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An Assessment of Microcomputer Water  
Information Dissemination Software

**E-040**

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## An Assessment of Microcomputer Water Information Dissemination Software

### I. Background

As early as 1981, at least one-third of all U.S. high schools possessed microcomputers. (1) Since this time, increased use of microcomputers has occurred; however, there has not been a great deal of formal research conducted on using the computer as an information dissemination tool. (2) The lack of research using computers with public school subjects results, in part, from the difficulty of gathering data within the public school context. Yet, it is generally accepted that research on computer software for water education be performed only in the context within which computer programs will be used. It follows that there is a need to:

1. identify water information dissemination software.
2. analyze the criteria used in evaluation.
3. compare objective application of criteria by teachers who select software with data on performance and perception from the actual student software user.

### II. Purpose

The purpose of this study was to determine if computer software programs in water education for high school students (1) are motivating, (2) influence attitude toward water resources, (3) increase water knowledge, and (4) are viewed the same by students and teachers.

Specifically, the purpose was to:

- A. identify commercially available water education software for use with high school students.
- B. analyze and select the criteria used in software evaluation.
- C. develop test instruments to measure teachers' and students' perceptions and students' water knowledge.
- D. compare:
  1. high school student water software users' and non-users':
    - a. level of concern over water issues.
    - b. knowledge of concepts treated in the software program.
  2. high school teachers' predicted vs. high school students' actual:
    - a. evaluation of software
    - b. level of water knowledge gained from water software

### III. Procedure:

#### A. Search for Water Education Programs and Evaluation Criteria.

1. To identify commercially available software, in June of 1985, an ERIC search was conducted using combinations of the following descriptors:

- a. Water
- b. Oceanography
- c. Marine education
- d. Environmental Education
- e. Conservation
- f. Natural Resources
- g. Microcomputers
- h. Computer simulation
- i. Computer assisted instruction

Only two software programs, Pollute and The Acid Rain Game, were located using ERIC.

2. A Resources In Computer Education (RICE) search located an additional program, Water Pollution.

3. The lack of available water software identified by computer search prompted a hand library search using various catalogs (Appendix A) and the Clearinghouse of Information on Microcomputers in Education (CHIME), College of Education, O.S.U. (3) In addition, software publishers listed in the National Science Teacher Association computer software supplement (Appendix A) and about 100 others found in current computer periodicals were surveyed. Five computer programs were randomly selected from a total of 19 suitable for high school water education (Appendix B).

B. To identify and analyze software evaluation criteria, a list of various evaluation forms were obtained from the 1985 Educational Software Evaluation Consortium (4) and from the National Council of Teachers in Mathematics. Specific criteria from 11 different evaluation forms were tallied and the more common identified. (Appendix C)

C. Water software non-user, user and teacher test construction

#### 1. Computer Software Non-user Test

To determine the level of water concern and water knowledge of high school students not using the software, the five item (Quest. 26-30) Watson Water Concern Scale (5) and subject matter content test questions written by the software authors were used to test each of the five computer programs. This data was to be compared with similar data from students using the software.

## 2. Computer Software User Test (Appendix F)

To determine the level of water concern and knowledge possessed by high school students using the computer program, the same test items were administered to users as was to non-users. In addition, the water software user responded to items taken from the list of criteria common to computer software evaluation forms (questions 7-30). This opinionnaire data was to be compared with that of the teachers to check for congruence.

## 3. Teachers' Prediction of Student Performance and Computer Software Evaluation Form (Appendix G)

For each of the five water education computer software programs, a three-part teacher evaluation form was constructed. Part I deals with general attitude toward and use of computers. Part II, questions 7-25, deal with corresponding questions asked of students who used the computer program, and Part III, where the teacher predicted the percent of students answering each question correctly before computer instruction, and then what percent would respond correctly after instruction by the computer.

### D. High School Science Teachers

Ten Teachers were sent a packet containing one or more program disks, a set of tests for student non-users, a set of tests for students who respond following interaction with the program, and a teacher's form.

In addition, step by step procedures were outlined, and the contents of the packet and their use explained to the teacher (Appendix H). Teachers were asked to randomly select and test student users and non-users of the computer programs. They were also asked to preview the software and (1) evaluate its effectiveness and (2) predict the proportion of correct responses for each knowledge question.

### E. High School Science Classrooms

High school sophomores and their teachers in the Tulsa, Pryor, Stillwater, Konawa and Oologah schools participated in the study.

## IV. Results

### A. Commercially Available Water Education Computer Programs

Nineteen water education software programs were identified. The topics they covered ranged from specific issues like acid rain to general topics like the water cycle. Five programs were randomly selected for study in the 5 high schools (Appendix B).

### B. Criteria Commonly Used to Evaluate Computer Software

Thirty-five criteria were identified from eleven separate evaluation forms. Fifteen of the thirty-five criteria most often appearing on the eleven forms were selected. These fifteen criteria were used to develop the software evaluation questions on the teachers' and students' tests (Appendix D).

### C. Student Reaction to Software

1. Table I lists the computer programs and the population of students and teachers participating in the study.

Table I

Computer Program	Student		Teachers
	non-user	user.	
Hydrologic Cycle	118	31	2
Water Pollution	31	22	2
Water Cycle	34	13	1
Water and Weather	77	21	2
Streams and Rivers	79	23	3
Total	339	110	10

2. High School Students Concern for Water Issues

To determine if water programs influenced high school students concern over water issues, 339 students not using the programs and 107 student who used one of the five programs were tested using the Watson Water Concern Scale. A score of 25 is the highest positive score possible. Table II shows a comparison of mean responses.

Table II

t-Test Comparison Between Water Concern Scale Mean Scores for Student Water Program Users and Non-users					
	N	$\bar{X}$	t	Df	Significance
Users	107	15.73			
			1.92	444	0.054
Non-users	339	15.15			

The slight difference in mean response could probably occur due to chance only 54 times in 1000. To identify which of the software programs contributed to the level of significance, users of each program were compared with 339 non-users having a mean response of 15.15.

Table III

t-Test Comparison Between Water Concern Scale Mean Scores of Users by Program With All Non-users				
	N	$\bar{X}$	t	Sig
Hydrologic Cycle-user	31	14.87	-0.53	0.59
Water Pollution	22	17.36	-3.66	0.0003
Water Cycle	13	16.38	-1.58	0.11
Water and Weather	18	14.72	0.63	0.52
Streams and Rivers	23	15.78	-1.06	0.28

Users of the Water Pollution Program showed the greater water concern mean score while scores on the Hydrologic Cycle, and Water and Weather programs were actually lower than the mean score water concern score of 339 high school student non-users. Only the mean gain for those taking the Water Pollution program were statistically significant.

### 3. High School Students Knowledge of Water Concepts

To determine if the water education program users had higher knowledge levels than non-users, mean scores on the subject matter content test were compared between groups for each of the 5 programs. Table IV shows users of the Hydrologic Cycle, Water Pollution and Streams and Rivers programs with statistically significant gains over non-users. No significant difference existed between users and non-users of the Water Cycle program and the Water and Weather program.

Table IV

t-test Comparison of Mean Knowledge Scores of Water Software Users and Non-users by Software Program

Computer Program	Student	N	$\bar{X}$	t	significance
Hydrologic Cycle	Users	31	9.87	4.6	0.0001
	Non-users	118	6.95		
Water Pollution	Users	22	7.09	4.07	0.0002
	Non-users	31	4.83		
Water Cycle	Users	13	11.46	1.48	0.158
	Non-users	34	9.38		
Water and Weather	Users	21	7.9	-1.45	.1492
	Non-users	77	8.97		
Streams and Rivers	Users	23	9.43	8.91	0.0001
	Non-users	79	4.72		

D. Comparison of High School Teachers' Predicted with Actual Student Evaluation and Knowledge Gains

1. Teacher and Student Program Evaluation

The maximum positive evaluation score any program could receive was 65. The evaluation score of all students using all programs were compared with the teachers' mean evaluation score in Table V.

Table V

t-test Comparison of Mean Evaluation Scores for Teacher and Student Water Software Users					
	N	$\bar{X}$	t	Df	Significance
Student Users	110	47.86	.108	118	.91
Teachers	10	47.60			

No significant difference existed between teacher and student mean evaluation scores for all programs combined. A comparison of student with teacher mean evaluation scores on each program revealed Water Pollution with the greatest difference between student and teacher evaluation. (student  $\bar{X}$  = 48.4, at 0.08 level of confidence). Table VI shows mean scores ranked from high to low.

Table VI

Student and Teacher Program Evaluation in Rank Order			
Software Program	Student Mean Score	Software Program	Teacher Mean Score
1. Streams and Rivers	51.0	1. Hydrologic Cycle <sup>2</sup>	53.5
2. Water Pollution	48.4	2. Water Cycle	49.0
3. Hydrologic Cycle	48.06	3. Water and Weather	49.0
4. Water and Weather	46.0	4. Streams and River	47.0
5. Water Cycle	43.8	5. Water Pollution	40.5



The two programs ranked highest by students were the two ranked lowest by teachers.

## 2. Teacher's predicted and actual student performance

Each computer program's objectives were measured by a series of test questions. Teachers were given these test items and asked to predict the percent of correct responses they would expect from high school students. Correct responses were predicted for students never using the water software and for students who took the test after using the computer software. Percent of predicted correct responses were categorized in the following groups:

1. 90 - 100%
2. 75 - 89%
3. 60 - 74%
4. 31 - 59%
5. 0 - 30%

Each test question percent correct category predicted by the teacher was compared with the actual percent category achieved by the users and non-users of the water software. The proportion of test items where the students performed the same, better, and worse than predicted by the teacher are reported in Table VII.

Table VII

Shift in Teacher Predicted and Actual Percent Categories by Program						
Program	BEFORE PROGRAM Predicted vs. Actual Student Performance			AFTER PROGRAM Predicted vs. Actual Student Performance		
	% Same	% Better	% Worse	% Same	% Better	% Worse
Hydrologic Cycle	32	20	47.5	15	5	80
Water Pollution	25	45	30	35	0	65
Water Cycle	30	20	50	10	5	85
Water and Weather	35	40	25	2.5	0	87.5
Streams and Rivers	41.6	33.3	25	22.2	44.4	33.3

Teachers' prediction of high school students performance where computer software had not been used shows no dominant pattern. Generally, teacher estimates were congruent with student performance about one third of the time.

When the student has used the water software, however, teacher prediction of achievement and actual student achievement are considerably different. Four of the five water programs show students performing considerably worse than teachers predicted.

In all cases, the proportion of students doing worse than predicted increased with use of the water education software.

