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ABSTRACT

Presented is the third component, Educational Simulations, of a special day class educational program for drug dependent minors. One objective of the project is said to have been the identification of instructional methods and materials suited to drug dependent minors. Educational games and simulations designed to provide practice in reading and arithmetic at the fifth or sixth grade level are described. Recommendations for use of the games include photocopying game materials in case of loss and adequate teacher preparation. Briefly described are the characteristics of each game or simulation in terms of title, designer, number of players, subject or subjects for which game is appropriate, time needed to play game, description of game, preliminary preparation necessary, and any special recommendations. The major portion of the document consists of the 11 games and simulations printed on heavy cardboard. Examples of games are the Mississippi Riverboat Race (arithmetic), Ascent-A Mountain Climbing Simulation (reading and arithmetic), Computer Poetry (reading and English), Grassland-An Ecology Simulation (reading and science), Historical Pairs (reading and history), and Zen Deity Science Quiz (science). (See EC 051 845, EC 051 846, EC 051 848, EC 051 849, and EC 050 205 through EC 050 212 for related documents). (DB)

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A GUIDE FOR THE MANAGEMENT OF SPECIAL EDUCATION PROGRAMS

NEWDAY OPERATIONS GUIDE FOR DRUG DEPENDENT MINOR PROGRAMS

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EHA TITLE VI-B

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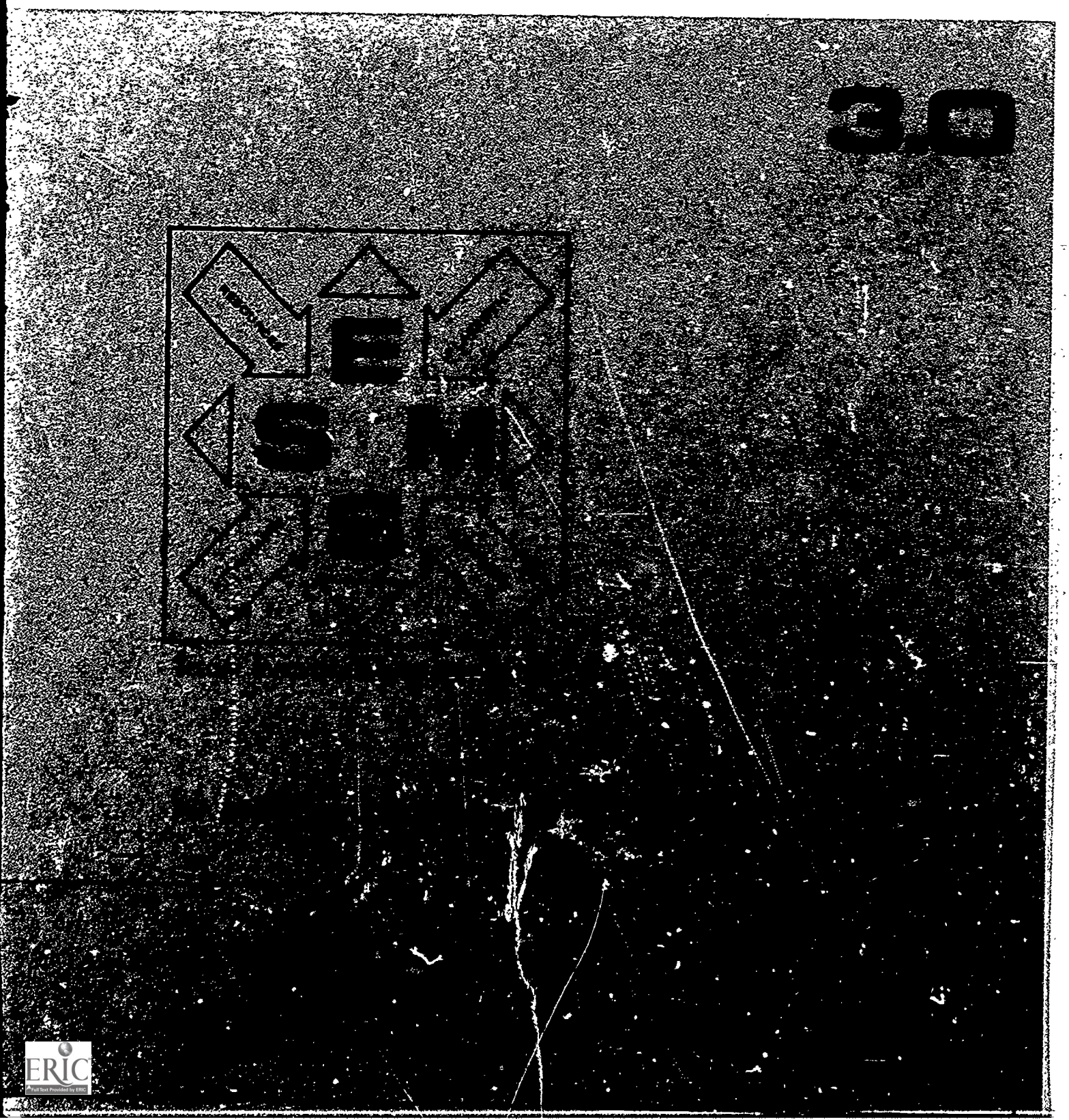


COMPONENT 3.0

EDUCATIONAL GAMES AND SIMULATIONS

3.1 INTRODUCTION

A characteristic of almost all drug dependent minors and other behaviorally exceptional youth is a negative feeling about schools and learning. Also, gaps are apparent in basic academic skills, even when students exhibit above-average intellectual ability. In order to provide additional motivation, as well as non-school-like activities, the identification of appropriate instructional methods and materials for drug dependent and other behaviorally exceptional students was made an objective of the project.

As part of the effort to fulfill this objective, commercially available simulations and games were investigated, but these were found to be too difficult academically. It was decided therefore to develop original games and simulations adaptable to the needs of drug dependent minors and which would not require more than sixth grade academic ability. This component was developed through the interest and expertice of the Project Coordinator, Douglas Eidsmore and was not part of the Title III Project Plan (Struck 1970).

This component of the Santa Cruz County Office of Education's Operations Guide for Drug Dependent Minors contains some of the games and simulations developed for trial at Sunshine School. The contents of this component are:

3.2 THE DEVELOPMENT OF THE GAMES AND SIMULATIONS

As stated in the introduction, one objective of the project was to identify instructional methods and materials especially suited to drug dependent minors and other behaviorally exceptional children with characteristics similar to those of drug dependent minors. These include students attending school in juvenile halls, county ranches and Youth Authority facilities. Instructional techniques considered included special instruction in the affective domain, valuing teaching, and behavior modification, as well as educational games and simulations. (The afore-mentioned techniques are discussed in Component 2.0)

Background

A simulation can be defined as a self-contained role-playing model that is designed to attain specified learning objectives. A simulation is an analytical model of reality or fantasy. Simulations may be competitive or cooperative or players may play alone. Educational simulations can be designed for a variety of subjects in the cognitive, affective and psychomotor domains. Games are defined as planned playful activities that may or may not include simulation. Like simulations, games can encompass a variety of learning subjects and domains.

Games and simulations are particularly useful for drug dependent minors. Drug dependent students typically exhibit poor educational skills, especially in reading and arithmetic; they exhibit anti-social behavior; they are not motivated; they are not goal-oriented; they lack decision-making abilities and logical skills; and they have not developed a workable value system.

Games and simulations can be designed to remedy the above problems. Certain inherent qualities make simulations an ideal means of meeting traditional educational objectives such as improvement in reading and arithmetic. The game process is socializing; the players behave according to the rules

of the game; all games require cooperation and fairness of play. Properly designed simulations are affectively as well as cognitively motivating. Players perform minor tasks leading to a goal; they must think logically and behave sensibly and modify their performance to reach that goal; they must make decisions based upon objectives and solve problems.

Games and simulations historically have been successful teaching strategies when used with a variety of populations. The first educational simulations were developed by Prussian Generals to teach battle tactics. Since that time, they have been used extensively by the military. In the last thirty years, they have been used by large corporations as tools to teach employees management theories and techniques. Games and simulations came into use by many educators during the late 1960's. They have been demonstrated to be successful learning motivators with a wide variety of elementary, secondary, and college students. Students with underdeveloped skills in reading and arithmetic have used them successfully.

A currently operational federally funded project for students with poor reading and arithmetic skills at Abraham Lincoln School in the San Jose Unified School District involves extensive use of games and simulations. The project has operated for three years and has been evaluated periodically by the Rand Corporation of Santa Monica. The California Achievement Test and the Comprehensive Test of Basic Skills were used as test instruments. The sample size ranged from 60 students in 1967-68 to 240 in 1970-71. (Reference 3). The following data shows the month per month gain in reading level for the years 1967-1971:

Grade Level	Gain per month	Year
7th	1.28	1970-71
8th	1.85	1967-68
	1.20	1968-69
9th	1.10	1968-69

For example, the eighth grade students gained 1.85 months of reading skills during one month's time when tested in 1967-68. The San Jose project staff believes that "the educational and motivational games used in their classrooms have been principle contributory factors in effecting attitudinal change and in improving reading skills". (Reference 3).

Simulations and Sunshine School

At first, commercially available educational simulations and games and entertainment games were purchased for trial at Sunshine School. Entertainment games included Probe, Scrabble, and Finance. Educational games included Life-Career, Democracy, and Generation-Gap. Valuing games included Timao, My Cup Runneth Over, and It's a Cruel, Cruel World. In general, commercial educational games were too difficult for these students, and while the entertainment games were motivating they lack educational relevance. It was decided to develop some games and simulations for specific trial at Sunshine School.

The following games and simulations, therefore, were developed by Doug Eidsmore, Project Coordinator, and by Mike Chester. (Chester had previously developed more than 300 games for the San Jose project.) (Reference 1)

Doug Eidsmore

Mississippi Riverboat Race
Math Challenge
Historical Pairs
Ascent
Lunar Explorers

Mike Chester

Computer Poetry
Marine Bio-rummy
Grasslands Simulation
Santa Cruz Salamander Simulation
Egyptian Archaeology
Zen Deity Science Quiz

The games and simulations all were designed to provide practice in reading and arithmetic at the fifth or sixth grade level. The designers attempted to include as wide a range of game and simulation chara istics as possible so that characteristics of both successful and unsuccessful games and simulations could be determined. Some of the games and simulations are cooperative, some competitive; some include simulation, and some do not; some are card games and some are board games. The individual games and simulations are described in Section 3.4 Characteristics of the Games and Simulations.

