rate.

c. Pollution problems will become more serious as population becomes more concentrated.

d. Cities will grow in size.

☐**8-3.** How could stopping the use of all pesticides cause other problems for humans?

☐**8-4.** Suggest a solution to city noise pollution resulting from airplanes.

☐**8-5.** Is your solution (from question 8-4) likely to produce other problems for humans? If so, what are these problems?

☐**8-6.** What makes the solution to our major pollution problems so difficult? Why is there not a simple solution?

☐**8-7.** You live in a small town. A large chemical industry is interested in locating a new plant there. The plant would provide employment for 500 to 600 people. This would add more than $1,000,000 to the town's economy, not to mention a big increase in tax money. If the city encourages this company, other industries may, in turn, decide to locate in or near the town. This could be the beginning of major growth for your area.

The head man of the chemical industry admits that the new industry may cause some pollution of a nearby river. He says, however, that at this time his company could not spend more than a few thousand dollars in trying to eliminate this pollution.

As chairman of the city planners, you have to vote for or against allowing the industry to locate in your town. Think about the advantages and the disadvantages to your city.

a. What additional information would help you decide how to vote?

b. What will your vote be and why?

☐ **8-8.** Disposing of junked car bodies has become a serious and expensive problem in the United States. After all usable parts have been removed, the car bodies are treated in one of several ways. They may accumulate in junkyards, piling up for years. They may be shipped by barge out to sea and dumped overboard to make artificial reefs. Or they may be compressed by machine into a small bale, shipped to a steel mill, and converted into new metal products. (Heat generated by the compression burns up the cloth and plastic in each car.)

a. What are the economic problems associated with each of these methods of disposal?

b. How does each reduce or add to the pollution of our environment?

☐ **8-9.** A newly constructed lumber mill on occasion has produced a smog problem in a small nearby city. The following solutions to this smog problem have been proposed.

1. Warn the residents when smog levels become dangerous, so they may stay indoors.
2. Close the lumber mill.
3. Close the lumber mill on days when weather conditions are likely to produce smog in the city.

4. Construct giant air-deflection fans to change the direction of smoke movement.
5. Construct a smoke-filtering system at the lumber mill.
6. Move the lumber mill to the other side of the city.
   a. Which of the suggested solutions is most impractical? Could each be considered impractical?

   b. Which of the suggested solutions will probably raise taxes? Could each possibly raise taxes?

   c. What are two problems associated with solution 3?

   d. Which of the suggested solutions might increase the cost of lumber? Could each possibly raise lumber costs?

Who is responsible for the solution of the problem?
a. Lumber company
b. City government
c. City citizens
d. State government
e. All of the above
f. None of the above

☐**8-10.** A pesty insect in the southeastern United States is the fire ant. One of the suggested solutions to this problem is to spray the land with a chemical called mirex. Mirex kills fire ants. What are some questions you would raise before allowing the chemical to be used?

☐**8-11.** Two of the world's greatest problems are called the two P's: population and pollution.

a. Explain how these two problems are related.

b. If population is controlled, will pollution disappear? Explain your answer.