## V. Discussion and Recommendations

- A. An extensive computer and hand library search identified only 19 water education computer programs. Considering the importance, depth, and breadth of the conceptual schemes associated with water, this paucity of computerized water education software is surprising. There is a need to develop software dealing with topics within broad areas such as the water cycle; i.e., ground water, and primary and tertiary sewage treatment, etc.
- B. Analysis of the criteria used to evaluate educational software revealed considerable continuity of criteria across the eleven different forms studied. The uniformity of criteria being used nationally makes the results of this study readily exportable to other educational contexts.
- C. Comparison of Water Software Users with Non-users

1. Does exposure to water education software appear to influence concern for water issues?

A comparison of high school student water software users' with non-users' scores on the Watson Water Concern Scale indicated that overall there was a higher score for users. The slight increase in mean scores is statistically significant at the 0.054 level of confidence (Table II). Generally, this would be accepted as evidence that use of the water software was increasing the level of concern over water issues. It is interesting to note, however, that the program Water Pollution had the highest mean water concern score (Table III). The difference in user vs. non-user mean score was significant at the 0.0003 level of confidence. One can infer that this water software program was responsible for the overall higher mean score for users. Considering the need for a concerned as well as well as informed citizenry, this program is a promising contribution to public education. The exact format, context, and methods employed in the Water Pollution program require further study!

2. Does use of water education computer programs influence high school students' level of water knowledge?

Mean scores on the knowledge test were compared by program. Increased mean scores on the Hydrologic Cycle, Water Pollution and Streams and Rivers programs were statistically significant at least

at the 0.0002 level of confidence (Table IV). An anomaly exists in that users of the Water and Weather program did worse than non-users. The 21 student users low mean score also resulted in students doing worse on 87.5% of the test for Water and Weather than teachers predicted. This group of students have responded disproportionately low! Four of the five programs show higher user mean scores. It can be concluded that, except for Water and Weather, these programs do teach water concepts to high school students. It must be noted, however, that the number of questions asked per program were not equal. The number of questions in sequence of how the programs are listed in Table IV are 20, 10, 20, 20, and 12 respectively. Thus non-users, i.e., a random sample of high school sophomores, responded correctly less than 50% of the time; this indicates low levels of water knowledge possessed by high school students and supports prior research indicating this fact!  
(6)

The greatest difference in user and non-user knowledge scores existed in the Water Pollution and Streams and Rivers programs. They also apparently influence concern for water issues.

#### D. Comparison of Teacher Predicted With Actual Student Performance

1. Do teachers and high school students evaluate water software equally?

The mean evaluation score of 110 student users of the software was compared with that of ten high school teachers. Only a 0.26 difference in mean score existed; however, when evaluations were compared by program, the two programs evaluated as best by students were the same two evaluated lowest by teachers (Table VI).

It is interesting to note that Water Pollution and Streams and Rivers were both evaluated high by students using criteria commonly used for this purpose by professionals! The two programs they rated high using the professional criteria were also those that apparently can increase their concern for water issues and substantially increased their knowledge. It appears that in the case of water education software, high school students know what is best for them.

2. What congruence exists between what teachers estimate students know and what the students actually know?

For each test of knowledge question, teachers, following review of the software, predicted the percent of high school students that would answer the question correctly before using the program and after. Students were then asked these questions and their responses compared with those predicted by the teacher. This was done for both student users and non-users of the software.

Table VII shows a relatively low congruence between what non-users of the software know and what teachers think they know. Only about 1/3 of the time was the predicted and actual percent correct in the same category! What high school students know about the water

resource is not readily apparent to teachers!

The estimated influence of four of the five water computer programs was judged inordinately high by teachers. On these programs, over 80 percent of the time, students knowledge was lower than that estimated by the teacher. Teachers had considerably more faith in the ability of the computer to teach than was warranted! This is perhaps due to the view of computers and their capabilities presented in the media!

The programs Water Pollution and Streams and Rivers stand out. They had the highest level of student/teacher congruence and the lowest proportion of students doing worse than predicted. These two programs appear to live up to teacher expectations more than the others.

#### E. Summary

High school students are apparently good judges of what is educationally sound water education software. The software studied can increase high school students knowledge level, but nowhere near what teachers predict it can! Teachers have an unreasonable faith in the ability of computer software to teach water concepts!

Three of the five programs studied appear to increase water concern levels. The Water Pollution program in particular showed this ability.

Two programs, Water Pollution and Streams and Rivers appear to increase both water knowledge and concern for water issues. These two programs should be analysed in greater detail!

## Bibliography

1. Ingersol, Gary M. et al. "Microcomputers in American Public Schools: A National Survey," Educational Computer, 3 (6): 28, p. 30-31, Oct. 1983.
2. Disinger, John F., and Rosanne W. Fortner. "Using Computers in Environmental Education," ERIC Information Bulletin, No. 3, 1984.
3. Roth, Susan K., Editor. Clearinghouse of Information on Microcomputers In Education (CHIME), College of Education, O.S.U.
4. Lathrop, Ann, Editor. The 1985 Educational Software Preview Guide. California TECC Library & Microcomputer Center, San Mateo County Office of Education, Redwood City, CA, 1985.
5. Watson, G.A. "Developing a Water Concern Scale," Journal of Environmental Education, No. 5, Summer, 1984, pp. 54-58.
6. Mills, Terence J. "Water Resources Knowledge Assessment of College Bound High School Students," Proceedings of the Oklahoma Academy of Science, Vol. 63, 1983, pp. 78-82.

APPENDIX A

## Catalog Sources for Computer Software

Lathrop, Ann, Editor. The 1985 Educational Software Preview Guide. California TECC Library & Microcomputer Center, San Mateo County Office of Education, Redwood City, CA, 1985.

MENU--The International Software DataBase. The Software Catalog 1985/86. Elsevier Science Publishing Co., Inc., New York, Amsterdam, Oxford.

NSTA, Supplement of Science Education Supplier, Computers/Software, NSTA, Washington, D.C., 1985.

Systems Development Department. The Software Encyclopedia 1985/86. R.R. Bowker Company, New York and London, 1985.

APPENDIX B



Water Education Computer Software  
for High School

- Acid Rain, Diversified Educational Enterprises, Inc., 725 Main Street,  
Lafayette, IN 47901
- Density and Salinity of Water, Allen Woolway, Focus Media, Inc., 839 Stewark  
Avenue, P.O. Box 865, Garden City, NY 11530.
- Water Budget, Earth Science Democomp Series, James Blake, Focus Media, Inc.,  
839 Stewark Avenue, P.O. Box 865, Garden City, NY 11530.
- Weather and Climate, the Oceans, Earth Science Series 2, Scot Robinson, Focus  
Media, Inc., 839 Stewark Avenue, P.O. Box 865, Garden City, NY 11530.
- Fish and Fishing, Cambridge Development Laboratory, Inc., 1696 Massachusetts  
Avenue, Cambridge, MA 02138.
- Ground Water, Earth Science Series, International Business Machines  
Corporation, P.O. Box 1328-S, Boca Raton, FL 33432.
- \*Hydrologic Cycle, Earth Science Series. Rita D. Haberlin and Patricia A.  
Kulda, International Business Machines Corporation, P.O. Box 1328-S, Boca  
Raton, FL 33432.
- Life in the Oceans, Right On Programs, Division of Computeam, Inc., 140 E. Main  
Street, Huntington, NY 11743.
- Moisture in the Atmosphere, Earth Science Series. International Business  
Machines Corporation, P.O. Box 1328-S, Boca Raton, FL 33432.
- Pollute, Diversified Educational Enterprises, Inc., 725 Main Street, Lafayette,  
IN 47901.
- Pond Ecology, Scott, Foresman & Co., 1900 East Lake Avenue, Glenview, IL 60025.
- Reservoirs, Dorsett Educational Systems, Inc., P.O. Box 1226, Norman, OK 73070.
- Rock & Water Cycle, Educational Computing System, Inc., 136 Fairbanks Road, Oak  
Ridge, TN 37830.
- \*Streams and Rivers, The Skies Above, The Waters Below, J. Marks, Copyright  
1982, Aquarius People Materials, Inc., P.O. Box 128, Indian Rocks Beach,  
FL 33535.
- Surface Water, Earth Science Series, International Business Machines  
Corporation, P.O. Box 1328-S, Boca Raton, FL 33432.
- The Oceans, The Skies Above, The Waters Below, Copyright 1982, J. Marks,  
Aquarius People Materials, Inc., P.O. Box 128, Indian Rocks Beach, FL 33535.
- \*Water Cycle, Nasco, 901 Janeville Avenue, Fort Atkinson, WI 53538.
- \*Water Pollution, Educational Materials and Equipment Co., P.O. Box 17, Pelham,  
NY 10803.
- \*Water & Weather Series, Morris Gartner, Copyright 1983, Focus Media, Inc., 839  
Stewark Avenue, P.O. Box 865, Garden City, NY 11530.

\*Randomly Selected for inclusion in this study.

APPENDIX C

Computer Software  
Evaluation Forms Reviewed

- A - CALIFORNIA LIBRARY MEDIA CONSORTIUM  
Alexandria City Public Schools  
Computer Software Evaluation Form
- B - NATIONAL COUNCIL FOR TEACHERS IN MATHEMATICS  
Software Evaluation Checklist
- C - INDIANA CLEARINGHOUSE FOR COMPUTER EDUCATION  
Northwest Consolidated Schools of Fairland & School of  
Library and Info Science IU
- D - TEXAS EDUCATION COMPUTER COOPERATIVE  
Courseware Evaluation Form
- E - ARIZONA STATE UNIVERSITY COLLEGE OF EDUCATION  
MICROCOMPUTER RESEARCH CLINIC  
Microcomputer Software Review
- F - MICROSIFT - NORTHWEST REGIONAL EDUCATIONAL LABORATORY  
Courseware Description
- G - E.P.I.E. INSTITUTE  
Microcomputer Courseware Evaluation Form
- H - CALIFORNIA TECC SOFTWARE LIBRARY AND CLEARINGHOUSE  
Evaluation of Instructional Courseware
- I - CLEARINGHOUSE FORM INFORMATION IN MICROCOMPUTER EDUCATION  
OKLAHOMA STATE UNIVERSITY  
Software Evaluation Form
- J - SECTOR PROJECT, UTAH  
Sector Courseware Evaluation Form
- K - ALBERTA EDUCATION  
Clearinghouse Evaluators' Guide for Microcomputer - Based  
Courseware

\*Code used to denote source using specific criteria; see Appendix D.

APPENDIX D

## Common Evaluation Criteria

Evaluation Criteria	ABCDEFGHIJK*
Learning will happen	D G K
Practice is necessary or testing during program	C G K
Content is accurate, has soundness and validity	-ABCD FG IJK
Content has educational value and significance	-AB D FG IJK
Content is free from stereotypes	-AB FGH K
Well defined purpose & instruction focus	-AB FG I K
Content is clear & logical	ABC FG JK
Difficulty - designed for target audience and/or test students ability	-A CD FGHIJK *****
Graphics/color/sound are appropriate and used	-AB FG I K
Package is motivational, arouses interest	-A CD FG I K
Stimulates student creativity and/or requires thought, student involvement	ABC F IJK *****
Feedback is adequate	-ABCD FGH JK
Learner controls rate and sequence	-AB D FGHIJK
Learning may be extended to different situations	AB D G J
Support materials are necessary	-AB DEFGHIJK
Support materials are comprehensive	A FG JK
Support materials are effective	A C FG JK
Informational displays are effectively organized	-ABCD FGH JK
No teacher intervention	-ABCD FG I K
Easy for teacher or student to use software	A D FGHIJK
Uses computers capabilities	A F H K
Program reliable in normal use	A H JK
Best group size	-ABCDE G I K
Execution time	-ABCD G I K
Freedom from disruption by systems errors	ABC GHI K
Simplicity of user input	B D JK
Copatability with other materials used and/or fits in to curriculum	BC GHI K *****
Social characteristics - competition, cooperation	H K
Summary of student performance tests	- BCDE G JK
Good directions	- B D GHI K
Meets objectives and/or goals	- CD FGHIJK
Would repeat program	CD G
Prerequisite skills	C FG J
Rating the program	-ABCDEFGHI K
Teacher controls data - input, output	HI K

- Criteria repeated most often on the evaluation forms and used to evaluate the 5 randomly selected programs. Total number of criteria equal eighteen.