From the trial games, it was learned that in general, games and simulations should be easily learned and have meaning for the student in order to succeed with drug dependent minors. Any fantasy or role playing should be in familiar areas (e.g., a student might more easily imagine himself a surfer than a sociologist). Materials should be appealing and the activity of game or simulation is important. Filling out complicated forms and recording large amounts of data distracts from the play of the game. Players should be rewarded in the context of the game or simulation for doing more work. Progress in winning or losing the game should be evident to players as they play. Little follow-up activity should be required to determine the winner. Finally, the teacher's instructions should be concise and preparation minimized. The aim of a 1972-73 Title VI-B Project: New Approaches to Behaviorally Exceptional Youth will emphasize the development and standardization of games and simulations.

Simulation Design

The design of games requires creativity and systematic thinking, an understanding of the affective and cognitive domains, as well as knowledge of all areas of students' interests. Strategies must be checked for dominance, scoring must be determined statistically, the educational objectives must be defined and met and simulation parameters must be scaled. Combining the educational objectives, the strategy, and simulated situation into a playful activity is an art. Some tasks required to design a game or simulation include:

1. With staff decide on the instructional goals of the game or simulation and the domain; cognitive, affective, and/or psychomotor.
2. Choose the simulation theme, e. g., Mississippi River, the moon, or exploring an Egyptian tomb.
3. Identify some basic game strategies, e.g., a race or forming card melds.
4. Research the theme, e.g., racing Mississippi Riverboats in 1860.
5. Describe the game or simulation in a game or simulation format, e.g., on game board or cards.
6. Produce a rough prototype, and play.
7. Redesign the prototype, and play.
8. Specify the final instructional objectives.
9. Complete preliminary graphics and typing (check grade level of written material).
10. Test in the school setting; receive teacher and student evaluations.
11. Redesign based on teacher and student recommendations.
12. Complete final graphics.
13. Print and distribute.

3.3 USE OF THE GAMES AND SIMULATIONS

These games and simulations obviously are not an entire curriculum for drug dependent minor programs or other youth of abnormal behavior; nor were they designed to be used in sequence to correlate with instruction in any course or grade level. Each must be examined individually, along with the evaluation included in Section 3.4 Characteristics of the Games and Simulations. Its appropriateness to specific areas of the curriculum may then be decided upon. Teachers must also modify these games and simulations to better suit the needs of particular pupils. Teachers may also use the strategies included here as guides in developing their own games and simulations. Students and teachers might work together in developing a simulation.

Adequate teacher preparation is necessary for effective use of each game. Some background information and attention-getting material to capture student interest, as well as clear directions on materials and procedures, must be provided at the outset. Some materials preparation is required for each of these games and simulations. General supplies to be purchased include several pairs of dice and game markers. A detailed description of the preparation requirements of each game or simulation is included in Section 5.4. However, there are some general preparations common to all of the games and simulations. These follow:

1. Photocopy all game materials: cards, boards, directions, and worksheets. If any materials are lost, duplicates may then be made. Additional photocopying is also required in preparing the play of individual games. These requirements are included in Section 3.4.

2. The game boards are printed on heavy paper. However, they should be stapled or taped to a stiff piece of poster board. If a game board is lost or destroyed and a photocopy of the original was made, it can then be stapled or taped to another stiff board.

3. Cards are included with many of the games. These may be printed on stiff card sheets and cut with a paper cutter.

4. Some of the games require cards which are not included with the materials. These cards will have to be made. Blank"Vis-Ed" cards may be purchased for 50¢ for 300. Courtesy cards may be purchased for 25¢ for 40. Business cards might be used, or cards may be cut from 3x5 inch stock. Cards should always be rectangular, since anything close to a square card is hard to shuffle and to orient into a deck.

5. Markers are needed. Quarter-inch aluminum nuts work best. Some quarter-inch diameter circular labels may be glued to the nuts. The labels may be colored or initialed with felt tip pens.

In may cases, pupils will not finish the game in one class period. If this occurs, they need to take up where they left off the previous day. To mark the spot, stick a pin or thumb tack through the marker and into the game board. Games may then be stored away and students may continue playing as soon as the board is taken out for the next day's play.

NOTE: After the materials are prepared, it is suggested that teachers enlist the services of friends in a practice game.

3.4 CHARACTERISTICS OF THE GAMES AND SIMULATIONS

This section contains detailed descriptions of the characteristics of each game and simulation. Participation, time required, a general description, preparation requirements, and recommendations for use, are included for each game or simulation.

These games and simulations were all tried at Sunshine School. The teachers and students evaluated each game or simulation after it was played. The games and simulations were redesigned where necessary, based on the trial and evaluation. It should be noted that trials at Sunshine School were performed with very rough prototypes of the games and simulations included in this component. The materials generally were of low quality. Also, these instructional materials were competing with a host of other materials that may or may not be available in other programs including teaching machines, programmed materials, video tape machines, and innovative materials created by the teachers.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

1. The Mississippi Riverboat Race

Subject: Arithmetic, Social Studies, Reading, History

Participation: Three Players

Time: One or two class periods

Description:

A simulation. In the 1880s boats designed for commerce along the Mississippi River engaged in races. This contributed a colorful chapter in the history of the river and provided an exciting outlet for citizens of towns on the river. Players race riverboats down the Mississippi River solving math problems along the way. Players take turns drawing cards and solving the problems printed on the cards. Some cards describe incidents that occur during the race and introduce strategy to the play. The incidents described are colorful and are based on events that occurred during the Riverboat Races of the 1860s.

Preparation:

Tape together the three 8 1/2 x 11 maps of the Mississippi River and staple them to a stiff poster board. Cut up the card sheets to form a deck of playing cards. Make three markers,(1/4" nuts work best). Mark each marker with an "N" or an "RL" or a "TB".

Recommendations:

This is a good game to begin with. The strategy is simple and easy to explain to students. Players must be able to round off to the nearest 100. More or less difficult problem cards may be made. The average value of the computation should be 100.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

2. Lunar Explorers

Subject: Arithmetic and Science

Participation: Two players

Time: Two to three class periods

Description:

A simulation. Players explore the Central Bay of the moon using "Lunar Roving Vehicles". They draw a card at each feature of the lunar surface that they visit. Each card describes an experiment they performed at the site. Motion of the "Lunar Roving Vehicles" is determined by rolling dice. Travel is constrained by a limited supply of oxygen and limited battery power. Computations involve squaring numbers, addition and using a square root table.

Preparation:

Tape the four 8½x11 inch game boards together and staple to a piece of poster board. Cut up the card sheets to form a deck of playing cards. Photo copy one square root-table, one explorers check list and five calculations sheets for each player. Each player needs a marker, the quarter-inch nuts work best.

Recommendations:

The game should be introduced by starting with one of the alternative modes of play as described in Step 12 of the directions. The game should be monitored by a teacher or aide until the players become familiar with the calculation routine. The game may be shortened by having the players visit 10 craters or so, or by having them just visit the craters on one side of the board.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

3. Math Challenge

Subject: Arithmetic

Participation: Four players

Time: Several rounds per class period.

Description:

A card game. Players estimate the value of a math problem and try to estimate the values of other players problems. Players expose cards in a fixed sequence thereby revealing information to other players about the winning potential of their hands. Poker chips or play money are used for betting.

Preparation:

You will have to make your own deck of cards. Business cards will do. Use three different colored felt-tip pens to make the cards or use three different colors of card stock.

Recommendations:

Players should be familiar with the terms "units place" and "tens place", negative numbers and decimals. Using a number line would be a good way to introduce negative and positive numbers and decimals. The students like this game and it was played by some of them almost every day for a month.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

4. Ascent - A Mountain Climbing Simulation — Subject: Reading, Arithmetic, and Discovery

Participation: Up to twenty players — Time: Two hours

Description:

Players assume roles of mountain climbers who are attempting to climb a fictitious mountain. They must prepare for the climb by purchasing supplies from a supply list. They may purchase marijuana if they choose to do so. However, their chances of surviving on the mountain are reduced if they purchase drugs. Students must solve problems and demonstrate skills along the way.

Preparation:

Photo copy one supply list and score sheet for each player. Six staff members or students must man the five stations and preparation activity. Have the people running the simulation read the directions carefully before starting. It is advised that you run one person through all five stations for practice.

Recommendations:

An excellent "special day activity". It will require some revising of schedules since it takes two hours. Some of those who choose to buy drugs will win but not very many. Be prepared to discuss the influence drugs had on the climb after the activity.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

5. Computer Poetry

Subject: English

Participation: One player per game

Time: Three to five class periods

Description:

Students write their own poetry using a random selection process. A poetry format is provided and students select words to be placed in word banks". Various words are obtained by throwing dice. Lines like "Careless elephants will wobble bitterly" are created. Pupils are asked to read and explain the poems they created. Sample word banks are provided.

Preparation:

Make one copy of the Memory Bank Sheets A through D, and both program sheets for each player. Each player needs a set of dice.

Recommendations:

A good way to introduce poetry. Be ready for some startling and humorous results. Try it with friends at a party for practice.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

6. Grasslands Simulation

Subject: Reading and Science

Participation: Two per game

Time: Three to four class periods

Description:

A simulation. Pupils try to balance ecological conditions in a grasslands ecology including grasshoppers, grass, meadowlarks and cattle. Pupils try to determine the maximum number of cattle that can be supported in the grasslands. The grasslands ecology is simulated using cards.

Preparation:

Cut out the cards and form decks of "grass cards", "cattle cards", "meadow lark cards", "weather cards", and "grasshopper cards". Copy 8 "data sheets" for each student and a "table of grassland changes".

Recommendations:

This simulation is not easy to learn. Have a staff member work with some students.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

7. Marine Bio Rummy — Subject: Reading and Science

Participation: Two to four players — Time: One or two class periods

Description:

This is a card game in which players "collect" various sea creatures. The players form groups or melds of various similar creatures. Players must consult a meld chart and a marine biology list. Players receive points for each meld formed.

Preparation:

Cut out the 54 cards to form a deck. Photocopy a melding chart and marine biology list for each pupil.

Recommendations:

A staff member should play this game with the students.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

8. Historical Pairs

Subject: English and history

Participation: Two players

Time: One or two class periods.

Description:

A card game. Players form matching pairs of events and dates using an American History Events list as a guide. Cards are placed face up on the desk or table. Winning players are those who can recognize and form the most historical pairs. This technique can be used for many educational subjects.

Preparation:

Make one copy of the American History Events list for each player. Use this list as a guide to make a deck of cards. Cards should have dates or events on them. One card for each date and one for each event.