Self-Evaluation Answer Key

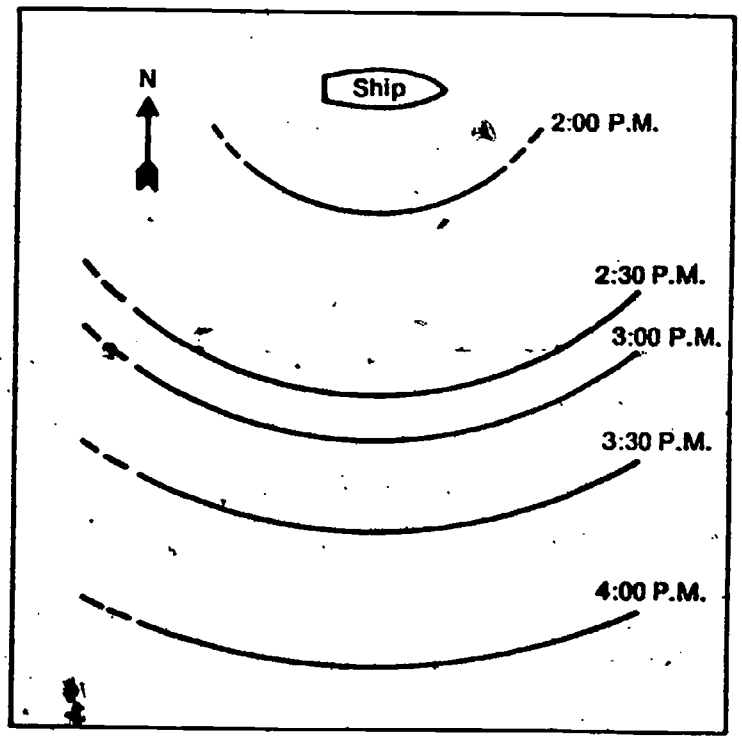
SELF-EVALUATION 1

1-1. Your definition should include the idea that a plague refers to an epidemic disease causing a high rate of mortality.

1-2. b. 3 out of 10

1-3. c. south and moved north.

1-4.



1-5. Some said it was spread by the miasma, or poison cloud. Others suspected such things as earthquakes, fire pillars, and other mysterious occurrences. Some suggested that it was bottled up in vessels and carried by evil men and released.

1-6. Crowded living, unsanitary conditions, and infestation by rats and other vermin

SELF-EVALUATION 2

2-1. Heat and oxygen. You will remember that you used friction as your source of heat energy to light your match.

2-2. Oxygen from the air

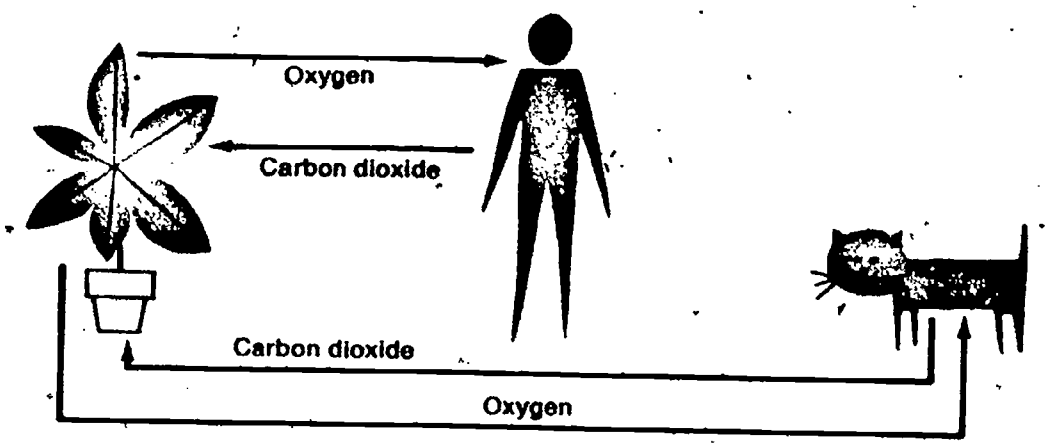
2-3. Input to

2-4. Carbon dioxide, water vapor, ash, sulfur oxide, phosphorus oxide, energy

2-5. A system is a set of things that influence each other.

2-6. A *system* is a set of things that influence each other. The things that make up a system are called *components*. The *input* to one component consists of those things that it takes from the surroundings. The *output* consists of those things that are released to the surroundings. Recall the match-air system.

2-7.