\*Code for source using this criteria

APPENDIX E

## STUDENT EVALUATION : PRETEST

### The Water Cycle

The questions you are about to answer are about water. You will not be graded on your answers, therefore, your name is not required. Scores will be averaged and compared. It is important that you answer each question to the best of your knowledge.

**DIRECTIONS:** Please write Student Pretest where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet.

1. I am taking test form (see title) (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
2. The test I am taking is (see subtitle) (A) Hydrologic Cycle (B) Water Pollution (C) Water Cycle (D) Water & Weather Series (E) Streams and Rivers.
3. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th (E) 12th
4. The number of sciences classes I have had is (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
5. We really haven't thought about cutting down our use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
6. Water reclaimed from waste is as good as any other water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
7. Mankind has a right to free and unlimited use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
8. Nature has a way to solve water supply problems before they get serious. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
9. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree

10. What is water? (A) H<sub>2</sub> (B) H<sub>2</sub>O (C) H<sub>2</sub>SO<sub>4</sub> (D) H<sub>2</sub>O<sub>2</sub>
11. At what temperature (Degrees Celsius) does water freeze?  
(A) -32 (B) 10 (C) 0 (D) 32
12. Water boils at what temperature (Degrees Celsius)?  
(A) 98.6 (B) 212 (C) 100 (D) 220
13. Is a summer sea breeze cooler than a land breeze?  
(A) yes (B) no
14. What part (%) of sunlight is reflected back to space by the air and clouds? (A) 50% (B) 30% (C) 20% (D) 10%
15. What is a monsoon? (A) a heavy rain (B) an onshore wind (C) a strong dry wind (D) a big storm
16. What part (%) of rainfall is evaporated from the soil and plants? (A) 5% (B) 64% (C) 79% (D) 31%
17. What part (%) of rainfall runs off directly to the rivers? (A) 25% (B) 5% (C) 10% (D) 52%
18. If the Antarctic Ice Cap melts the sea will rise by...  
(A) 3 meters (B) 1 meter (C) 30 to 60 meters  
(D) 5 to 6 meters
19. When air rises... (A) it becomes cooler. (B) it doesn't change temperature. (C) it becomes warmer. (D) it becomes drier.
20. Air currents travel from... (A) low pressure to high pressure. (B) not at all (C) high pressure to low pressure. (D) north to south.
21. Does air heat up faster over... (A) a bog. (B) the water. (C) the soil. (D) Air heats up equally over all areas.
22. Would air pressure be higher over... (A) a mountain top (B) a warm part of the surface (C) pressure isn't changed by temperature (D) A cool part of the surface
23. Does water evaporate faster at... (A) room temperature (B) high temperatures (C) low temperatures (D) temperature does not matter
24. Which affects evaporation? (A) heat (B) both light and heat (C) light (D) pressure
25. Can water evaporate at a temperature below its boiling point? (A) yes (B) no



26. Energy from the sun causes seawater... (A) to become saltier (B) solar energy does not effect the sea (C) to become less salty (D) to sink
27. If the same amount of heat escapes as is absorbed--the temperature... (A) rises (B) falls (C) remains the same (D) rises then falls
28. In the northern hemisphere an anticyclone rotates... (A) clockwise (B) they don's rotate at all (C) counterclockwise (D) north to south
29. Typical thunderstorms have... (A) wind, rain, and clouds (B) heavy rains (C) clouds (D) strong winds

## STUDENT EVALUATION : PRETEST

### Hydrologic Cycle

The questions you are about to answer are about water. You will not be graded on your answers, therefore, your name is not required. Scores will be averaged and compared. It is important that you answer each question to the best of your knowledge.

DIRECTIONS: Please write Student Pretest where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet.

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3. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th (E) 12th
4. The number of sciences classes I have had is (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
5. We really haven't thought about cutting down our use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
6. Water reclaimed from waste is as good as any other water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
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8. Nature has a way to solve water supply problems before they get serious. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
9. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree

10. What is the source of energy for the hydrologic cycle?  
(A) Gravity (B) Radioactivity (C) The sun (D) Water  
(E) Mountain building
11. Which of the following is not a part of the hydrologic cycle? (A) Lithosphere (B) Biosphere (C) Atmosphere  
(D) Oceans (E) Mantle
12. What is the process that passes water through the pores of plants? (A) Evaporation (B) Percolation  
(C) Outgassing (D) Transpiration (E) None of these
13. What is the entrance of water into the soil called?  
(A) Porosity (B) Capillarity (C) Infiltration  
(D) Permeability
14. Approximately how much of the earth's total water supply is found in the ocean? (A) 30% (B) 50% (C) 75% (D) 97%
15. Which of the following makes up about 2% of the total earth's water supply? (A) Freshwater lakes (B) Rivers  
(C) The soil (D) Glaciers and icepacks (E) Ground water
16. Which of the following contains more water than all of the world's rivers? (A) Glaciers and icepacks  
(B) The ground (C) Lakes (D) All of the above
17. What happens whenever water changes from the gaseous state to the liquid state? (A) Heat is released.  
(B) Heat is absorbed. (C) Water is evaporated.  
(D) Only B and C occur.
18. How does water make its way from the ocean to land areas? (A) By evaporation and runoff (B) By ground water runoff and surface runoff (C) By evaporation, condensation, and precipitation (D) By evapotranspiration and precipitation
19. What happens to most of the water that falls as rain?  
(A) It stays in the soil. (B) It runs off the land in streams. (C) It returns to the atmosphere by evapotranspiration. (D) It sinks into the ground water zone.
20. What is the source of water for the underground zone?  
(A) Lakes (B) Precipitation (C) Rivers (D) Springs
21. What is the average annual rainfall over the continental United States? (A) 10 inches (B) 20 inches  
(C) 30 inches (D) 40 inches (E) 50 inches

22. From where does metropolitan Los Angeles obtain its water? (A) Northern California (B) The Colorado River (C) Owens Valley and Mono Lake Basin (D) Ground water (E) All of the above
23. Which section of California receives the most rainfall? (A) The southern third (B) The Central Valley (C) The northern third
24. Which section of the United States receives the most rainfall? (A) The western states (B) The eastern states
25. Which section of the United States consumes the most water? (A) The West (B) The East
26. Which of the following consumes water that is withdrawn? (A) Irrigation (B) Public Water Supply (C) Hydropower (D) Industrial cooling
27. Which of the following withdraws the most water? (A) Public water supply (B) Industry (C) Irrigation (D) Recreation
28. What is the amount of per capita domestic (in-home) water use in the United States? (A) 2000 gallons a day (B) 90 gallons a day (C) 300 gallons a day (D) 1000 gallons a day
29. Which of the following has occurred in this century, partly as a result of human activities? (A) Glaciers have expanded. (B) Sea level has risen. (C) More water sink into the ground water zone. (D) All of the above have occurred.

## STUDENT EVALUATION : PRETEST

### Water & Weather Series

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3. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th (E) 12th
4. The number of sciences classes I have had is (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
5. We really haven't thought about cutting down our use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
6. Water reclaimed from waste is as good as any other water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
7. Mankind has a right to free and unlimited use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
8. Nature has a way to solve water supply problems before they get serious. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
9. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree

10. When the rate of condensation is equal to the rate of evaporation, the air is said to be...  
(A) supersaturated (B) supercooled (C) saturated  
(D) unsaturated.
11. Evaporation takes place most slowly when the air is...  
(A) humid (B) dry (C) saturated (D) hot.
12. As the temperature decreases, the amount of dew...  
(A) varies (B) increases (C) stays the same  
(D) decreases.
13. You have a glass filled with ice-cold soda pop. Moisture will appear most quickly on a day which is...  
(A) warm and dry (B) cold and dry (C) warm and humid  
(D) cold and humid.
14. As the amount of cloud cover increases, the rate of evaporation from the earth's surface will...  
(A) increase (B) decrease (C) stay the same (D) vary.
15. Which is not an example of evaporation? (A) gaseous water forming from liquid water (B) cooling of your skin after a swim (C) water boiling (D) cloud formation from water vapor
16. The ability of the atmosphere to hold water vapor is determined by its... (A) humidity. (B) oxygen content (C) pressure (D) temperature.
17. If the amount of moisture in the air increases while the temperature remains the same, the relative humidity will... (A) decrease (B) vary upwards or downwards (C) increase (D) remain constant.
18. Where would you normally find the greatest difference in temperature readings between the wet and dry-bulb thermometers of a psychrometer? (A) the seashore (B) an inland city (C) a tropical rain forest (D) the desert
19. The liquid inside a wet-bulb thermometer is...  
(A) cobalt chloride (B) water (C) alcohol (D) mercury
20. Dew point is measured in... (A) liters (B) grams (C) percent (D) degrees.
21. The air contains the smallest amount of water vapor during... (A) Fall (B) Spring (C) Summer (D) Winter.
22. A humid day is one which is... (A) is hot (B) has a lot of moisture in the air (C) is foggy (D) is rainy.

23. Snow crystals have... (A) 10 sides (B) 8 sides  
(C) 6 sides (D) 4 sides.
24. The process of changing gaseous water to liquid water is called... (A) precipitation (B) condensation  
(C) sublimation (D) evaporation.
25. Most high clouds are made of... (A) condensation  
nuclei (B) water droplets (C) ice crystals  
(D) water vapor.
26. Approximately how many cloud droplets are equal to the  
size of a raindrop? (A) 1 thousand (B) 1 hundred  
(C) 10 (D) 1 million
27. One centimeter of rain is equivalent to about...  
(A) 100 centimeters of snow (B) 10 centimeters of snow  
(C) 1 centimeter of snow (D) 2 centimeters of snow.
28. If the temperature remains at zero degrees C. or below  
from the clouds all the way down to the ground, any  
precipitation will be in the form of... (A) sleet  
(B) glaze (C) wet snow (D) dry snow.
29. Which represents the correct order of cloud formation?  
The moist air... (A) evaporates - rises - cools to dew  
point - condenses (B) cools to dew point - rises -  
evaporates - condenses (C) rises - cools to dew point -  
evaporates - condenses (D) evaporates - cools to dew  
point - rises - condenses.

## STUDENT EVALUATION : PRETEST

### Streams and Rivers

The questions you are about to answer are about water. You will not be graded on your answers, therefore, your name is not required. Scores will be averaged and compared. It is important that you answer each question to the best of your knowledge.