Recommendations:

This is pretty easy to play once the students get started.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

9. Egyptian Archaeology

Subject: Reading and history

Participation: Two players

Time: Two to four class periods

Description:

A simulation. The students play a board game that simulates the work of Egyptian Archaeologists. The rolls of dice and the drawing of cards represent various archaeological finds. The players enter symbols onto a scoreboard to represent their archaeological finds. A scoring system assigns point values to the discoveries made. After the play of the game the students interpret the cards that they collected in the courses of play.

Preparation:

Cut up the card sheet to form an 18-card deck. Photocopy a data sheet and symbols and scoring sheet for each player. Remove the game board and photocopy the scoreboard. Each player needs a marker. The quarter inch nuts work best.

Recommendations:

A discussion of Egyptian history, tombs, grave robbers and archaeology should precede playing the game. The students should understand the meaning of the symbols and the value of archaeological finds. Some students may find the interpretive phase of the game too difficult.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

10. Salamander Study Simulation

Subject: Reading and science

Participation: Whole class

Time: One class period

Description:

The students read a story "The Saga of the Long Toed Salamanders" (a type of salamander in existence only in Santa Cruz County) and a description of some salamander scenes. They must match the description of each scene to a pictorial representation of the scene to a pictorial representation of the scene on a "salamanders map". They then take a quiz based on the story and map. A discussion follows the playing of the game.

Preparation:

Photocopy one "Saga of the Long Toed Salamanders", a "salamanders scenes", a "salamanders map" and a quiz for each student.

Recommendations:

This game is easy to present and play. The discussion after play is over can be an excellent introduction to values and individual rights.

CHARACTERISTICS OF THE GAMES AND SIMULATIONS

11. Zen Deity Science Quiz

Subject: Reading and discovery

Participation: Six players

Time: Three class periods

Description:

This quiz game is similar to the television quiz show "To Tell the Truth". Three students assume the roles of guests on a quiz show. All three claim to be a certain person -- but only one is telling the truth. A panel attempts to determine who is telling the truth. The panel and guests use written guides of questions and responses. The roles include a Zen Master, a Greek Deity, and a scientist.

Preparation:

Make 3 photocopies of each "Introductory Note", and "Question Guide". Make 6 photocopies of each "Data Sheet". Make one copy of each response guide and identity sheet.

Recommendations.

Once the students understand how to use the various question and response guides the game is very easy to play. The Sunshine students adapted to the roles very quickly and soon were following their own lines of inquiry and responses.

3.5 BIBLIOGRAPHY

1. Chester, Mike., Designer, 1492 Revelstoke Way, Sunnyvale, California. Interview. September 9, 1971.

2. Nesbitt, William A., Simulation Games for the Social Studies Classroom, Foreign Policy Association, 1971.

3. Project R-3, The Right to Read, "Information Capsule", unpublished report prepared by Learning Achievements Corporation.

3.6 THE GAMES AND SIMULATIONS

The games and simulations produced for the Santa Cruz County Drug Dependent Minor Program begin on the next page. They are in the sequence as listed in the introduction. Each game or simulation is individually paginated.

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Doug Eidsmore

Subject: Math (Eighth Grade)

Activity Name: Mississippi Riverboat Race

Participation: 3 players

Time: 1-2 hours

Theme

Players race riverboats down the Mississippi River from St. Louis to New Orleans. Riverboat progress is simulated by drawing cards that contain a math problem, the solution to which determines distance travelled during that turn. Some of these cards also contain a description of the color of the times as well as affect the movement of the riverboats.

Instructional Objectives

Each student is to:

1. Correctly solve at least 12 arithmetic problems.
2. Correctly round off at least 12 numbers to the nearest 10's place.

Preparation

1. Tape the three game boards together or staple them to a stiff piece of cardboard.
2. Cut up the card sheets with a paper cutter to form the movement deck.
3. Make some small markers (1/4 inch nuts with a 1/4 inch diameter label work fine). One marker should have a TB on it, one should have an N, and another an RL.
4. You will also need one die per game.

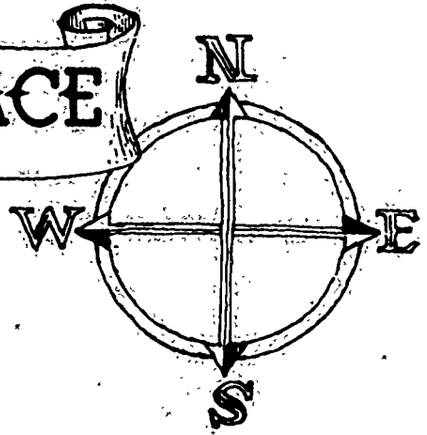
Bibliography

1. Burman, Ben, Big River to Cross, Blue Ribbon Books, 1943.
2. Cramer, Zudok, The Navigator, University Microfilms, Ann Arbor Michigan.
3. Glazier, Captain William; Down the Great River, Hubbard Brothers, Philadelphia, 1889.
4. Hereford, Robert, Old Man River, Caxton Printers, Caldwell, Idaho, 1942.
5. School Math Study Group, Mathematics for the Elementary School, Yale University Press, Volumn 6.

Directions

1. Explain the background of the times to the players. (1860) Riverboat races were common in those days and a matter of great pride to the captain and crews. Races were considered a good way to promote Riverboat Lines by boat owners. Crowds would gather at each town to cheer the boats on. The three boats in the race, the Natchez, the Tennessee Belle, and the Robert E. Lee were some of the fastest boats to race on the river. The characters and events described on the cards are based on real events.
2. Players each choose a boat and roll die to see who goes first.
3. Players take turns drawing cards and moving their boats down river. Each dot on the board represents 10 miles. They must round off to the nearest 10 miles. Players should round up, i.e., if a value of 85 is obtained, it is rounded up to 90.
4. Some cards affect the movement of only one riverboat; others affect all the boats, and some affect the movement of specific positions on the river.
5. The winner is the first boat that reaches New Orleans. Play should continue until second place is determined.