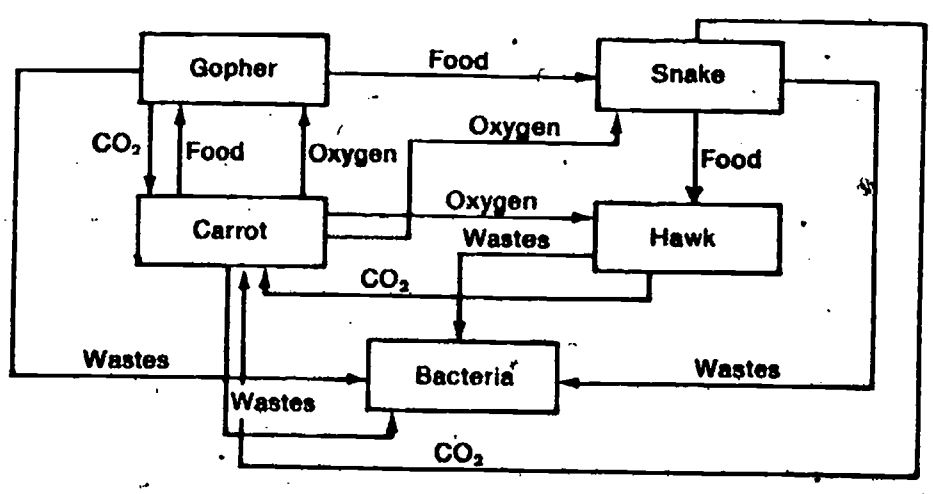
2-8. Oxygen

2-9. Carbon dioxide

2-10. Producer(s): carrots
Decomposer(s): bacteria
Consumer(s): gopher, snake, hawks

2-11.

Figure 2-3



2-12. a. The number of carrots would probably increase because the gophers were not there to eat them.

b. The number of snakes would probably decrease because there would be fewer gophers there for them to eat, and so the snakes would probably leave the area.

c. Since the number of snakes would probably decrease, the number of hawks probably would decrease also, since the hawks feed on the snakes. The hawks would also probably leave the area.

d. The number of bacteria would probably decrease because the number of animals supplying wastes decreased, or animal decomposers would decrease while plant decomposers increased.

2-13. Green plants use energy from the sun to build chemicals needed for growth. These chemicals store some of the energy that came originally from the sun. They are therefore called producers, since they produce the "food" utilized by other organisms.

2.14

$$\xrightarrow{CO_2} \boxed{\text{PLANT}} \xrightarrow{\text{Oxygen}}$$

2-15. Living things remove things from their surroundings and add things to their surroundings.

2-16. You should have included in your description all the things you took from your environment and all the things you added to your environment during one day.

These include the following.

Input to you	Output from you
1. Food	1. Carbon dioxide
2. Oxygen	2. Other wastes
3. Water	3. Heat

SELF-EVALUATION 3

3-1. Green aquatic plants

3-2. The need for oxygen by living things

3-3. The yeast represented the decay organisms. The milk represented the sewage.

3-4. Dissolved oxygen

3-5. c. Oxygen is present in tube B but not in A and C. (Remember that methylene blue turned colorless as dissolved oxygen was removed from the solution.)

3-6. c. It increases because microorganisms use up oxygen when decomposing sewage. (Remember that in your experiment oxygen was used up faster when the concentration of sewage was increased. This was caused by the microorganisms using up oxygen in decomposing sewage.)

3-7. a. The population of microorganisms that are decomposers will decrease, since there will not be as much sewage available for them.

b. The biochemical oxygen demand will decrease, since the amount of sewage to be decomposed will be less. There will be less oxygen needed to decompose the smaller amount.

3-8. 64 glugs (At the end of 30 seconds, you will have 2; at the end of 1 minute, you will have 4; at the end of 1½ minutes, you will have 8; at the end of 2 minutes, you will have 16; at the end of 2½ minutes, you will have 32; at the end of 3 minutes, you will have 64.)

3-9. Your definition should indicate that it is the addition of some excess to the environment that results in changing the environment so that it is no longer suitable to support that life which originally inhabited that environment.

SELF-EVALUATION 4

4-1. Detergents are longer lasting than soap, have more suds than soap, affect the germination of seeds, and are biodegradable by algae, resulting in algae population explosions.

4-2. oxygen.

4-3. carbon dioxide.

4-4. A substance is biodegradable if it is capable of being decomposed (chemically broken down) and utilized by organisms.

4-5.

Concentration of DDT	Organism
0.3	Algae and microscopic organisms
0.9	Minnow
2.4	Bigger fish
21.6	Fish-eating bird

4-6. carbon dioxide.