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3. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th (E) 12th
4. The number of sciences classes I have had is (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
5. We really haven't thought about cutting down our use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
6. Water reclaimed from waste is as good as any other water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
7. Mankind has a right to free and unlimited use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
8. Nature has a way to solve water supply problems before they get serious. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
9. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree



10. The greatest amount of rain falls at... (A) higher elevations (B) lower elevations.
11. In the eastern United States most rivers flow toward the (A) Atlantic Ocean (B) Gulf of Mexico (C) Pacific Ocean (D) both A and B (E) both B and C.
12. In the western United States most rivers flow toward the (A) Atlantic Ocean (B) Pacific Ocean (C) Mississippi River (D) both A and C (E) both B and C.
13. A feature which appears at the bottom of a waterfall is a... (A) delta (B) deposit (C) pothole (D) meander
14. During heavy rainstorms, water sometimes gradually erodes the tops of waterfalls causing them to become longer. This process is called... (A) headward erosion (B) headward deposition (C) meandering (D) braiding.
15. Waterfalls usually develop in places where... (A) softrock overlays hardrock (B) hardrock alone exists (C) hardrock overlays softrock (D) softrock alone exists.
16. When a river meets an ocean or lake what is the feature that often forms? (A) seamount (B) meander (C) pothole (D) delta
17. If a stream flows through a raised sandy area what type of stream occurs? (A) waterfall (B) headward erosional stream (C) meandering stream (D) braided stream
18. A river in flat area with no mountains will tend to be a (A) braided river (B) meandering river (C) waterfall (D) headward erosional river.
19. In a meandering stream, deposition occurs on (A) the high outside bank (B) the low inside bank (C) both A and B (D) neither bank.
20. In a meandering stream, erosion takes place on (A) the high outside bank (B) the low inside bank (C) both A and B (D) neither bank.
21. A double delta may form... (A) after a flood (B) when the sea level changes (C) when a river changes course (D) all of the above.

## STUDENT EVALUATION : PRETEST

### Water Pollution

The questions you are about to answer are about water. You will not be graded on your answers, therefore, your name is not required. Scores will be averaged and compared. It is important that you answer each question to the best of your knowledge.

DIRECTIONS: Please write Student Pretest where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet.

1. I am taking test form (see title) (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
2. The test I am taking is (see subtitle) (A) Hydrologic Cycle (B) Water Pollution (C) Water Cycle (D) Water & Weather Series (E) Streams and Rivers.
3. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th (E) 12th
4. The number of sciences classes I have had is (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
5. We really haven't thought about cutting down our use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
6. Water reclaimed from waste is as good as any other water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
7. Mankind has a right to free and unlimited use of water. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
8. Nature has a way to solve water supply problems before they get serious. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree
9. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided (D) disagree (E) strongly disagree

10. As the temperature of a body of water decreases dissolved oxygen levels (A) decrease (B) increase (C) remain the same (D) decrease then increase.
11. Before stocking a lake with game fish, what is the most important factor to check? (A) Dissolved oxygen content (B) Water temperature (C) Rate of flow (D) Type of waste being dumped
12. As the flow rate of a body of water decreases the dissolved oxygen levels (A) decrease (B) increase (C) remain the same (D) increase and then decrease.
13. BOD is an abbreviation for (A) beneficial organic decay (B) biochemical oxygen demand (C) biological organic decomposition (D) benethic oxidation and decay.
14. All of the following are true about water except it (A) is found in all living things (B) can contain dissolved gases and minerals (C) is most dense at 0 degrees Celsius (D) can be treated to remove harmful matter.
15. As the concentration of organic wastes in a body of water increases the BOD (A) decreases (b) increases (C) stays the same (D) increases then levels off.
16. Which body of water has the highest BOD? (A) 1 degree Celsius lake with 5 ppm of secondary treated industrial waste (B) 1 degree Celsius slow river with 5ppm of primary treated sewage (C) 20 degree Celsius fast river with 13pp of untreated industrial waste (D) 20 degree Celsius pond with 15pp of untreated sewage.
17. Organisms that decompose wastes even after the dissolved oxygen level drops to 0 are (A) Anaerobic (can do without oxygen) (B) Aerobic (need oxygen) (C) undergoing respiratory distress (D) in need of secondary treatment.
18. Most game fish die in bodies of water with dissolved oxygen levels of less than (A) 3 ppm (parts per million) (B) 5 ppm (C) 10 ppm (D) 14 ppm.
19. Secondary treatment of wastes before dumping into waterways is more desirable than just primary treatment because (A) it kills harmful microorganisms (B) it keeps the BOD low (C) none of the above (D) both A and B

APPENDIX F

STUDENT EVALUATION : POST REVIEW

The Water Cycle

The questions you are about to answer are about water. You will not be graded on your answers, therefore, your name is not required. Scores will be averaged and compared. It is important that you answer each question to the best of your knowledge.

DIRECTIONS: Please write POST REVIEW where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

1. I am taking test form (A) Teacher Evaluation  
(B) Student Evaluation : Post Review (C) Student  
Evaluation : Pretest
2. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th  
(E) 12th
3. The number of science classes I have had is (A) 1 (B) 2  
(C) 3 (D) 4 (E) 5 or more.
4. My previous experience on a computer is (A) 0 to 20  
hours (B) 21 to 40 hours (C) 41 to 60 hours  
(D) 61 to 80 hours (E) over 81 hours.
5. How many educational microcomputer programs have you  
used or seen in your classes prior to this program?  
(A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or  
more
6. I feel comfortable using computers. (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly  
disagree

Please answer the following questions after running the program.

7. The computer software that I am working with is on  
(A) IBM Hydrologic Cycle (B) APPLE Water Pollution  
(C) APPLE Water Cycle (D) APPLE Water & Weather Series  
(E) APPLE Streams and Rivers.
8. This was a high quality program compared to others you  
have used or seen. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree

9. I enjoyed using this program. (A) strongly agree  
(B) agree (C) neutral (D) disagree  
(E) strongly disagree
10. I would share this information with a friend.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
11. What grade level do you think this material is  
appropriate for? (A) 4th and 5th (B) 6th and 7th  
(C) 8th and 9th (D) 10th and 11th (E) 12th or more.
12. There was enough visual material (graphics) to help me.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
13. The length of the program is appropriate for a single  
lesson or class period. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
14. I was able to control the rate and sequence of  
presentation and review. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
15. I was able to operate the program without  
teacher assistance. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
16. The directions were easy to understand. (A) strongly  
agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
17. My mistakes were explained for me. (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly  
disagree
18. The content is free of race, ethnic, sex and other  
stereotypes. (A) strongly agree (B) agree (C) neutral  
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19. This computer program is as useful as other learning  
materials such as books, worksheets, charts, lectures  
and films. (A) strongly agree (B) agree (C) neutral  
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20. The books, worksheets, charts, etc. that came with the  
program were helpful. (A) strongly agree (B) agree  
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21. I find this program "exciting." (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly disagree

22. This program should be used in sciences classes.  
(A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
23. More time should be spent learning with computer software programs. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
24. I think water education is important. (A) strongly agree (B) agree (C) neutral (D) disagree  
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30. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
31. What is water? (A) H<sub>2</sub> (B) H<sub>2</sub>O (C) H<sub>2</sub>SO<sub>4</sub> (D) H<sub>2</sub>O<sub>2</sub>
32. At what temperature (Degrees Celsius) does water freeze?  
(A) -32 (B) 10 (C) 0 (D) 32
33. Water boils at what temperature (Degrees Celsius)?  
(A) 98.6 (B) 212 (C) 100 (D) 220
34. Is a summer sea breeze cooler than a land breeze?  
(A) yes (B) no
35. What part (%) of sunlight is reflected back to space by the air and clouds? (A) 50% (B) 30% (C) 20% (D) 10%
36. What is a monsoon? (A) a heavy rain (B) an onshore wind (C) a strong dry wind (D) a big storm

37. What part (%) of rainfall is evaporated from the soil and plants? (A) 5% (B) 64% (C) 79% (D) 31%
38. What part (%) of rainfall runs off directly to the rivers? (A) 25% (B) 5% (C) 10% (D) 52%
39. If the Antarctic Ice Cap melts the sea will rise by... (A) 3 meters (B) 1 meter (C) 30 to 60 meters (D) 5 to 6 meters
40. When air rises... (A) it becomes cooler. (B) it doesn't change temperature. (C) it becomes warmer. (D) it becomes drier.
41. Air currents travel from... (A) low pressure to high pressure. (B) not at all (C) high pressure to low pressure. (D) north to south.
42. Does air heat up faster over... (A) a bog. (B) the water. (C) the soil. (D) Air heats up equally over all areas.
43. Would air pressure be higher over... (A) a mountain top (B) a warm part of the surface (C) pressure isn't changed by temperature (D) A cool part of the surface
44. Does water evaporate faster at... (A) room temperature (B) high temperatures (C) low temperatures (D) temperature does not matter
45. Which affects evaporation? (A) heat (B) both light and heat (C) light (D) pressure
46. Can water evaporate at a temperature below its boiling point? (A) yes (B) no
47. Energy from the sun causes seawater... (A) to become saltier (B) solar energy does not effect the sea (C) to become less salty (D) to sink
48. If the same amount of heat escapes as is absorbed--the temperature... (A) rises (B) falls (C) remains the same (D) rises then falls
49. In the northern hemisphere an anticyclone rotates... (A) clockwise (B) they don's rotate at all (C) counterclockwise (D) north to south
50. Typical thunderstorms have... (A) wind, rain, and clouds (B) heavy rains (C) clouds (D) .strong winds



## STUDENT EVALUATION : POST REVIEW

### Water & Weather Series

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4. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
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31. When the rate of condensation is equal to the rate of evaporation, the air is said to be...  
(A) supersaturated (B) supercooled (C) saturated  
(D) unsaturated.
32. Evaporation takes place most slowly when the air is...  
(A) humid (B) dry (C) saturated (D) hot.
33. As the temperature decreases, the amount of dew...  
(A) varies (B) increases (C) stays the same  
(D) decreases.
34. You have a glass filled with ice-cold soda pop. Moisture will appear most quickly on a day which is...  
(A) warm and dry (B) cold and dry (C) warm and humid  
(D) cold and humid.