MISSISSIPPI RIVERBOAT RACE



START

ST. LOUIS

MISSOURI

KASKASKA RIVER

ILLINOIS

OHIO RIVER

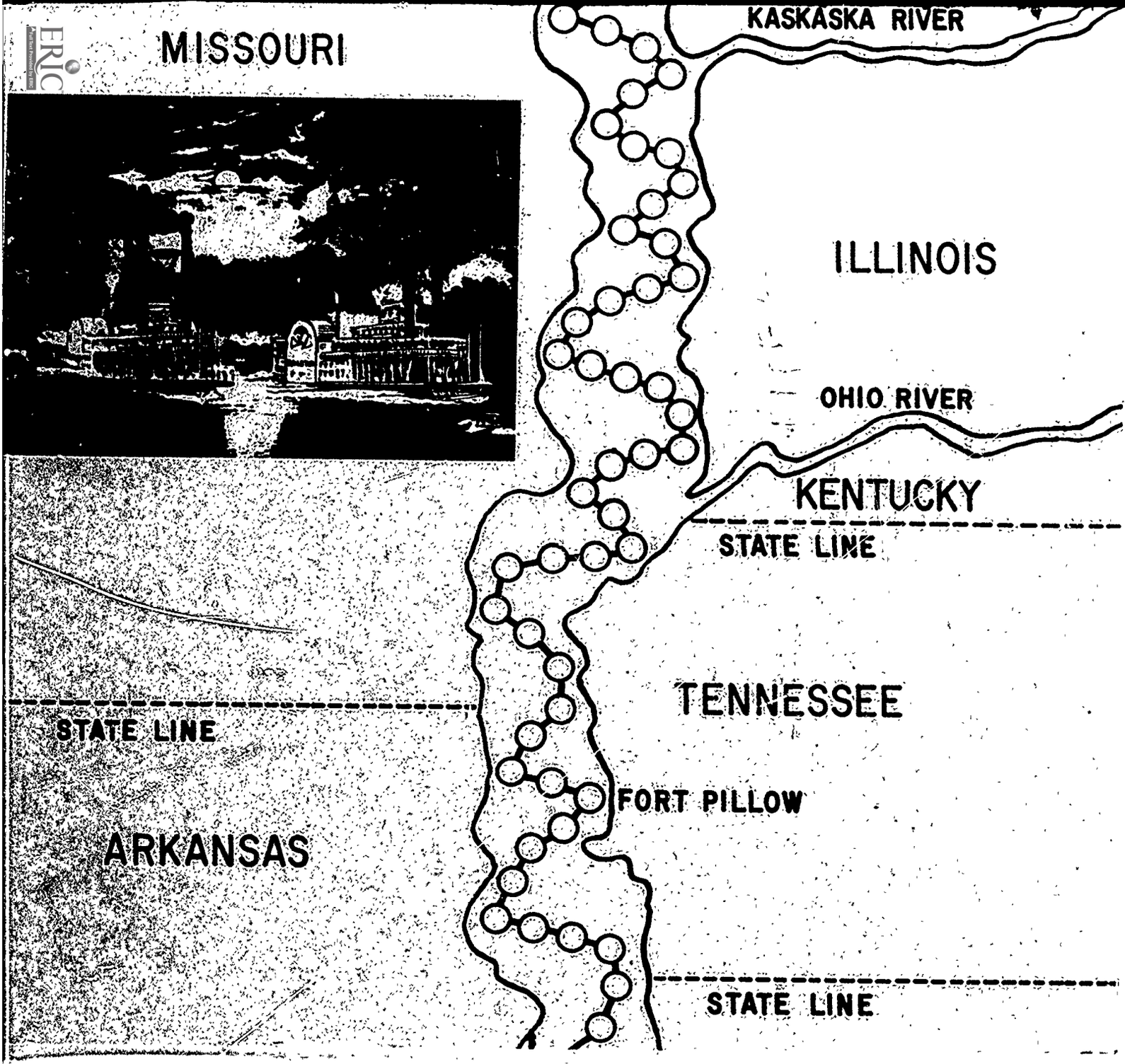
KENTUCKY

STATE LINE

TENNESSEE

STATE LINE

FORT PILLOW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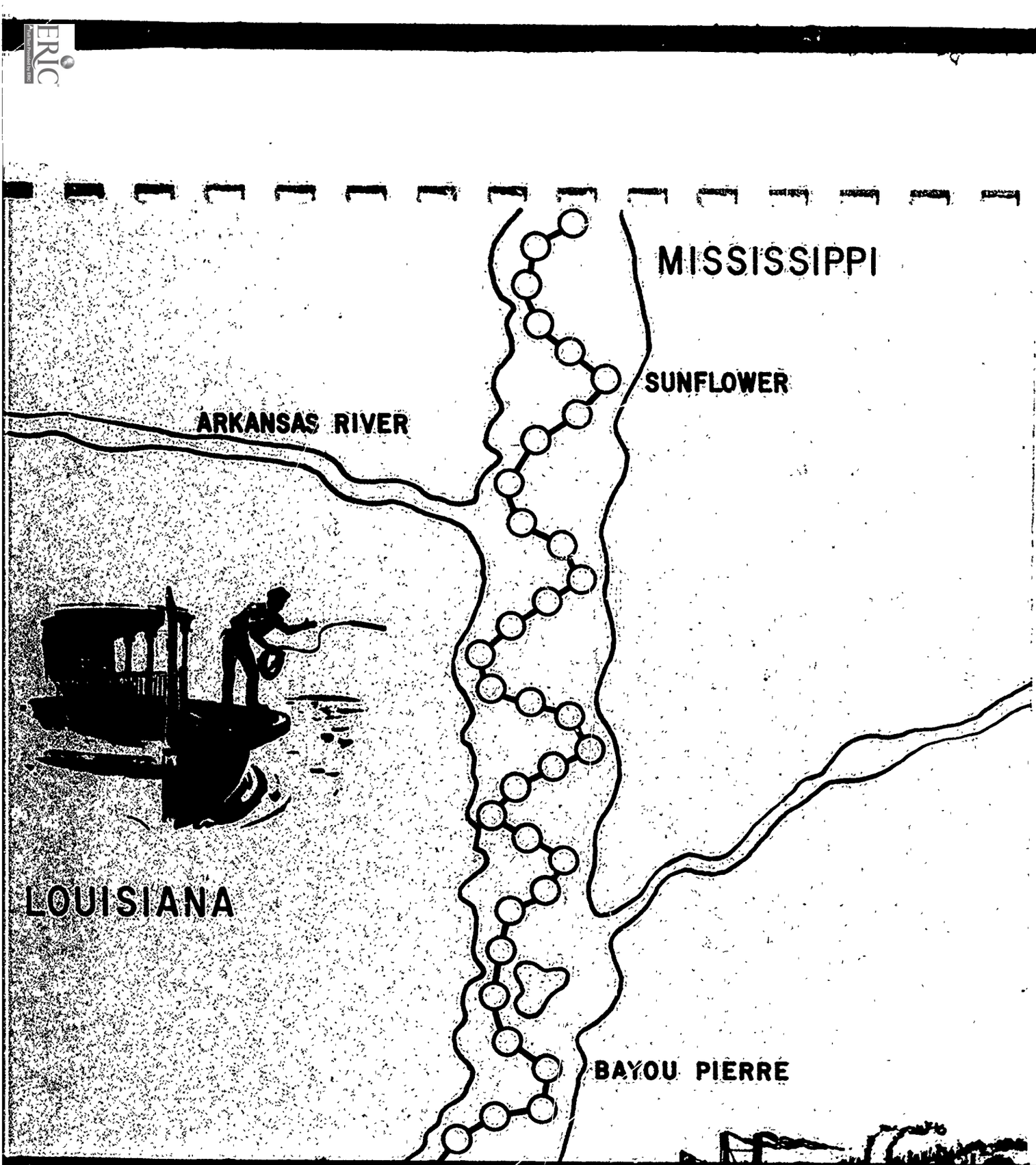
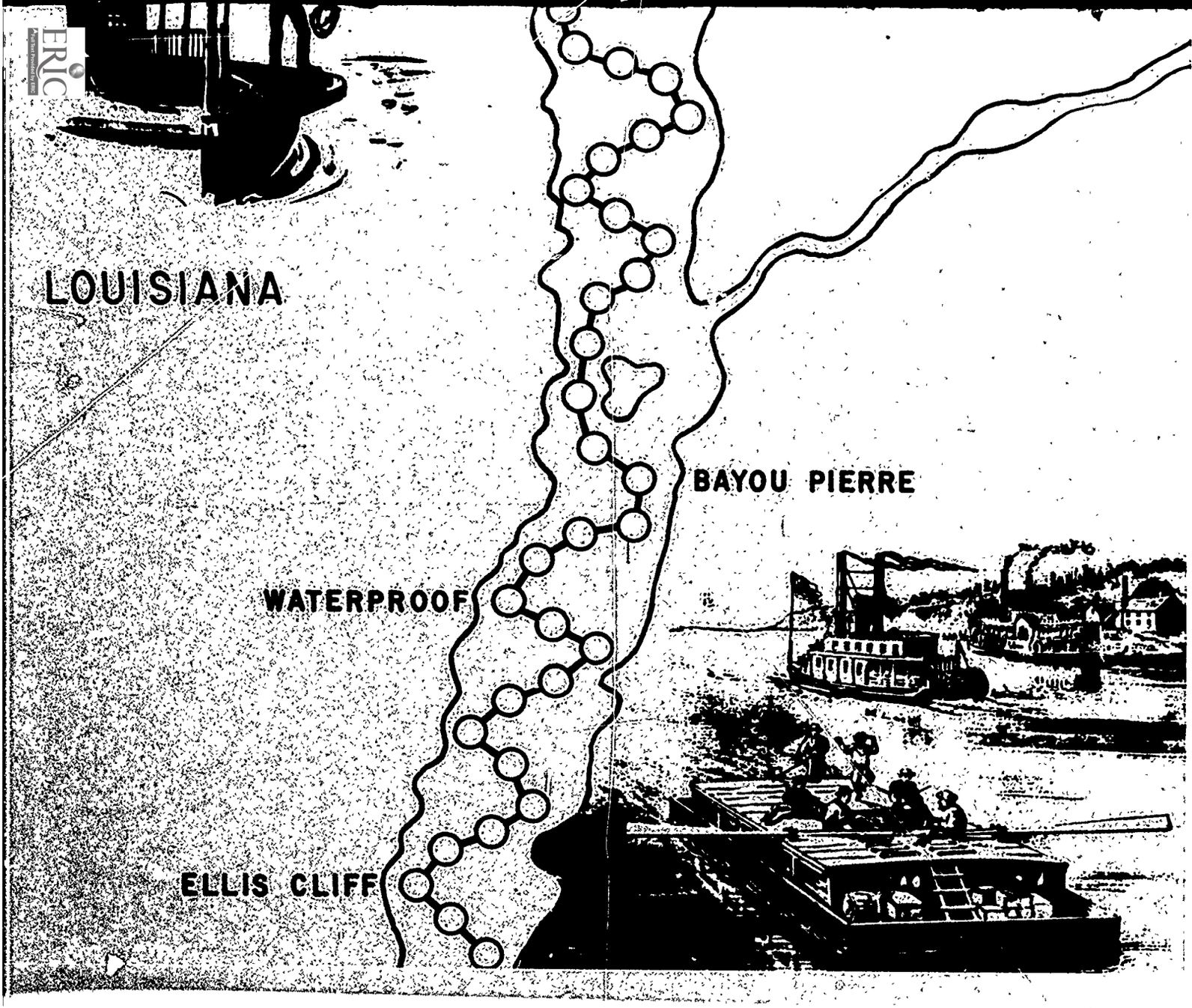
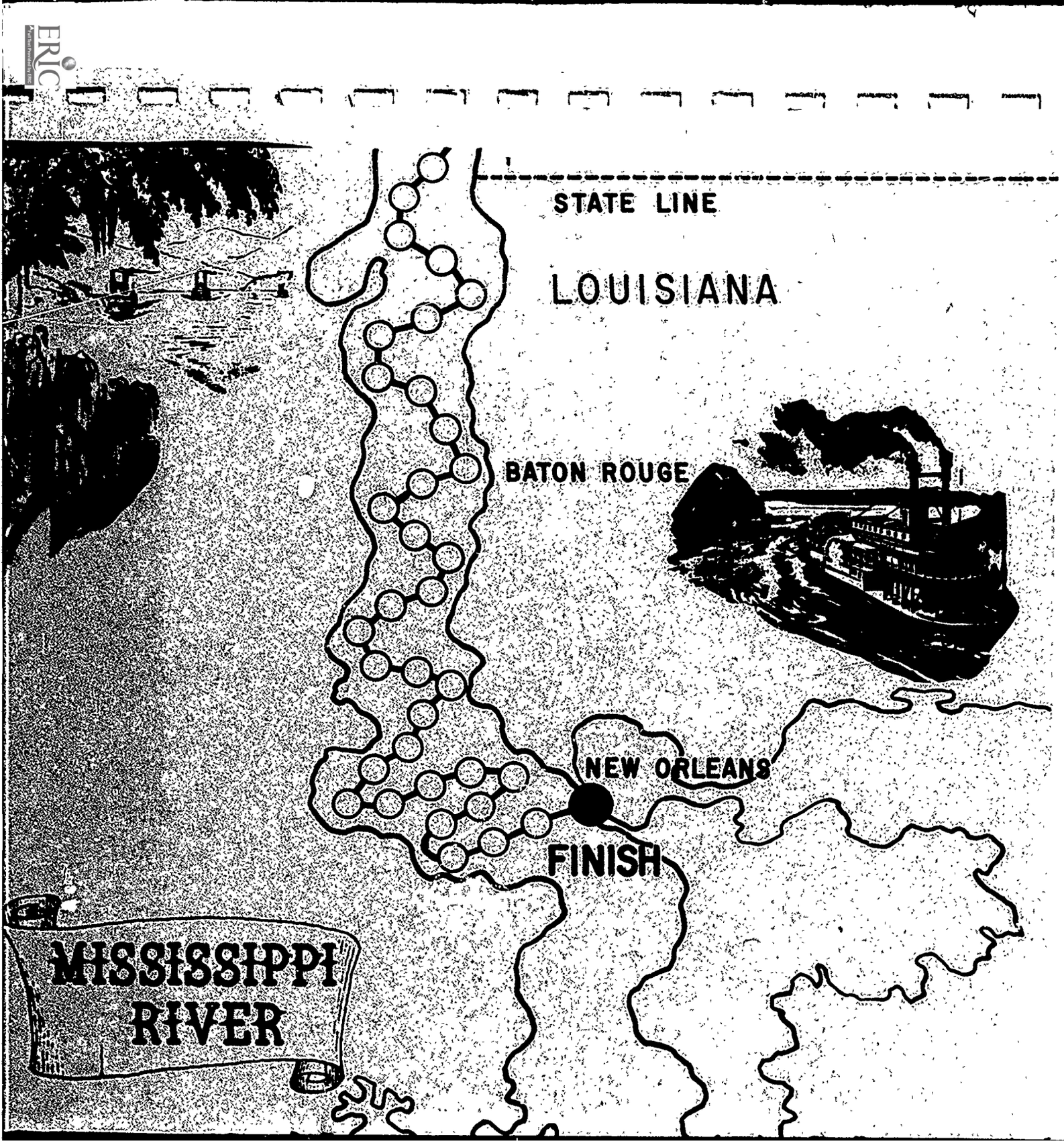
FORT PILLOW
ARKANSAS
STATE LINE