4-7. Germinating seeds use oxygen from the environment, so they are more like animals in their exchange of gases in the air.

4-8. $\frac{18}{24} \times 100 = 75\%$

4-9. Green plants (most common)—Rabbits—Coyotes (least common)

4-10. We find DDT entering oceans along the land areas where it is used. Plants in the ocean pick up the DDT. Small organisms feeding on plants pick up the DDT. Small fish feeding on these small organisms concentrate DDT in their bodies. These fish are able to move farther from the place where DDT was applied. Larger and larger fish concentrate DDT in their bodies. These fish move great distances from the place of application, eventually reaching the Antarctic waters where fish-eating birds feed on them.

4-11. Excess sewage; cleaning agents (detergents); pesticides

4-12. d. Changes phenol red color to yellow (the fact that a substance causes an indicator to change color does not make it a contributor to pollution).

4-13. Meat, fish, eggs, milk, and vegetables are all possible sources of pesticides.

SELF-EVALUATION 5

5-1. b. decreases with increasing temperature.

5-2. Column B
(The amount of oxygen that can dissolve in water decreases with increasing temperature. Column B is the only column that shows this relationship.)

5-3. **b.** As the temperature increases, the rate of chemical change increases.

5-4. **a.** increase. Since photosynthesis involves chemical changes and increasing the temperature increases the rate of a chemical change, photosynthesis may increase.

5-5. **c.** changes as the environmental temperature changes.

5-6. When an animal is cold-blooded, its temperature changes as the environmental temperature changes. If the temperature of the environment is too low or too high, the animal will die. Therefore, certain animals are temperature sensitive.

5-7. Power-generating plants

5-8. Goldfish "prefer" water that is room temperature.

5-9. Trout "prefer" colder water temperatures. They will die if the water is too warm because of insufficient oxygen.

5-10. **a.** I; **b.** III; **c.** I; **d.** III; **e.** I; **f.** III

5-11. The concentration of dissolved oxygen is less in warm water than in cold water. Living organisms use dissolved oxygen more rapidly in warm water than in cold water.

5-12. Your description should include the effects thermal pollution will have on plant and animal life in the water.

5-13. You should include any ways in which you increase the temperature of surface waters.

5-14. Your explanation should indicate what you think about the resulting thermal pollution.

SELF-EVALUATION 6

6-1. Air pollution may be considered as any of the materials that man adds to the air. Your definition may be quite different, depending on your way of thinking. Even good things in large amounts may be bad.

6-2. **b.** The number of families owning only one automobile will increase. (The trend is toward families owning two or more automobiles instead of one.)

6-3. Carbon monoxide can cause death if its concentration is high enough. Small concentrations can cause dizziness, headaches, fatigue, and slowed reactions. It reduces the ability of blood to carry oxygen.

6-4. They may produce lung diseases. They can irritate the eyes, nose, and throat. They can cause headaches, general fatigue, and interfere with normal breathing.

6-5. They can kill plants, destroy metals, produce smog, dirty objects, and reduce visibility.

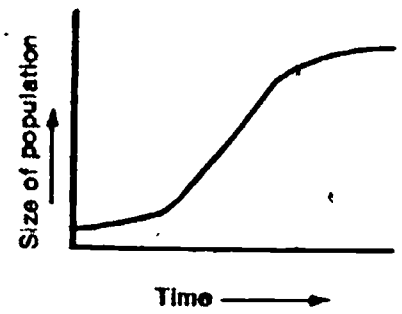
6-6. Reduce the amount of air pollution:

6-7. Motor vehicles are the largest contributor to air pollution. Since there are more cars than any other types of motor vehicles, cars could be considered the single most important contributor.

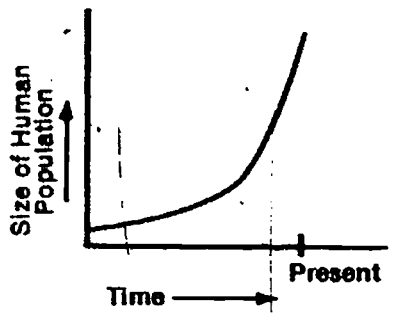
6-8. Possible recommendations may include the use of anti-pollution devices, changing the types of engines, or even reducing the number of automobiles. The practicality of each recommendation should be considered.