35. As the amount of cloud cover increases, the rate of evaporation from the earth's surface will...  
(A) increase (B) decrease (C) stay the same (D) vary.
36. Which is not an example of evaporation? (A) gaseous water forming from liquid water (B) cooling of your skin after a swim (C) water boiling (D) cloud formation from water vapor
37. The ability of the atmosphere to hold water vapor is determined by its... (A) humidity (B) oxygen content (C) pressure (D) temperature.
38. If the amount of moisture in the air increases while the temperature remains the same, the relative humidity will... (A) decrease (B) vary upwards or downwards (C) increase (D) remain constant.
39. Where would you normally find the greatest difference in temperature readings between the wet and dry-bulb thermometers of a psychrometer? (A) the seashore (B) an inland city (C) a tropical rain forest (D) the desert
40. The liquid inside a wet-bulb thermometer is...  
(A) cobalt chloride (B) water (C) alcohol (D) mercury
41. Dew point is measured in... (A) liters (B) grams (C) percent (D) degrees.
42. The air contains the smallest amount of water vapor during... (A) Fall (B) Spring (C) Summer (D) Winter.
43. A humid day is one which is... (A) is hot (B) has a lot of moisture in the air (C) is foggy (D) is rainy.
44. Snow crystals have... (A) 10 sides (B) 8 sides (C) 5 sides (D) 4 sides.
45. The process of changing gaseous water to liquid water is called... (A) precipitation (B) condensation (C) sublimation (D) evaporation.
46. Most high clouds are made of... (A) condensation nuclei (B) water droplets (C) ice crystals (D) water vapor.
47. Approximately how many cloud droplets are equal to the size of a raindrop? (A) 1 thousand (B) 1 hundred (C) 10 (D) 1 million

48. One centimeter of rain is equivalent to about...  
(A) 100 centimeters of snow (B) 10 centimeters of snow  
(C) 1 centimeter of snow (D) 2 centimeters of snow.
49. If the temperature remains at zero degrees C. or below from the clouds all the way down to the ground, any precipitation will be in the form of... (A) sleet  
(B) glaze (C) wet snow (D) dry snow.
50. Which represents the correct order of cloud formation? The moist air... (A) evaporates - rises - cools to dew point - condenses (B) cools to dew point - rises - evaporates - condenses (C) rises - cools to dew point - evaporates - condenses (D) evaporates - cools to dew point - rises - condenses.

STUDENT EVALUATION : POST REVIEW

Hydrologic Cycle

The questions you are about to answer are about water. You will not be graded on your answers, therefore, your name is not required. Scores will be averaged and compared. It is important that you answer each question to the best of your knowledge.

DIRECTIONS: Please write POST REVIEW where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

1. I am taking test form (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
2. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th (E) 12th
3. The number of science classes I have had is (A) 1 (B) 2 (C) 3 (D) 4 (E) 5 or more.
4. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
5. How many educational microcomputer programs have you used or seen in your classes prior to this program? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
6. I feel comfortable using computers. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

Please answer the following questions after running the program.

7. The computer software that I am working with is on (A) IBM Hydrologic Cycle (B) APPLE Water Pollution (C) APPLE Water Cycle (D) APPLE Water & Weather Series (E) APPLE Streams and Rivers.
8. This was a high quality program compared to others you have used or seen. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

9. I enjoyed using this program. (A) strongly agree  
(B) agree (C) neutral (D) disagree  
(E) strongly disagree
10. I would share this information with a friend.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
11. What grade level do you think this material is  
appropriate for? (A) 4th and 5th (B) 6th and 7th  
(C) 8th and 9th (D) 10th and 11th (E) 12th or more.
12. There was enough visual material (graphics) to help me.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
13. The length of the program is appropriate for a single  
lesson or class period. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
14. I was able to control the rate and sequence of  
presentation and review. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
15. I was able to operate the program without  
teacher assistance. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
16. The directions were easy to understand. (A) strongly  
agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
17. My mistakes were explained for me. (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly  
disagree
18. The content is free of race, ethnic, sex and other  
stereotypes. (A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
19. This computer program is as useful as other learning  
materials such as books, worksheets, charts, lectures  
and films. (A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
20. The books, worksheets, charts, etc. that came with the  
program were helpful. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
21. I find this program "exciting." (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly disagree

22. This program should be used in sciences classes.  
(A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
23. More time should be spent learning with computer software programs. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
24. I think water education is important. (A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
25. I think water education should be taught in the schools.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
26. We really haven't thought about cutting down our use of water. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
27. Water reclaimed from waste is as good as any other water. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
28. Mankind has a right to free and unlimited use of water.  
(A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
29. Nature has a way to solve water supply problems before they get serious. (A) strongly agree (B) agree  
(C) undecided (D) disagree (E) strongly disagree
30. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
31. What is the source of energy for the hydrologic cycle?  
(A) Gravity (B) Radioactivity (C) The sun (D) Water  
(E) Mountain building
32. Which of the following is not a part of the hydrologic cycle? (A) Lithosphere (B) Biosphere (C) Atmosphere  
(D) Oceans (E) Mantle
33. What is the process that passes water through the pores of plants? (A) Evaporation (B) Percolation  
(C) Outgassing (D) Transpiration (E) None of these
34. What is the entrance of water into the soil called?  
(A) Porosity (B) Capillarity (C) Infiltration  
(D) Permeability
35. Approximately how much of the earth's total water supply is found in the ocean? (A) 30% (B) 50% (C) 75% (D) 97%



36. Which of the following makes up about 2% of the total earth's water supply? (A) Freshwater lakes (B) Rivers (C) The soil (D) Glaciers and icepacks (E) Ground water
37. Which of the following contains more water than all of the world's rivers? (A) Glaciers and icepacks (B) The ground (C) Lakes (D) All of the above
38. What happens whenever water changes from the gaseous state to the liquid state? (A) Heat is released. (B) Heat is absorbed. (C) Water is evaporated. (D) Only B and C occur.
39. How does water make its way from the ocean to land areas? (A) By evaporation and runoff (B) By ground water runoff and surface runoff (C) By evaporation, condensation, and precipitation (D) By evapotranspiration and precipitation
40. What happens to most of the water that falls as rain? (A) It stays in the soil. (B) It runs off the land in streams. (C) It returns to the atmosphere by evapotranspiration. (D) It sinks into the ground water zone.
41. What is the source of water for the underground zone? (A) Lakes (B) Precipitation (C) Rivers (D) Springs
42. What is the average annual rainfall over the continental United States? (A) 10 inches (B) 20 inches (C) 30 inches (D) 40 inches (E) 50 inches
43. From where does metropolitan Los Angeles obtain its water? (A) Northern California (B) The Colorado River (C) Owens Valley and Mono Lake Basin (D) Ground water (E) All of the above
44. Which section of California receives the most rainfall? (A) The southern third (B) The Central Valley (C) The northern third
45. Which section of the United States receives the most rainfall? (A) The western states (B) The eastern states
46. Which section of the United States consumes the most water? (A) The West (B) The East
47. Which of the following consumes water that is withdrawn? (A) Irrigation (B) Public Water Supply (C) Hydropower (D) Industrial cooling

48. Which of the following withdraws the most water?  
(A) Public water supply (B) Industry (C) Irrigation  
(D) Recreation
49. What is the amount of per capita domestic (in-home) water use in the United States? (A) 2000 gallons a day  
(B) 90 gallons a day (C) 300 gallons a day (D) 1000 gallons a day
50. Which of the following has occurred in this century, partly as a result of human activities? (A) Glaciers have expanded. (B) Sea level has risen. (C) More water sink into the ground wate zone. (D) All of the above have occurred.

## STUDENT EVALUATION : POST REVIEW

### Streams and Rivers

The questions you are about to answer are about water. You will not be graded on your answers, therefore, your name is not required. Scores will be averaged and compared. It is important that you answer each question to the best of your knowledge.

**DIRECTIONS:** Please write POST REVIEW where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

1. I am taking test form (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
2. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th (E) 12th
3. The number of science classes I have had is (A) 1 (B) 2 (C) 3 (D) 4 (E) 5 or more.
4. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
5. How many educational microcomputer programs have you used or seen in your classes prior to this program? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
6. I feel comfortable using computers. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

Please answer the following questions after running the program.

7. The computer software that I am working with is on (A) IBM Hydrologic Cycle (B) APPLE Water Pollution (C) APPLE Water Cycle (D) APPLE Water & Weather Series (E) APPLE Streams and Rivers.
8. This was a high quality program compared to others you have used or seen. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

9. I enjoyed using this program. (A) strongly agree  
(B) agree (C) neutral (D) disagree  
(E) strongly disagree
10. I would share this information with a friend.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
11. What grade level do you think this material is  
appropriate for? (A) 4th and 5th (B) 6th and 7th  
(C) 8th and 9th (D) 10th and 11th (E) 12th or more.
12. There was enough visual material (graphics) to help me.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
13. The length of the program is appropriate for a single  
lesson or class period. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
14. I was able to control the rate and sequence of  
presentation and review. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
15. I was able to operate the program without  
teacher assistance. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
16. The directions were easy to understand. (A) strongly  
agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
17. My mistakes were explained for me. (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly  
disagree
18. The content is free of race, ethnic, sex and other  
stereotypes. (A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
19. This computer program is as useful as other learning  
materials such as books, worksheets, charts, lectures  
and films. (A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
20. The books, worksheets, charts, etc. that came with the  
program were helpful. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
21. I find this program "exciting." (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly disagree

22. This program should be used in sciences classes.  
(A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
23. More time should be spent learning with computer software programs. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
24. I think water education is important. (A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
25. I think water education should be taught in the schools.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
26. We really haven't thought about cutting down our use of water. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
27. Water reclaimed from waste is as good as any other water. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
28. Mankind has a right to free and unlimited use of water.  
(A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
29. Nature has a way to solve water supply problems before they get serious. (A) strongly agree (B) agree  
(C) undecided (D) disagree (E) strongly disagree
30. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
31. The greatest amount of rain falls at... (A) higher elevations (B) lower elevations.
32. In the eastern United States most rivers flow toward the  
(A) Atlantic Ocean (B) Gulf of Mexico (C) Pacific Ocean (D) both A and B (E) both B and C.
33. In the western United States most rivers flow toward the  
(A) Atlantic Ocean (B) Pacific Ocean (C) Mississippi River (D) both A and C (E) both B and C.
34. A feature which appears at the bottom of a waterfall is a... (A) delta (B) deposit (C) pothole (D) meander

35. During heavy rainstorms, water sometimes gradually erodes the tops of waterfalls causing them to become longer. This process is called... (A) headward erosion (B) headward deposition (C) meandering (D) braiding.
36. Waterfalls usually develop in places where... (A) softrock overlays hardrock (B) hardrock alone exists (C) hardrock overlays softrock (D) softrock alone exists.
37. When a river meets an ocean or lake what is the feature that often forms? (A) seamount (B) meander (C) pothole (D) delta
38. If a stream flows through a raised sandy area what type of stream occurs? (A) waterfall (B) headward erosional stream (C) meandering stream (D) braided stream
39. A river in flat area with no mountains will tend to be a (A) braided river (B) meandering river (C) waterfall (D) headward erosional river.
40. In a meandering stream, deposition occurs on (A) the high outside bank (B) the low inside bank (C) both A and B (D) neither bank.
41. In a meandering stream, erosion takes place on (A) the high outside bank (B) the low inside bank (C) both A and B (D) neither bank.
42. A double delta may form... (A) after a flood (B) when the sea level changes (C) when a river changes course (D) all of the above.

STUDENT EVALUATION : POST REVIEW

Water Pollution

The questions you are about to answer are about water. You will not be graded on your answers, therefore, your name is not required. Scores will be averaged and compared. It is important that you answer each question to the best of your knowledge.

DIRECTIONS: Please write POST REVIEW where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

1. I am taking test form (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
2. My grade level is (A) 8th (B) 9th (C) 10th (D) 11th (E) 12th
3. The number of science classes I have had is (A) 1 (B) 2 (C) 3 (D) 4 (E) 5 or more.
4. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
5. How many educational microcomputer programs have you used or seen in your classes prior to this program? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
6. I feel comfortable using computers. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

Please answer the following questions after running the program.