MISSISSIPPI
SUNFLOWER
ARKANSAS RIVER
LOUISIANA
BAYOU PIERRE


LOUISIANA
BAYOU PIERRE
WATERPROOF
ELLIS CLIFF


STATE LINE
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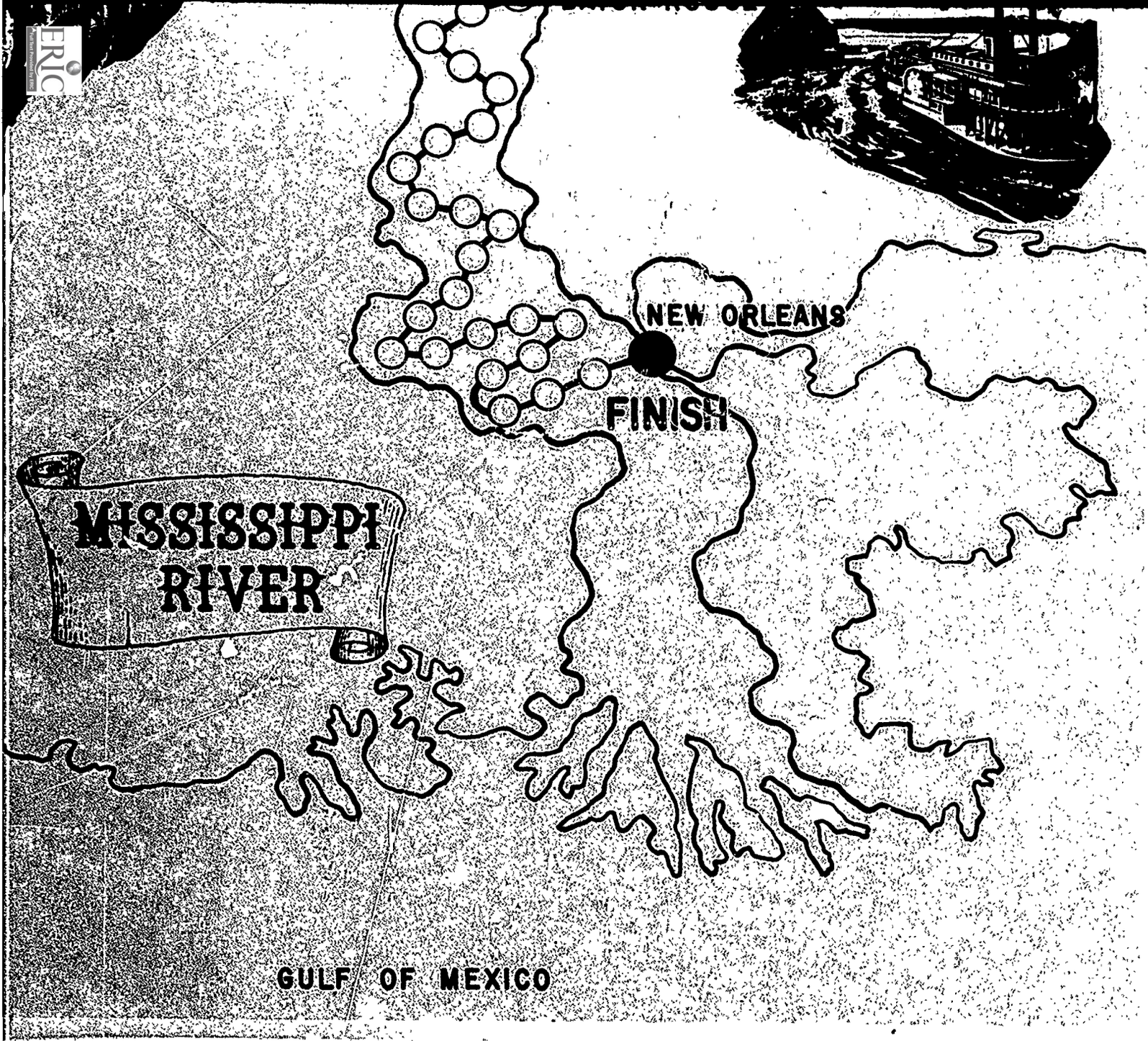
FINISH
MISSISSIPPI
RIVER


NEW ORLEANS
FINISH
MISSISSIPPI
RIVER
GULF OF MEXICO

CARDS FOR MISSISSIPPI RIVERBOAT RACE

NAME THE SUM 34 +52 = miles ROUND OFF TO NEAREST 10 MILES	NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) x ____ = miles DRAW ANOTHER CARD	ROUND
NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) x ______ = miles DRAW ANOTHER CARD	NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) = miles DRAW ANOTHER CARD	ROUND
NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) = [illegible] miles DRAW ANOTHER CARD	NAME THE PRODUCT [illegible] [illegible] [illegible] [illegible]	[illegible]

CARDS FOR MISSISSIPPI RIVERBOAT RACE

ILES	NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) x ____ = miles DRAW ANOTHER CARD
NAME THE PRODUCT 17 x6 = miles ROUND OFF TO NEAREST 10 MILES	
anks. 10 miles. miles	NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) = miles DRAW ANOTHER CARD
NAME THE PRODUCT 36 x3 = miles ROUND OFF TO NEAREST 10 MILES	
anks. 10 miles.	NAME THE PRODUCT 14 x16 = miles ROUND OFF TO NEAREST 10 MILES
NAME THE PRODUCT 19 x11 = miles ROUND OFF TO NEAREST 10 MILES	

CARDS FOR MISSISSIPPI RIVERBOAT RACE

When you get to Baton Rouge, stop and load fuel. Do not move down river until your following move. SAVE THIS CARD AND DRAW ANOTHER	Your boiler bursts. YOU LOSE TWO TURNS	Your roustabou see "Old Al, t (a huge alliga a pipe) and pa YOU LOSE
You are attacked by river pirates in a shanty b at at Ellis Cliff Mississippi. WHEN YOU GET THERE, STOP, YOU LOSE A TURN SAVE THIS CARD AND DRAW ANOTHER	Your riverboat ran aground on a sandbar. YOU LOSE YOUR TURN	Catfish Johnny YOU LOSE
Two roustabouts: Half-Dollar and Turtle get in a fight. YOU LOSE YOUR TURN	Your riverboat rammed a cluster of logs. YOU LOSE YOUR TURN	Blue Johnny, y shot by a shan YOU LOSE

CARDS FOR MISSISSIPPI RIVERBOAT RACE

	Your boiler bursts. YOU LOSE TWO TURNS	Your roustabouts think they see "Old Al, the River King" (a huge alligator smoking a pipe) and panic. YOU LOSE YOUR TURN
es	Your riverboat ran aground on a sandbar. YOU LOSE YOUR TURN	Catfish Johnny falls overboard. YOU LOSE YOUR TURN
	Your riverboat rammed a cluster of logs. YOU LOSE YOUR TURN	Blue Johnny, your engineer was shot by a shanty boat pilot. YOU LOSE YOUR TURN

CARDS FOR MISSISSIPPI RIVERBOAT RACE

NAME THE SUM 83 +11 = miles ROUND OFF TO NEAREST 10 MILES	NAME THE SUM 67 +9 = miles ROUND OFF TO NEAREST 10 MILES	NA ROUND
NAME THE SUM 47 +54 = miles ROUND OFF TO NEAREST 10 MILES	NAME THE SUM 26 19 +71 = miles ROUND OFF TO NEAREST 10 MILES	FI ROUND
NAME THE SUM 76 +48 = miles ROUND OFF TO NEAREST 10 MILES	NAME THE SUM 27 35 +11 = miles ROUND OFF TO NEAREST 10 MILES	FI ROUND

CARDS FOR MISSISSIPPI RIVERBOAT RACE

10 MILES	NAME THE SUM 67 +9 = miles ROUND OFF TO NEAREST 10 MILES	NAME THE SUM 47 41 +36 = miles ROUND OFF TO NEAREST 10 MILES
10 MILES	NAME THE SUM 26 19 +71 = miles ROUND OFF TO NEAREST 10 MILES	FIND THE SUM 62 18 39 +29 = miles ROUND OFF TO NEAREST 10 MILES
1 S	NAME THE SUM 27 35 +11 = miles ROUND OFF TO NEAREST 10 MILES	FIND THE SUM 14 32 37 +49 = miles ROUND OFF TO NEAREST 10 MILES

CARDS FOR MISSISSIPPI RIVERBOAT RACE

NAME THE SUM 34 +52 = miles ROUND OFF TO NEAREST 10 MILES	NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) x ____ = miles DRAW ANOTHER CARD	ROUND
NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) x ____ = miles DRAW ANOTHER CARD	NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) = miles DRAW ANOTHER CARD	ROUND
NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____ x ____) x = miles DRAW ANOTHER CARD	NAME THE PRODUCT 14 x16 = miles ROUND OFF TO NEAREST 10 MILES	ROUN

CARDS FOR MISSISSIPPI RIVERBOAT RACE

NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (_____ x _____) x _____ = miles DRAW ANOTHER CARD	NAME THE PRODUCT 17 x6 = miles ROUND OFF TO NEAREST 10 MILES
NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (_____ x _____) = miles DRAW ANOTHER CARD	NAME THE PRODUCT 36 x3 = miles ROUND OFF TO NEAREST TO MILES
NAME THE PRODUCT 14 x16 = miles ROUND OFF TO NEAREST 10 MILES	NAME THE PRODUCT 19 x11 = miles ROUND OFF TO NEAREST 10 MILES

CARDS FOR MISSISSIPPI RIVERBOAT RACE

FIND THE DIFFERENCE 1443 -1279 =miles ROUND OFF TO NEAREST 10 MILES	Roll two dice to fill in blanks. Then find the following value: (____ + ____) x _____ = miles ROUND OFF TO NEAREST 10 MILES	Roll two d Then find (____ + ROUND
FIND THE DIFFERENCE 1781 -1609 = miles ROUND OFF TO NEAREST 10 MILES	Roll two dice to fill in blanks. Then find the following value: (____ + ____) x _____ = miles ROUND OFF TO NEAREST 10 MILES	Roll two d Then find (____+ ROUND
FIND THE DIFFERENCE 1500 -1450 = miles ROUND OFF TO NEAREST 10 MILES	Roll two dice to fill in blank. Then find the following value: (____ + ____) x _____ = miles ROUND OFF TO NEAREST 10 MILES	Roll two d Then find (____ + ROUND