SELF-EVALUATION 7

7-1.



7-2.



7-3. The presence of disease organisms; the presence of wastes and poisons; the amount of food and needed gases; and the availability of space for the organism.

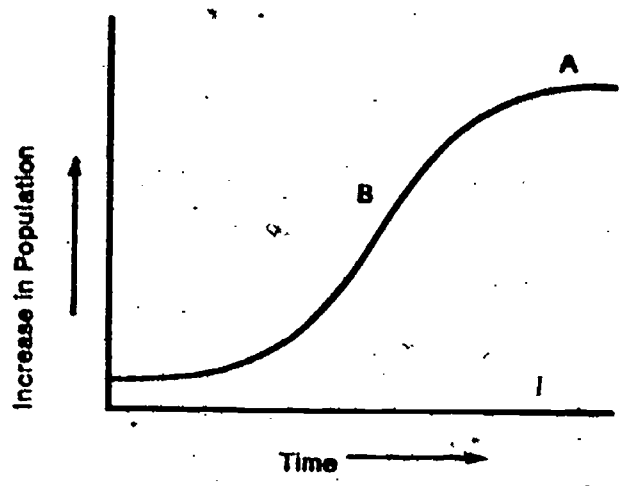
7-4. There were very few people in the area, and there was no real industry to cause pollution problems.

7-5. Population explosion refers to a population increase of an organism at an explosive rate.

7-6. One or more of the variables that you should have listed in 7-3 will probably cause the human population growth to level off.

7-7. Pollution can cause disease and reduce food supplies, resulting in a leveling off of human population growth.

7-8.



SELF-EVALUATION 8

8-1. Population change = births + People* moving in − Deaths − People* moving away *optional

8-2. b. Human birthrate will equal human death rate.

8-3. Your answer should include the idea that the number of pests could become so large as to possibly cause sickness or disease. Food supplies could become smaller if plants and animals are being attacked by the pests.

8-4. There are several possible solutions. How economically feasible is the one you suggested?

8-5. The problems could be economic, or perhaps simply cause inconveniences. The important thing to see is that by trying to solve one problem, you usually create others.

8-6. As you have probably already seen many times, a solution to one problem creates different problems. Hopefully, you could give several good examples of this.

8-7. You should be able to defend whatever decision you made.

8-8. a. Junkyards full of cars take up valuable land. Machines to compress the cars and convert them into new metal products are expensive; so also is the transportation necessary for dumping at sea.

b. There are several pollution problems associated with junkyards. The ugly sight and problems with rats are just two you may have mentioned. The heat generated by the compression machines and the burning of the cloth and plastic are pollution problems associated with the other disposal method.

8-9. a. The one that is *most* impractical depends on your point of view. Some are more impractical than others.

b. Solutions 2 and 3 perhaps would raise taxes more than the other solutions would.

c. It's often difficult to predict weather conditions, and they can change rapidly. It would be difficult for employees to have their jobs depend on the weather.

d. Solutions 2 through 6 could possibly cause an increase in the cost of lumber.

e. ●

8-10. Among the questions you may ask are the following: (a) How big a pest are the fire ants? (b) What problems do they cause? (c) What are the problems that Mirex would cause if it was used? (d) How much do we really know about Mirex?

8-11. a. The larger the population, the greater the pollution seems to be.

b. Population control probably wouldn't make pollution disappear. You should be able to explain why. But you should also be able to explain how it would help the pollution problem to control population.

My Progress

Keep track of your progress in the course by plotting the percent correct for each Self Evaluation as you complete it.

$$\text{Percent correct} = \frac{\text{Number correct}}{\text{Number of questions}} \times 100$$

To find how you are doing, draw lines connecting these points. After you've tested yourself on all chapters, you may want to draw a best-fit line. But in the meantime, unless you always get the same percent correct, your graph will look like a series of mountain peaks.

RECORD OF MY PROGRESS