7. The computer software that I am working with is on (A) IBM Hydrologic Cycle (B) APPLE Water Pollution (C) APPLE Water Cycle (D) APPLE Water & Weather Series (E) APPLE Streams and Rivers.
8. This was a high quality program compared to others you have used or seen. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

9. I enjoyed using this program. (A) strongly agree  
(B) agree (C) neutral (D) disagree  
(E) strongly disagree
10. I would share this information with a friend.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
11. What grade level do you think this material is  
appropriate for? (A) 4th and 5th (B) 6th and 7th  
(C) 8th and 9th (D) 10th and 11th (E) 12th or more.
12. There was enough visual material (graphics) to help me.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
13. The length of the program is appropriate for a single  
lesson or class period. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
14. I was able to control the rate and sequence of  
presentation and review. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
15. I was able to operate the program without  
teacher assistance. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
16. The directions were easy to understand. (A) strongly  
agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
17. My mistakes were explained for me. (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly  
disagree
18. The content is free of race, ethnic, sex and other  
stereotypes. (A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
19. This computer program is as useful as other learning  
materials such as books, worksheets, charts, lectures  
and films. (A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
20. The books, worksheets, charts, etc. that came with the  
program were helpful. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
21. I find this program "exciting." (A) strongly agree  
(B) agree (C) neutral (D) disagree (E) strongly disagree



22. This program should be used in sciences classes.  
(A) strongly agree (B) agree (C) neutral  
(D) disagree (E) strongly disagree
23. More time should be spent learning with computer software programs. (A) strongly agree (B) agree  
(C) neutral (D) disagree (E) strongly disagree
24. I think water education is important. (A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
25. I think water education should be taught in the schools.  
(A) strongly agree (B) agree (C) neutral (D) disagree  
(E) strongly disagree
26. We really haven't thought about cutting down our use of water. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
27. Water reclaimed from waste is as good as any other water. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
28. Mankind has a right to free and unlimited use of water.  
(A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
29. Nature has a way to solve water supply problems before they get serious. (A) strongly agree (B) agree  
(C) undecided (D) disagree (E) strongly disagree
30. It's the people who should do something about the water problem. (A) strongly agree (B) agree (C) undecided  
(D) disagree (E) strongly disagree
31. As the temperature of a body of water decreases dissolved oxygen levels (A) decrease (B) increase  
(C) remain the same (D) decrease then increase.
32. Before stocking a lake with game fish, what is the most important factor to check? (A) Dissolved oxygen content  
(B) Water temperature (C) Rate of flow (D) Type of waste being dumped
33. As the flow rate of a body of water decreases the dissolved oxygen levels (A) decrease (B) increase  
(C) remain the same (D) increase and then decrease.
34. BOD is an abbreviation for (A) beneficial organic decay  
(B) biochemical oxygen demand (C) biological organic decomposition (D) benethic oxidation and decay.

35. All of the following are true about water except it (A) is found in all living things (B) can contain dissolved gases and minerals (C) is most dense at 0 degrees Celsius (D) can be treated to remove harmful matter.
36. As the concentration of organic wastes in a body of water increases the BOD (A) decreases (b) increases (C) stays the same (D) increases then levels off.
37. Which body of water has the highest BOD? (A) 1 degree Celsius lake with 5 ppm of secondary treated industrial waste (B) 1 degree Celsius slow river with 5ppm of primary treated sewage (C) 20 degree Celsius fast river with 13ppm of untreated industrial waste (D) 20 degree Celsius pond with 15ppm of untreated sewage
38. Organisms that decompose wastes even after the dissolved oxygen level drops to 0 are (A) Anaerobic (can do without oxygen) (B) Aerobic (need oxygen) (C) undergoing respiratory distress (D) in need of secondary treatment.
39. Most game fish die in bodies of water with dissolved oxygen levels of less than (A) 3 ppm (parts per million) (B) 5 ppm (C) 10 ppm (D) 14 ppm.
40. Secondary treatment of wastes before dumping into waterways is more desirable than just primary treatment because (A) it kills harmful microorganisms (B) it keeps the BOD low (C) none of the above (D) both A and B

APPENDIX G

## TEACHER EVALUATION

### The Water Cycle

#### PART I

DIRECTIONS: Please write TEACHER EVALUATION where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

1. I am taking test form (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
2. I have taught science from (A) 0 to 2 years (B) 3 to 5 years (C) 6 to 8 years (D) 9 to 11 years (E) over 12 years.
3. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
4. How many different educational microcomputer programs have you examined prior to this program? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
5. How many programs have you used with your class prior to this evaluation? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
6. I feel comfortable using computers. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

#### PART II

Please answer the following questions after running the program.

7. The computer software that I am working with is on (A) IBM Hydrologic Cycle (B) APPLE Water Pollution (C) APPLE Water Cycle (D) APPLE Water & Weather Series (E) APPLE Streams and Rivers
8. This was a high quality program compared to others you have used or seen. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
9. High school students will enjoy this program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

10. High school students will want to share this information with a friend. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
11. What grade level do you think this material is appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
12. The program had enough visual material (graphics) to help the student. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
13. The length of the program is appropriate for a single lesson or class period. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
14. The students can control the rate and sequence of presentation and review. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
15. The students will be able to operate the program without teacher assistance. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
16. The students will easily understand the directions. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
17. The students will find the feedback adequate when a mistake is made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
18. The content is free of race, ethnic, sex and other stereotypes. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
19. This computer program is as useful as other teaching materials such as books, worksheets, charts, lectures and films. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
20. The books, worksheets, charts, etc. that came with the program were helpful. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
21. Students will find this program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
22. This program should be used in sciences classes. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

23. More time should be spent teaching with computer software programs. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
24. I think water education is important. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
25. I think water education should be taught in the schools. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

PART III

DIRECTIONS: Please answer the question "What percent of high school students will answer each question correctly before and after using the program?" by using the following:

- |                |               |
|----------------|---------------|
| (A) 90 to 100% | (D) 31 to 59% |
| (B) 75 to 89%  | (E) 30 to 0%  |
| (C) 60 to 74%  |               |

What is water? (A) H<sub>2</sub> (B) H<sub>2</sub>O (C) H<sub>2</sub>SO<sub>4</sub> (D) H<sub>2</sub>O<sub>2</sub>

26. \_\_\_\_\_ % Before  
 27. \_\_\_\_\_ % After

At what temperature (Degrees Celsius) does water freeze?  
 (A) -32 (B) 10 (C) 0 (D) 32

28. \_\_\_\_\_ % Before  
 29. \_\_\_\_\_ % After

Water boils at what temperature (Degrees Celsius)?  
 (A) 98.6 (B) 212 (C) 100 (D) 220

30. \_\_\_\_\_ % Before  
 31. \_\_\_\_\_ % After

Is a summer sea breeze cooler than a land breeze?  
 (A) yes (B) no

32. \_\_\_\_\_ % Before  
 33. \_\_\_\_\_ % After

What part (%) of sunlight is reflected back to space by the air and clouds? (A) 50% (B) 30% (C) 20% (D) 10%

34. \_\_\_\_\_ % Before  
 35. \_\_\_\_\_ % After

What is a monsoon? (A) a heavy rain (B) an onshore wind (C) a strong dry wind (D) a big storm

36. \_\_\_\_\_ % Before

37. \_\_\_\_\_ % After

What part (%) of rainfall is evaporated from the soil and plants? (A) 5% (B) 64% (C) 79% (D) 31%

38. \_\_\_\_\_ % Before

39. \_\_\_\_\_ % After

What part (%) of rainfall runs off directly to the rivers? (A) 25% (B) 5% (C) 10% (D) 52%

40. \_\_\_\_\_ % Before

41. \_\_\_\_\_ % After

If the Antarctic Ice Cap melts the sea will rise by...  
(A) 3 meters (B) 1 meter (C) 30 to 60 meters  
(D) 5 to 6 meters

42. \_\_\_\_\_ % Before

43. \_\_\_\_\_ % After

When air rises... (A) it becomes cooler. (B) it doesn't change temperature. (C) it becomes warmer. (D) it becomes drier.

44. \_\_\_\_\_ % Before

45. \_\_\_\_\_ % After

Air currents travel from... (A) low pressure to high pressure. (B) not at all (C) high pressure to low pressure. (D) north to south.

46. \_\_\_\_\_ % Before

47. \_\_\_\_\_ % After

Does air heat up faster over... (A) a bog. (B) the water. (C) the soil. (D) Air heats up equally over all areas.

48. \_\_\_\_\_ % Before

49. \_\_\_\_\_ % After

Would air pressure be higher over... (A) a mountain top (B) a warm part of the surface (C) pressure isn't changed by temperature (D) A cool part of the surface

50. \_\_\_\_\_ % Before

51. \_\_\_\_\_ % After

Does water evaporate faster at... (A) room temperature  
(B) high temperatures (C) low temperatures  
(D) temperature does not matter

52. \_\_\_\_\_ % Before  
53. \_\_\_\_\_ % After

Which affects evaporation? (A) heat (B) both light and  
heat (C) light (D) pressure

54. \_\_\_\_\_ % Before  
55. \_\_\_\_\_ % After

Can water evaporate at a temperature below its boiling  
point? (A) yes (B) no

56. \_\_\_\_\_ % Before  
57. \_\_\_\_\_ % After

Energy from the sun causes seawater... (A) to become  
saltier (B) solar energy does not effect the sea  
(C) to become less salty (D) to sink

58. \_\_\_\_\_ % Before  
59. \_\_\_\_\_ % After

If the same amount of heat escapes as is absorbed--the  
temperature... (A) rises (B) falls (C) remains the  
same (D) rises then falls

60. \_\_\_\_\_ % Before  
61. \_\_\_\_\_ % After

In the northern hemisphere an anticyclone rotates...  
(A) clockwise (B) they don's rotate at all  
(C) counterclockwise (D) north to south

62. \_\_\_\_\_ % Before  
63. \_\_\_\_\_ % After

Typical thunderstorms have... (A) wind, rain, and  
clouds (B) heavy rains (C) clouds (D) strong winds

64. \_\_\_\_\_ % Before  
65. \_\_\_\_\_ % After



## THE WATER CYCLE

Answers to the questions of PART III are listed below.

Question #26. B

#28. C

#30. C

#32. A

#34. B

#36. B

#38. B

#40. A

#42. C

#44. A

Question #46. C

#48. C

#50. D

#52. B

#54. B

#56. A

#58. A

#60. C

#62. A

#64. A

## TEACHER EVALUATION

### Water Pollution

#### PART I

DIRECTIONS: Please write TEACHER EVALUATION where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

1. I am taking test form (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
2. I have taught science from (A) 0 to 2 years (B) 3 to 5 years (C) 6 to 8 years (D) 9 to 11 years (E) over 12 years.
3. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
4. How many different educational microcomputer programs have you examined prior to this program? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
5. How many programs have you used with your class prior to this evaluation? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
6. I feel comfortable using computers. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

#### PART II

Please answer the following questions after running the program.