CARDS FOR MISSISSIPPI RIVERBOAT RACE

Roll two dice to fill in blanks. Then find the following value: (_____+_____) x ______ = miles ROUND OFF TO NEAREST 10 MILES	Roll two dice to fill in blanks. Then find the following value: (_____+_____) x ______ = miles ROUND OFF TO NEAREST 10 MILES
Roll two dice to fill in blanks. Then find the following value: (_____+_____) x ______ = miles ROUND OFF TO NEAREST 10 MILES	Roll two dice to fill in blanks. Then find the following value: (_____+_____) x ______ = miles ROUND OFF TO NEAREST 10 MILES
Roll two dice to fill in blanks. Then find the following value: (_____+_____) x ______ = miles ROUND OFF TO NEAREST 10 MILES	Roll two dice to fill in blanks. Then find the following value: (_____+_____) x ______ = miles ROUND OFF TO NEAREST 10 MILES

ES

LES

ES

CARDS FOR MISSISSIPPI RIVERBOAT RACE

GIVE THIS CARD TO ANOTHER PLAYER DRAW ANOTHER CARD Your boat will float in three and a half feet of water. You tried to float in three feet and have hit bottom. YOU LOSE A TURN	FIND THE MISSING ADDEND 493 -379 = miles ROUND OFF TO NEAREST 10 MILES	FIND ROUND O
GIVE THIS CARD TO ANOTHER PLAYER DRAW ANOTHER CARD Your boiler is leaking; so is your bottom. Stop for repairs. YOU LOSE TWO TURNS	FIND THE MISSING ADDEND 147 -28 = miles ROUND OFF TO NEAREST 10 MILES	FIND ROUND O
FIND THE MISSING ADDEND 94 -5 = miles ROUND OFF TO NEAREST 10 MILES	FIND THE MISSING ADDEND 283 -192 = miles ROUND OFF TO NEAREST 10 MILES	FIND ROUND O

CARDS FOR MISSISSIPPI RIVERBOAT RACE

YER e ou	FIND THE MISSING ADDEND 493 -379 = miles ROUND OFF TO NEAREST 10 MILES
FIND THE MISSING ADDEND 976 -842 = miles ROUND OFF TO NEAREST 10 MILES	
YER s rs.	FIND THE MISSING ADDEND 147 -28 = miles ROUND OFF TO NEAREST 10 MILES
FIND THE DIFFERENCE 1297 -1177 = miles ROUND OFF TO NEAREST 10 MILES	
LES	FIND THE MISSING ADDEND 283 -192 = miles ROUND OFF TO NEAREST 10 MILES
FIND THE DIFFERENCE 975 -895 = miles ROUND OFF TO NEAREST 10 MILES	

CARDS FOR MISSISSIPPI RIVERBOAT RACE

NAME THE PRODUCT Roll one die to fill in blanks. Then round off to nearest 10 miles. (____x____) x _____ = miles DRAW ANOTHER CARD	FIND THE QUOTIENT 567 - 81 = miles ROUND OFF TO NEAREST 10 MILES	R
NAME THE PRODUCT 12 x15 = miles ROUND OFF TO NEAREST 10 MILES	FIND THE QUOTIENT 350 - 5 = miles ROUND OFF TO NEAREST 10 MILES	
FIND THE QUOTIENT 5538 - 39 = miles ROUND OFF TO NEAREST 10 MILES	FIND THE QUOTIENT 13,741 - 91 = miles ROUND OFF TO NEAREST 10 MILES	

CARDS FOR MISSISSIPPI RIVERBOAT RACE

FIND THE QUOTIENT 567 - 81 = miles ROUND OFF TO NEAREST 10 MILES	FIND THE QUOTIENT 387 - 9 = miles ROUND OFF TO NEAREST 10 MILES
FIND THE QUOTIENT 350 - 5 = miles ROUND OFF TO NEAREST 10 MILES	
FIND THE QUOTIENT 13,741 - 91 = miles ROUND OFF TO NEAREST 10 MILES	

CARDS FOR MISSISSIPPI RIVERBOAT RACE

All boats between Waterproof, Louisiana and Sunflower, Mississippi have sandbar trouble. THEY SUBTRACT 50 MILES FROM NEXT TURN DRAW ANOTHER CARD	The trailing boat finds a short cut. LAST BOAT AHEAD BY 50 MILES DRAW ANOTHER CARD	"The Nato a race, B the other BELLE GOE
All boats between Fort Pillow, Tennessee and the mouth of the Arkansas river are slowed by bayous. THEY SUBTRACT 50 MILES FROM NEXT TURN. DRAW ANOTHER CARD	Chattanooga Jack, one of your Roustabouts, spies an island in the nick of time. GO AHEAD 50 MILES DRAW ANOTHER CARD	The lead LEAD BOAT IF YOU AR
Captain Leathers of the Lee uses spoiled pork for fuel and gets up a good head of steam. ROBERT E. LEE AHEAD 100 MILES. DRAW ANOTHER CARD	Captain Andy of the Natchez follows a crane through the fog. (Cranes are known in the legends as old river boatmen). NATCHEZ GOES AHEAD 100 MILES. DRAW ANOTHER CARD	All boats Pierre, N fog and DRAW ANOT UP RIVER

CARDS FOR MISSISSIPPI RIVERBOAT RACE

The trailing boat finds a short cut. LAST BOAT AHEAD BY 50 MILES DRAW ANOTHER CARD	"The Natchez, Lee, and Belle had a race, Belle throwed water in the others face." BELLE GOES AHEAD 100 MILES. DRAW ANOTHER CARD
Chattanooga Jack, one of your Roustabouts, spies an island in the nick of time. GO AHEAD 50 MILES DRAW ANOTHER CARD	The lead boat hits a snag. LEAD BOAT LOSES NEXT TURN. IF YOU ARE NOT THE LEAD BOAT, DRAW ANOTHER CARD.
Captain Andy of the Natchez follows a crane through the fog. (Cranes are known in the legends as old river boatmen). NATCHEZ GOES AHEAD 100 MILES. DRAW ANOTHER CARD	All boats down river of Bayou Pierre, Mississippi hit heavy fog and lose a turn. DRAW ANOTHER CARD IF YOU ARE UP RIVER OF BAYOU PIERRE.

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Doug Eidsmore

Subject: Math

Activity Name: Lunar Explorers

Participation: Two Players

Time: Two to Four Class Periods.

Theme

Players assume roles of astronauts exploring the surface of the moon. The astronauts do their exploring on Lunar Roving Vehicles and visit various craters and other surface features near their base. At each point of interest visited, the astronauts draw a card representing the collection of a core sample, performance of an experiment. The LRV's movement is simulated by rolling dice. Each roll simulates an hour of time. The range (miles) of the LRV's are limited and astronauts carry a limited amount of oxygen (hours). In emergencies, players must cooperate to help return an astronaut who is short of oxygen to Sinus Medii (central bay) Base. The base is on the Lunar equator at 0° longitude, i.e., at the center of the near side of the moon.

Instructional Objectives

Each student is to correctly:

1. Square two one digit numbers a minimum of 30 times.
2. Find the sum of these two squared numbers.
3. Find the square root of the sum of the squares of these numbers using a square root table.
4. Multiply the square root by 5.
5. Name the sums of at least four columns of two and three place numbers with a minimum of ten numbers in each column.

Bibliography

The Time Atlas of the Moon, Times Ltd, London 1969

Roving through the Mountains of the Moon, LIFE, August 20, 1971

Apollo 15's Moon Buggy, NEWSWEEK, May 17, 1971.

Mathematics for the Elementary School, Volume 6, School Math Study Group, Yale University Press.

Materials

1. A deck of 31 experiment (27) and emergency cards (4).
2. A game board (lunar map) consisting of four 8½ x 11 sheets to be taped together.
3. Four calculation sheets per player.
4. A square root table for each player.
5. An Exploration Check List for each player.

Also, each player needs a distinctive marker and a pencil. One set of dice is also needed per game.

Preparation

Tape the game boards together or staple them to a stiff piece of cardboard. It is desirable that players be familiar with the pythagorean theorem. Dice are thrown that determine the legs of right triangles. The length of the hypotenuse is found using the pythagorean theorem.

Rules

1. Players place their marker on the square on the center of the board labeled Sinus Medii Base.

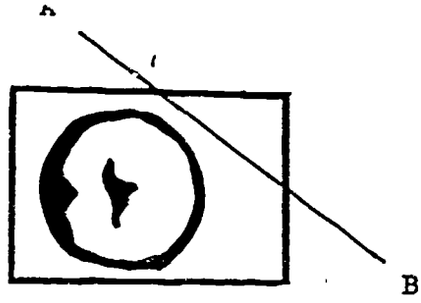
2. Players roll the dice to see who goes first.

3. The player with the highest value rolls first. Assume his roll yields a five and a one. He does not add these together but moves his marker one direction for each value. He may move five spaces to the right or left or five spaces up or down. Assume the player decided to move fivce spaces down, he must then decide whether to move one space to the right or one space to the left. Assume the player decided to move to the right. He would then be heading towards the lower right hand corner of the board.

4. The object of the game is to visit as many craters and other surface phenomenon as possible. When a player crosses a heavily bordered area enclosing a crater, he draws a card. Most of these cards describe an experiment that the astronaut has performed at the sight. Players receive points for each experiment. These are entered on the exploration check list and points are added up at the end of the game. Some cards describe an emergency situation. This situation is discussed in number 10.

5. Players can leave Sinus Medii at any point along the bordered edge.

6. Players may draw a card for points for visiting an exploration area by passing over any square in the area below:

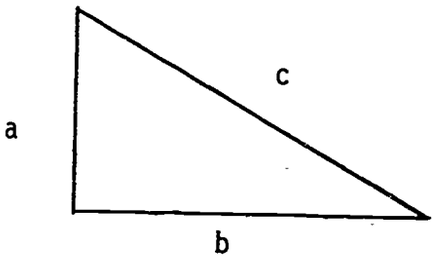


Player moves from A to B -- he draws card even though he has not landed in the bordered areas.

7. The distance players can travel before returning to Sinus Medii Base is limited by two things. The batteries that supply power to the motors of the Lunar Roving Vehicle and the supply of oxygen they can carry. The batteries will supply power for 400 miles and the oxygen supply is limited to 18 hours. Each time a player rolls the dice one hour is assumed to have passed. Note that the calculation sheets are limited to 18 calculations (dice throws or moves). Players must return to base within 18 moves or declare an emergency situation and request help from the other player. (See emergencies number 10)

8. The calculation sheets are used to keep track of the number of hours passed per trip and to calculate the miles traveled. After each roll of the dice, the player must enter the values obtained on the calculation sheet. One die yields a value for (a) the other for (b). It does not matter which value goes where. The player must square each value and then name the sum of a^2+b^2. The player then finds the square root, using the table of the value a^2+b^2. The resulting root is then multiplied times 5. This converts the throw of the dice to miles. Players should keep a running total of the distance they have traveled in the column on the right. The player must return to base before traveling 400 miles. If the total miles traveled exceeds 400, he must either walk to the base, moving one square per move without dice (five miles per hour) or declare an emergency and have the other player pick him up.