7. The computer software that I am working with is on (A) IBM Hydrologic Cycle (B) APPLE Water Pollution (C) APPLE Water Cycle (D) APPLE Water & Weather Series (E) APPLE Streams and Rivers
8. This was a high quality program compared to others you have used or seen. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
9. High school students will enjoy this program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

10. High school students will want to share this information with a friend. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
11. What grade level do you think this material is appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
12. The program had enough visual material (graphics) to help the student. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
13. The length of the program is appropriate for a single lesson or class period. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
14. The students can control the rate and sequence of presentation and review. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
15. The students will be able to operate the program without teacher assistance. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
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17. The students will find the feedback adequate when a mistake is made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
18. The content is free of race, ethnic, sex and other stereotypes. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
19. This computer program is as useful as other teaching materials such as books, worksheets, charts, lectures and films. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
20. The books, worksheets, charts, etc. that came with the program were helpful. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
21. Students will find this program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
22. This program should be used in sciences classes. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

23. More time should be spent teaching with computer software programs. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
24. I think water education is important. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
25. I think water education should be taught in the schools. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

PART III

DIRECTIONS: Please answer the question "What percent of high school students will answer each question correctly before and after using the program?" by using the following:

- |                |               |
|----------------|---------------|
| (A) 90 to 100% | (D) 31 to 59% |
| (B) 75 to 89%  | (E) 30 to 0%  |
| (C) 60 to 74%  |               |

As the temperature of a body of water decreases the dissolved oxygen levels (A) decrease (B) increase (C) remain the same (D) decrease then increase.

26. \_\_\_\_\_% Before  
27. \_\_\_\_\_% After

Before stocking a lake with game fish, what is the most important factor to check? (A) Dissolved oxygen content (B) Water temperature (C) Rate of flow (D) Type of waste being dumped

28. \_\_\_\_\_% Before  
29. \_\_\_\_\_% After

As the flow rate of a body of water decreases the dissolved oxygen levels (A) decrease (B) increase (C) remain the same (D) increase and then decrease.

30. \_\_\_\_\_% Before  
31. \_\_\_\_\_% After

BOD is an abbreviation for (A) beneficial organic decay (B) biochemical oxygen demand (C) biological organic decomposition (D) benethic oxidation and decay.

32. \_\_\_\_\_% Before  
33. \_\_\_\_\_% After

All of the following are true about water except it  
(A) is found in all living things (B) can contain  
dissolved gases and minerals (C) is most dense at  
0 degrees Celsius (D) can be treated to remove harmful  
matter.

34. \_\_\_\_\_ % Before  
35. \_\_\_\_\_ % After

As the concentration of organic wastes in a body of  
water increases the BOD (A) decreases (b) increases (C)  
stays the same (D) increases then levels off.

36. \_\_\_\_\_ % Before  
37. \_\_\_\_\_ % After

Which body of water has the highest BOD? (A) 1 degree  
Celsius lake with 5 ppm of secondary treated industrial  
waste (B) 1 degree Celsius slow river with 5ppm of  
primary treated sewage (C) 20 degree Celsius fast river  
with 13ppm of untreated industrial waste (D) 20 degree  
Celsius pond with 15ppm of untreated sewage

38. \_\_\_\_\_ % Before  
39. \_\_\_\_\_ % After

Organisms that decompose wastes even after the dissolved  
oxygen level drops to 0 are (A) Anaerobic (can do  
without oxygen) (B) Aerobic (need oxygen) (C) undergoing  
respiratory distress (D) in need of secondary treatment.

40. \_\_\_\_\_ % Before  
41. \_\_\_\_\_ % After

Most game fish die in bodies of water with dissolved  
oxygen levels of less than (A) 3 ppm (parts per million)  
(B) 5 ppm (C) 10 ppm (D) 14 ppm.

42. \_\_\_\_\_ % Before  
43. \_\_\_\_\_ % After

Secondary treatment of wastes before dumping into  
waterways is more desirable than just primary treatment  
because (A) it kills harmful microorganisms (B) it keeps  
the BOD low (C) none of the above (D) both A and B

44. \_\_\_\_\_ % Before  
45. \_\_\_\_\_ % After

WATER POLLUTION

Answers to the questions of PART III are listed below.

Question #26. B

#28. A

#30. A

#32. B

#34. C

Question #36. B

#38. D

#40. A

#42. B

#44. D

## TEACHER EVALUATION

### Streams and Rivers

#### PART I

DIRECTIONS: Please write TEACHER EVALUATION where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

1. I am taking test form (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
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3. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
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#### PART II

Please answer the following questions after running the program.

7. The computer software that I am working with is on (A) IBM Hydrologic Cycle (B) APPLE Water Pollution (C) APPLE Water Cycle (D) APPLE Water & Weather Series (E) APPLE Streams and Rivers
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9. High school students will enjoy this program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

10. High school students will want to share this information with a friend. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
11. What grade level do you think this material is appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
12. The program had enough visual material (graphics) to help the student. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
13. The length of the program is appropriate for a single lesson or class period. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
14. The students can control the rate and sequence of presentation and review. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
15. The students will be able to operate the program without teacher assistance. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
16. The students will easily understand the directions. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
17. The students will find the feedback adequate when a mistake is made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
18. The content is free of race, ethnic, sex and other stereotypes. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
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- |                |               |
|----------------|---------------|
| (A) 90 to 100% | (D) 31 to 59% |
| (B) 75 to 89%  | (E) 30 to 0%  |
| (C) 60 to 74%  |               |

The greatest amount of rain falls at... (A) higher elevations (B) lower elevations.

26. \_\_\_\_\_ % Before  
27. \_\_\_\_\_ % After

In the eastern United States most rivers flow toward the (A) Atlantic Ocean (B) Gulf of Mexico (C) Pacific Ocean (D) both A and B (E) both B and C.

28. \_\_\_\_\_ % Before  
29. \_\_\_\_\_ % After

In the western United States most rivers flow toward the (A) Atlantic Ocean (B) Pacific Ocean (C) Mississippi River (D) both A and C (E) both B and C.

30. \_\_\_\_\_ % Before  
31. \_\_\_\_\_ % After

A feature which appears at the bottom of a waterfall is a... (A) delta (B) deposit (C) pothole (D) meander

32. \_\_\_\_\_ % Before  
33. \_\_\_\_\_ % After

During heavy rainstorms, water sometimes gradually erodes the tops of waterfalls causing them to become longer. This process is called... (A) headward erosion (B) headward deposition (C) meandering (D) braiding.

34. \_\_\_\_\_% Before  
35. \_\_\_\_\_% After

Waterfalls usually develop in places where... (A) softrock overlays hardrock (B) hardrock alone exists (C) hardrock overlays softrock (D) softrock alone exists.

36. \_\_\_\_\_% Before  
37. \_\_\_\_\_% After

When a river meets an ocean or lake what is the feature that often forms? (A) seamount (B) meander (C) pothole (D) delta

38. \_\_\_\_\_% Before  
39. \_\_\_\_\_% After

If a stream flows through a raised sandy area what type of stream occurs? (A) waterfall (B) headward erosional stream (C) meandering stream (D) braided stream

40. \_\_\_\_\_% Before  
41. \_\_\_\_\_% After

A river in flat area with no mountains will tend to be a (A) braided river (B) meandering river (C) waterfall (D) headward erosional river.

42. \_\_\_\_\_% Before  
43. \_\_\_\_\_% After

In a meandering stream, deposition occurs on (A) the high outside bank (B) the low inside bank (C) both A and B (D) neither bank.

44. \_\_\_\_\_% Before  
45. \_\_\_\_\_% After

In a meandering stream, erosion takes place on (A) the high outside bank (B) the low inside bank (C) both A and B (D) neither bank.

46. \_\_\_\_\_% Before  
47. \_\_\_\_\_% After

A double delta may form... (A) after a flood (B) when the sea level changes (C) when a river changes course (D) all of the above.

48. \_\_\_\_\_ % Before  
49. \_\_\_\_\_ % After

STREAMS AND RIVERS

Answers to the questions of PART III are listed below.

Question #26.	A	Question #38.	D
#28.	D	#40.	D
#30.	E	#42.	B
#32.	C	#44.	B
#34.	A	#46.	A
#36.	C	#48.	B

## TEACHER EVALUATION

### Hydrologic Cycle

#### PART I

DIRECTIONS: Please write TEACHER EVALUATION where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

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- |                |               |
|----------------|---------------|
| (A) 90 to 100% | (D) 31 to 59% |
| (B) 75 to 89%  | (E) 30 to 0%  |
| (C) 60 to 74%  |               |

What is the source of energy for the hydrologic cycle?  
 (A) Gravity (B) Radioactivity (C) The sun (D) Water  
 (E) Mountain building

26. \_\_\_\_\_ % Before  
 27. \_\_\_\_\_ % After

Which of the following is not a part of the hydrologic cycle? (A) Lithosphere (B) Biosphere (C) Atmosphere (D) Oceans (E) Mantle

28. \_\_\_\_\_ % Before  
 29. \_\_\_\_\_ % After

What is the process that passes water through the pores of plants? (A) Evaporation (B) Percolation (C) Outgassing (D) Transpiration (E) None of these

30. \_\_\_\_\_ % Before  
 31. \_\_\_\_\_ % After

What is the entrance of water into the soil called? (A) Porosity (B) Capillarity (C) Infiltration (D) Permeability

32. \_\_\_\_\_ % Before  
 33. \_\_\_\_\_ % After

Approximately how much of the earth's total water supply is found in the ocean? (A) 30% (B) 50% (C) 75% (D) 97%

34. \_\_\_\_\_ % Before  
35. \_\_\_\_\_ % After

Which of the following makes up about 2% of the total earth's water supply? (A) Freshwater lakes (B) Rivers (C) The soil (D) Glaciers and icepacks (E) Ground water

36. \_\_\_\_\_ % Before  
37. \_\_\_\_\_ % After

Which of the following contains more water than all of the world's rivers? (A) Glaciers and icepacks (B) The ground (C) Lakes (D) All of the above

38. \_\_\_\_\_ % Before  
39. \_\_\_\_\_ % After

What happens whenever water changes from the gaseous state to the liquid state? (A) Heat is released. (B) Heat is absorbed. (C) Water is evaporated. (D) Only B and C occur.

40. \_\_\_\_\_ % Before  
41. \_\_\_\_\_ % After

How does water make its way from the ocean to land areas? (A) By evaporation and runoff (B) By ground water runoff and surface runoff (C) By evaporation, condensation, and precipitation (D) By evapotranspiration and precipitation

42. \_\_\_\_\_ % Before  
43. \_\_\_\_\_ % After

What happens to most of the water that falls as rain? (A) It stays in the soil. (B) It runs off the land in streams. (C) It returns to the atmosphere by evapotranspiration. (D) It sinks into the ground water zone.