9. Miles traveled is calculated by using the Pythagorean Theorem. Each die determines one of the legs of a right triangle.



(In the triangle above $a^2+ b^2 = C^2$; to find C, find the square root of $(a^2+ b^2.)$ If one die has a value of 3 and the other of 4, the distance traveled would be:

$$\sqrt{3^2+4^2} = \sqrt{25} = 5$$

10. EMERGENCY SITUATION - A player declares that an emergency situation exists when he draws a card placing him in an emergency (oxygen shortage or power shortage) situation or when he feels he is unable to return to the base without running short of oxygen. When an emergency is declared, the other player must help the player in trouble. They must first arrange a rendezvous. (The players must come within three squares of each other). The helping player may have to return to base and pick up more oxygen. Once the rescue is made, the players return to the base together both moving to the same square after each dice throw. They can cooperate in filling out a calculation sheet for the return home. They both must return to the base in under nine hours. (The oxygen supply is still limited to 18 hours and the rescuing player uses some oxygen in making the rendevous and they use twice as much going back)

    As a reward for his help, the player who performed the rescue receives all the point cards collected by the other player during that excursion.

11. After returning to the base, the players enter their points on the "Exploration Check List". They then go on another excursion until all the points of interest have been visited. They use a separate calculation sheet for each trip. The winner is the player with the most points at the end of the game.

12. ALTERNATIVE MODES OF PLAY

    Some students may find the objectives and activities of the game just presented too difficult at first. Three alternative modes are suggested that lead up to the present game. The least difficult mode would be to roll dice, move markers as stated in #3 and performing no calculations other than a running count of the number of turns taken per trip. The calculation sheets need not be used for this mode of play.

    A second mode which is slightly more difficult would be to have the players assume that the distance traveled corresponded to the legs of a right triangle rather than the hypotenuse. They would therefore, determine A and B by rolling the dice and finding the sum of these values and multiplying this sum by 5 to find the number of miles traveled during that turn.

12. (cont'd)

A third mode would be to play the game as described previously omitting step 10 and removing the emergency cards from the deck.

A fourth alternative would be to limit the number of craters that could be visited by removing some of the point cards from the deck. This in effect shortens the game. For the students who are having trouble with the game as presented, it is highly recommended that they be allowed to play one of these sample modes first, thereby giving them practice in moving the markers, exploring the surface of the moon, drawing point cards, etc.

EXPLORATION CHECK LIST

Enter Points in Column

BLAGG CRATER	
BRUCE CRATER	
CHLADNI CRATER	
DEMBOWSKI CRATER	
HERSCHEL CRATER	
HERSCHEL C CRATER	
HIPPARCHUS G CRATER	
HORROCKS CRATER	
LALANDE CRATER	
LALANDA B CRATER	
MOSTING CRATER	
MOSTING A CRATER	
PALLAS A CRATER	
	PALLAS E CRATER
	PICKERING CRATER
	REAUMUR A CRATER
	RHAETICUS A CRATER
	RIMA FLAMMARION
	RIMA REAUMUR
	RIMA TRIESNECKER I
	SCHROTER
	SCHROTER W CRATER
	SEELIGER CRATER
	SOMMERING CRATER
	SPORER
	TRIESNECKER CRATER
SUB TOTAL (1)	SUB TOTAL (2)

total score = _____ Sub-total (1) + Sub-total (2)

YER

p

LUNAR EXPLORERS

CALCULATION SHEET

LIMITS - 400 miles per trip

- 18 hours of oxygen per trip

b	a^2	b^2	a^2+b^2	SQUARE ROOT	x5	TOTAL MILES

YER

LUNAR EXPLORERS

CALCULATION SHEET

LIMITS - 400 miles per trip

- 18 hours of oxygen per trip

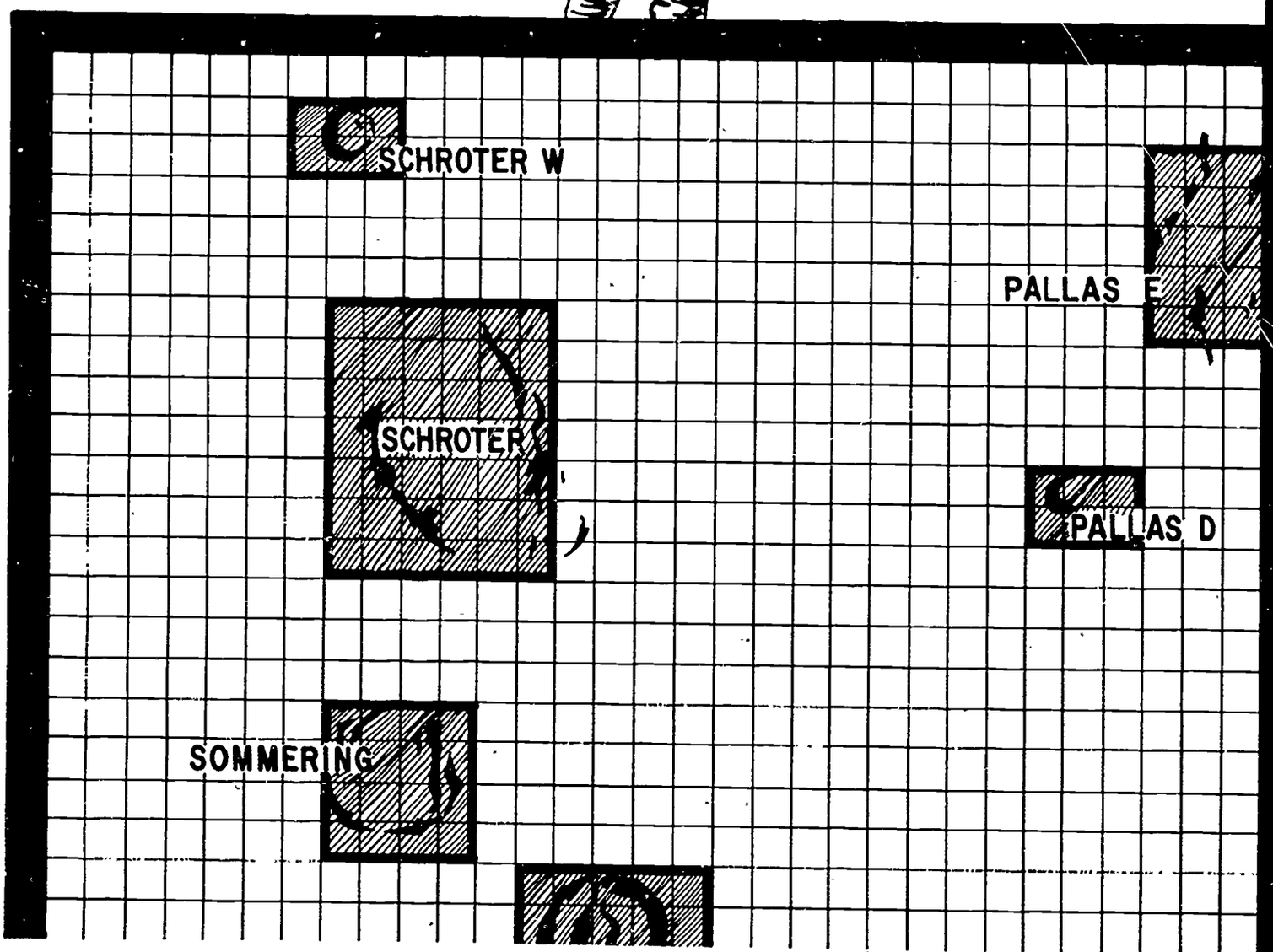
b	a^2	b^2	a^2+b^2	SQUARE ROOT	x5	TOTAL MILES

LUNAR EXPLORERS SQUARE ROOT TABLE

a^2+b^2	SQUARE ROOT	a^2+b^2	SQUARE ROOT	a^2+b^2	SQUARE ROOT	a^2+b^2	SQUARE ROOT
1	1.0	21	4.6	41	6.4	61	7.8
2	1.4	22	4.7	42	6.5	62	7.9
3	1.7	23	4.8	43	6.6	63	7.9
4	2.0	24	4.9	44	6.6	64	8.0
5	2.2	25	5.0	45	6.7	65	8.1
6	2.4	26	5.1	46	6.8	66	8.1
7	2.6	27	5.2	47	6.8	67	8.2
8	2.8	28	5.3	48	6.9	68	8.2
9	3.0	29	5.4	49	7.0	69	8.3
10	3.2	30	5.5	50	7.1	70	8.4
11	3.3	31	5.6	51	7.1	71	8.4
12	3.5	32	5.7	52	7.2	72	8.5
13	3.6	33	5.7	53	7.3	73	8.5
14	3.7	34	5.8	54	7.3	74	8.6
15	3.9	35	5.9	55	7.4	75	8.7
16	4.0	36	6.0	56	7.5	76	8.7
17	4.1	37	6.1	57	7.5	77	8.8
18	4.2	38	6.2	58	7.6	78	8.8
19	4.3	39	6.2	59	7.7	79	8.9
20	4.5	40	6.3	60	7.7	80	8.9