44. \_\_\_\_\_ % Before  
45. \_\_\_\_\_ % After

What is the source of water for the underground zone? (A) Lakes (B) Precipitation (C) Rivers (D) Springs

46. \_\_\_\_\_ % Before  
47. \_\_\_\_\_ % After



What is the average annual rainfall over the continental United States? (A) 10 inches (B) 20 inches (C) 30 inches (D) 40 inches (E) 50 inches

48. \_\_\_\_\_ % Before  
49. \_\_\_\_\_ % After

From where does metropolitan Los Angeles obtain its water? (A) Northern California (B) The Colorado River (C) Owens Valley and Mono Lake Basin (D) Ground water (E) All of the above

50. \_\_\_\_\_ % Before  
51. \_\_\_\_\_ % After

Which section of California receives the most rainfall? (A) The southern third (B) The Central Valley (C) The northern third

52. \_\_\_\_\_ % Before  
53. \_\_\_\_\_ % After

Which section of the United States receives the most rainfall? (A) The western states (B) The eastern states

54. \_\_\_\_\_ % Before  
55. \_\_\_\_\_ % After

Which section of the United States consumes the most water? (A) The West (B) The East

56. \_\_\_\_\_ % Before  
57. \_\_\_\_\_ % After

Which of the following consumes water that is withdrawn? (A) Irrigation (B) Public Water Supply (C) Hydropower (D) Industrial cooling

58. \_\_\_\_\_ % Before  
59. \_\_\_\_\_ % After

Which of the following withdraws the most water? (A) Public water supply (B) Industry (C) Irrigation (D) Recreation

60. \_\_\_\_\_ % Before  
61. \_\_\_\_\_ % After

What is the amount of per capita domestic (in-home) water use in the United States? (A) 2000 gallons a day (B) 90 gallons a day (C) 300 gallons a day (D) 1000 gallons a day

62. \_\_\_\_\_% Before

63. \_\_\_\_\_% After

Which of the following has occurred in this century, partly as a result of human activities? (A) Glaciers have expanded. (B) Sea level has risen. (C) More water sink into the ground wate zone. (D) All of the above have occurred.

64. \_\_\_\_\_% Before

65. \_\_\_\_\_% After

HYDROLOGIC CYCLE

Answers to the questions of PART III are listed below.

Question #26.	C	Question #46.	B
#28.	E	#48.	C
#30.	D	#50.	E
#32.	C	#52.	C
#34.	D	#54.	B
#36.	D	#56.	A
#38.	D	#58.	A
#40.	A	#60.	B
#42.	C	#62.	B
#44.	C	#64.	B

## TEACHER EVALUATION

### Water & Weather Series

#### PART I

DIRECTIONS: Please write TEACHER EVALUATION where your name would be on the answer sheet and then answer the following questions and statements by marking the appropriate letter on the computer sheet. Answer questions 1-6 before previewing the program.

1. I am taking test form (A) Teacher Evaluation (B) Student Evaluation : Post Review (C) Student Evaluation : Pretest
2. I have taught science from (A) 0 to 2 years (B) 3 to 5 years (C) 6 to 8 years (D) 9 to 11 years (E) over 12 years.
3. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
4. How many different educational microcomputer programs have you examined prior to this program? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
5. How many programs have you used with your class prior to this evaluation? (A) 0 (B) 1 to 3 (C) 4 to 6 (D) 7 to 9 (E) 10 or more
6. I feel comfortable using computers. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

#### PART II

Please answer the following questions after running the program.

7. The computer software that I am working with is on (A) IBM Hydrologic Cycle (B) APPLE Water Pollution (C) APPLE Water Cycle (D) APPLE Water & Weather Series (E) APPLE Streams and Rivers
8. This was a high quality program compared to others you have used or seen. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
9. High school students will enjoy this program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

10. High school students will want to share this information with a friend. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
11. What grade level do you think this material is appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
12. The program had enough visual material (graphics) to help the student. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
13. The length of the program is appropriate for a single lesson or class period. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
14. The students can control the rate and sequence of presentation and review. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
15. The students will be able to operate the program without teacher assistance. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
16. The students will easily understand the directions. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
17. The students will find the feedback adequate when a mistake is made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
18. The content is free of race, ethnic, sex and other stereotypes. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
19. This computer program is as useful as other teaching materials such as books, worksheets, charts, lectures and films. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
20. The books, worksheets, charts, etc. that came with the program were helpful. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
21. Students will find this program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
22. This program should be used in sciences classes. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

23. More time should be spent teaching with computer software programs. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
24. I think water education is important. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree
25. I think water education should be taught in the schools. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree

PART III

DIRECTIONS: Please answer the question "What percent of high school students will answer each question correctly before and after using the program?" by using the following:

- |                |               |
|----------------|---------------|
| (A) 90 to 100% | (D) 31 to 59% |
| (B) 75 to 89%  | (E) 30 to 0%  |
| (C) 60 to 74%  |               |

When the rate of condensation is equal to the rate of evaporation, the air is said to be... (A) superstaturated (B) supercooled (C) saturated (D) unsaturated

26. \_\_\_\_\_ % Before  
27. \_\_\_\_\_ % After

Evaporation takes place most slowly when the air is... (A) humid (B) dry (C) saturated (D) hot.

28. \_\_\_\_\_ % Before  
29. \_\_\_\_\_ % After

As the temperature decreases, the amount of dew... (A) varies (B) increases (C) stays the same (D) decreases.

30. \_\_\_\_\_ % Before  
31. \_\_\_\_\_ % After

You have a glass filled with ice-cold soda pop. Moisture will appear most quickly on a day which is... (A) warm and dry (B) cold and dry (C) warm and humid (D) cold and humid.

32. \_\_\_\_\_ % Before  
33. \_\_\_\_\_ % After

As the amount of cloud cover increases, the rate of evaporation from the earth's surface will...  
(A) increase (B) decrease (C) stay the same (D) vary.

34. \_\_\_\_\_% Before  
35. \_\_\_\_\_% After

Which is not an example of evaporation? (A) gaseous water forming from liquid water (B) cooling of your skin after a swim (C) water boiling (D) cloud formation from water vapor

36. \_\_\_\_\_% Before  
37. \_\_\_\_\_% After

The ability of the atmosphere to hold water vapor is determined by its... (A) humidity (B) oxygen content (C) pressure (D) temperature.

38. \_\_\_\_\_% Before  
39. \_\_\_\_\_% After

If the amount of moisture in the air increases while the temperature remains the same, the relative humidity will... (A) decrease (B) vary upwards or downwards (C) increase (D) remain constant.

40. \_\_\_\_\_% Before  
41. \_\_\_\_\_% After

Where would you normally find the greatest difference in temperature readings between the wet and dry-bulb thermometers of a psychrometer? (A) the seashore (B) an inland city (C) a tropical rain forest (D) the desert

42. \_\_\_\_\_% Before  
43. \_\_\_\_\_% After

The liquid inside a wet-bulb thermometer is... (A) cobalt chloride (B) water (C) alcohol (D) mercury

44. \_\_\_\_\_% Before  
45. \_\_\_\_\_% After

Dew point is measured in... (A) liters (B) grams (C) percent (D) degrees.

46. \_\_\_\_\_% Before  
47. \_\_\_\_\_% After

The air contains the smallest amount of water vapor during... (A) Fall (B) Spring (C) Summer (D) Winter.

48. \_\_\_\_\_ % Before

49. \_\_\_\_\_ % After

A humid day is one which is... (A) is hot (B) has a lot of moisture in the air (C) is foggy (D) is rainy.

50. \_\_\_\_\_ % Before

51. \_\_\_\_\_ % After

Snow crystals have... (A) 10 sides (B) 8 sides (C) 6 sides (D) 4 sides.

52. \_\_\_\_\_ % Before

53. \_\_\_\_\_ % After

The process of changing gaseous water to liquid water is called... (A) precipitation (B) condensation (C) sublimation (D) evaporation.

54. \_\_\_\_\_ % Before

55. \_\_\_\_\_ % After

Most high clouds are made of... (A) condensation nuclei (B) water droplets (C) ice crystals (D) water vapor.

56. \_\_\_\_\_ % Before

57. \_\_\_\_\_ % After

Approximately how many cloud droplets are equal to the size of a raindrop? (A) 1 thousand (B) 1 hundred (C) 10 (D) 1 million

58. \_\_\_\_\_ % Before

59. \_\_\_\_\_ % After

One centimeter of rain is equivalent to about... (A) 100 centimeters of snow (B) 10 centimeters of snow (C) 1 centimeter of snow (D) 2 centimeters of snow.

60. \_\_\_\_\_ % Before

61. \_\_\_\_\_ % After



If the temperature remains at zero degrees C. or below from the clouds all the way down to the ground, any precipitation will be in the form of... (A) sleet (B) glaze (C) wet snow (D) dry snow.

62. \_\_\_\_\_% Before

63. \_\_\_\_\_% After

Which represents the correct order of cloud formation? The moist air... (A) evaporates - rises - cools to dew point - condenses (B) cools to dew point - rises - evaporates - condenses (C) rises - cools to dew point - evaporates - condenses (D) evaporates - cools to dew point - rises - condenses.

64. \_\_\_\_\_% Before

65. \_\_\_\_\_% After

WATER & WEATHER SERIES

Answers to the questions of PART III are listed below.

Question #26. C

#28. C

#30. B

#32. C

#34. B

#36. D

#38. D

#40. C

#42. D

#44. D

Question #46. D

#48. D

#50. B

#52. C

#54. B

#56. C

#58. D

#60. B

#62. D

#64. A

APPENDIX H

## For The Teacher

### Background Information

Teachers have suggested that computer software should be evaluated within the context of its use, i.e., in real classrooms with real teachers and students. This evaluation by inservice professionals and their students seldom takes place! Thank you for your important contribution in this software evaluation.

The purpose of this study is to determine if software programs in water education for high school students (1) are motivating, (2) influence attitude toward water, (3) increase water knowledge, and (4) are viewed the same by students and teachers. The results will be shared with teachers participating. The computer response sheets and evaluation forms can be anonymous.

#### Contents of the Envelope and How To Use It.

##### Contents:

1. Software Package with written material
2. Teacher Evaluations
3. Student Evaluation : Pretests
4. Student Evaluation : Post Reviews
5. Computer Response Sheets
6. Pencils - #2 Lead
7. Self-addressed Envelopes

#### Step One--Teacher Evaluation

Each program has its own separate teacher evaluation form. Please review the water education software yourself and then answer the questionnaire labeled TEACHER EVALUATION.

#### Step Two--Student Evaluation

Each program has two different student evaluation forms labeled STUDENT EVALUATION : POST REVIEW and STUDENT EVALUATION : PRETEST. Please divide your students randomly into two groups. The students in one group are given the Student Evaluation : Pretest while the students in the other group first review the water software and then answer the Student Evaluation : Post Review. If you are limited in time or have limited computer hardware, please select a cross-section sample of as many students as possible. For any one student the maximum time to preview the software and to answer the evaluation form is 2 class periods. Evaluation questions may be used more than once if necessary. The written material that comes with the software package should be used by the students to help them. Please give the students one of the complementary pencils for use on the computer response sheet.

**Step Three--Return Materials**

When the evaluation is completed, please return the computer answer sheets in the self-addressed envelopes to the following address:

Dr. Terence J. Mills  
Oklahoma State University  
Curriculum and Instruction  
306-G Gunderson  
Stillwater, OK 74078

It would be very helpful if the completed printed material and the software package are returned within two weeks. If time permits, please give the envelope, software, and any unused evaluation forms and answer sheets to another participating teacher at your school. Thanks again for your time and contribution.