LUNA

LEFT TOP



LUNAR

SCHROTER W

PALLAS E

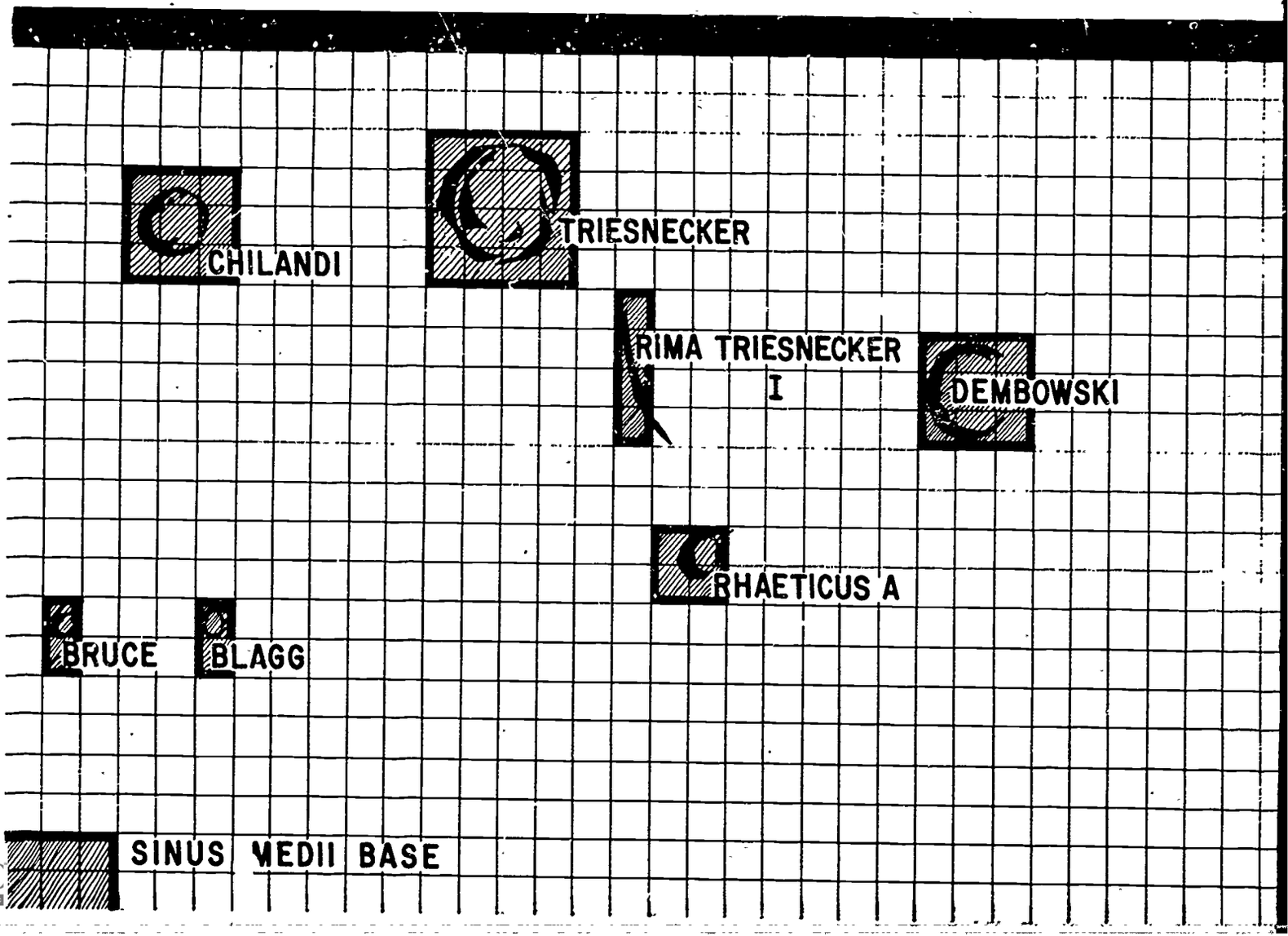
SCHROTER

PALLAS D

ERING

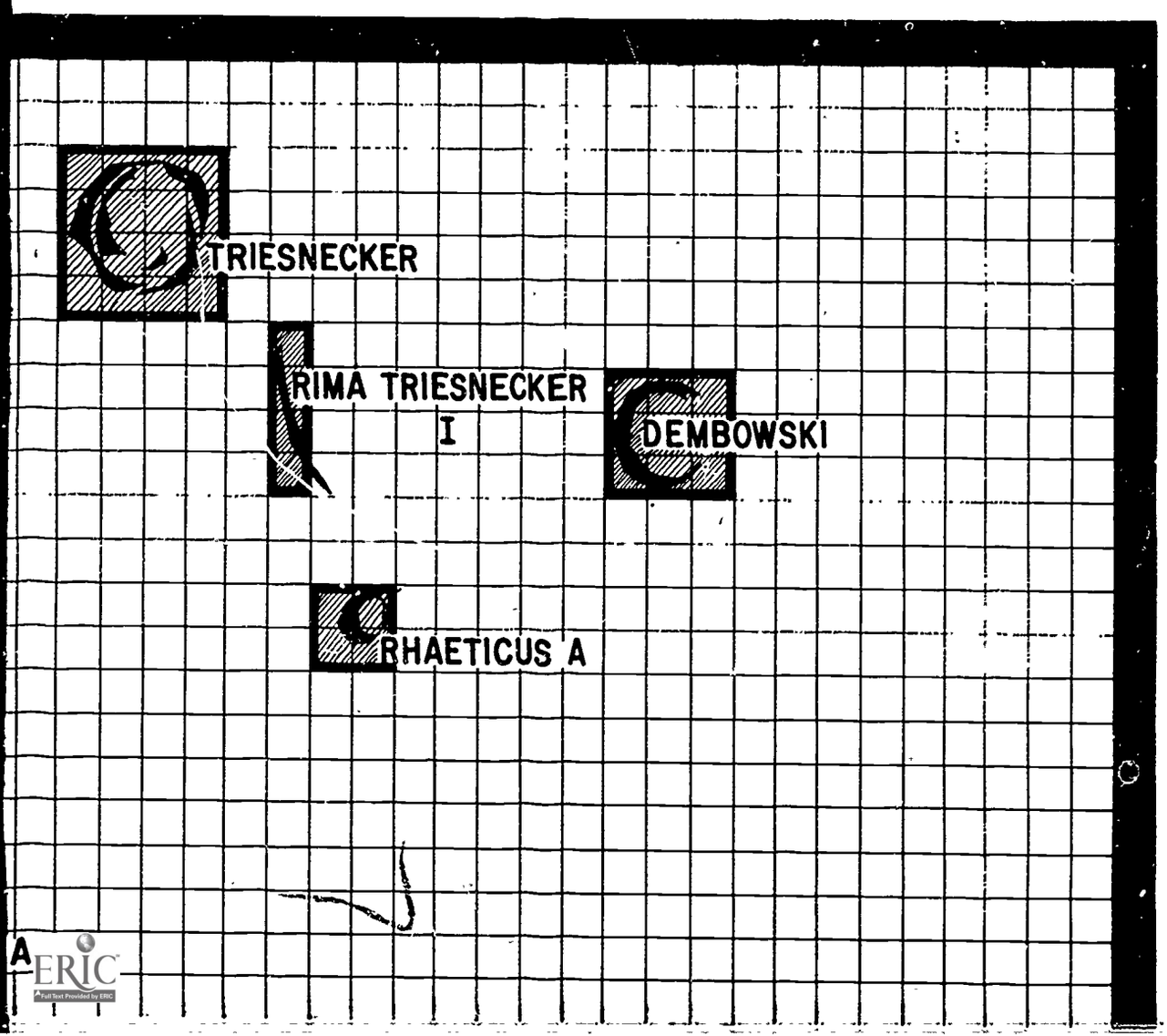
EXPLORERS

RI



LORERS

RIGHT TOP



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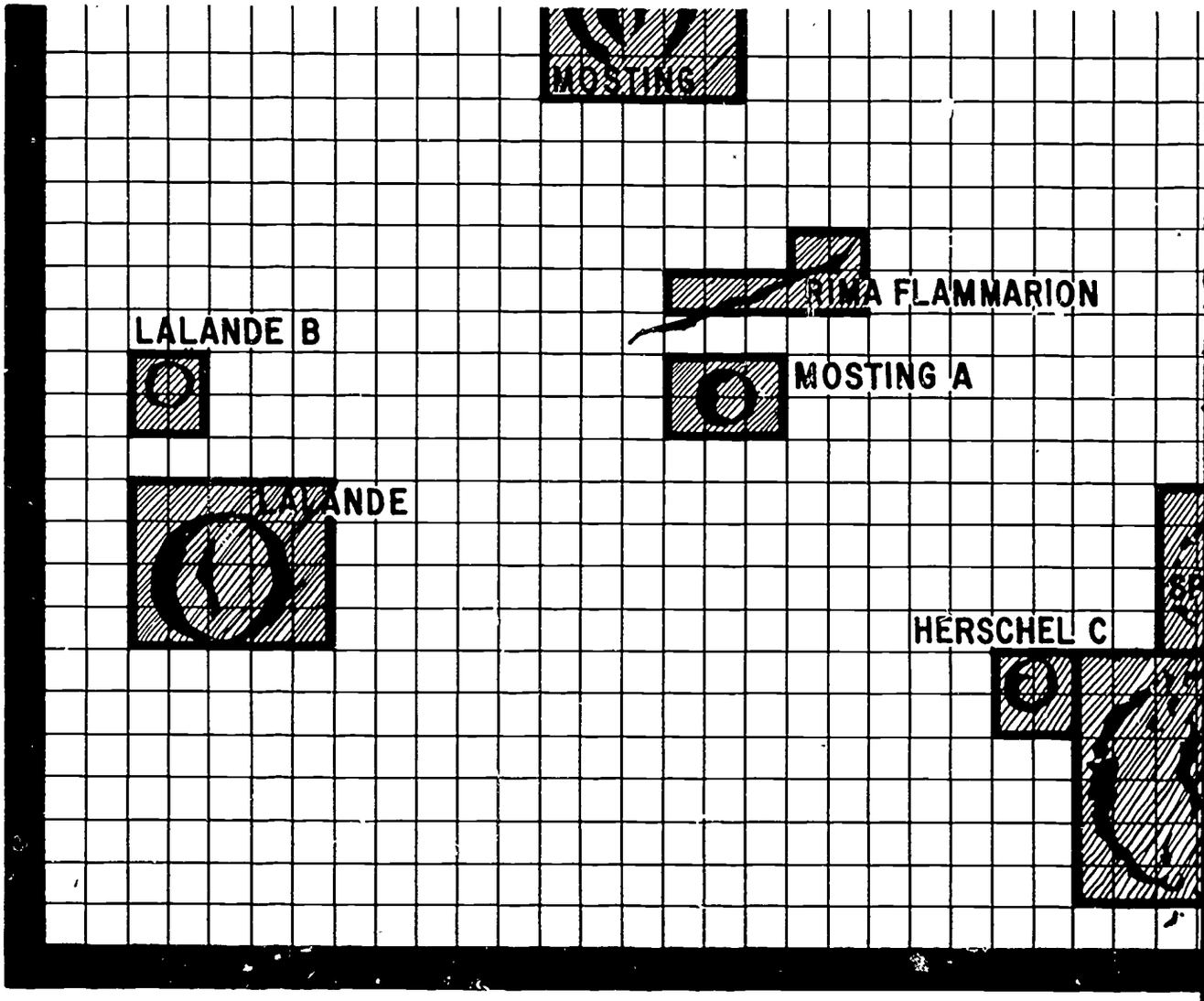
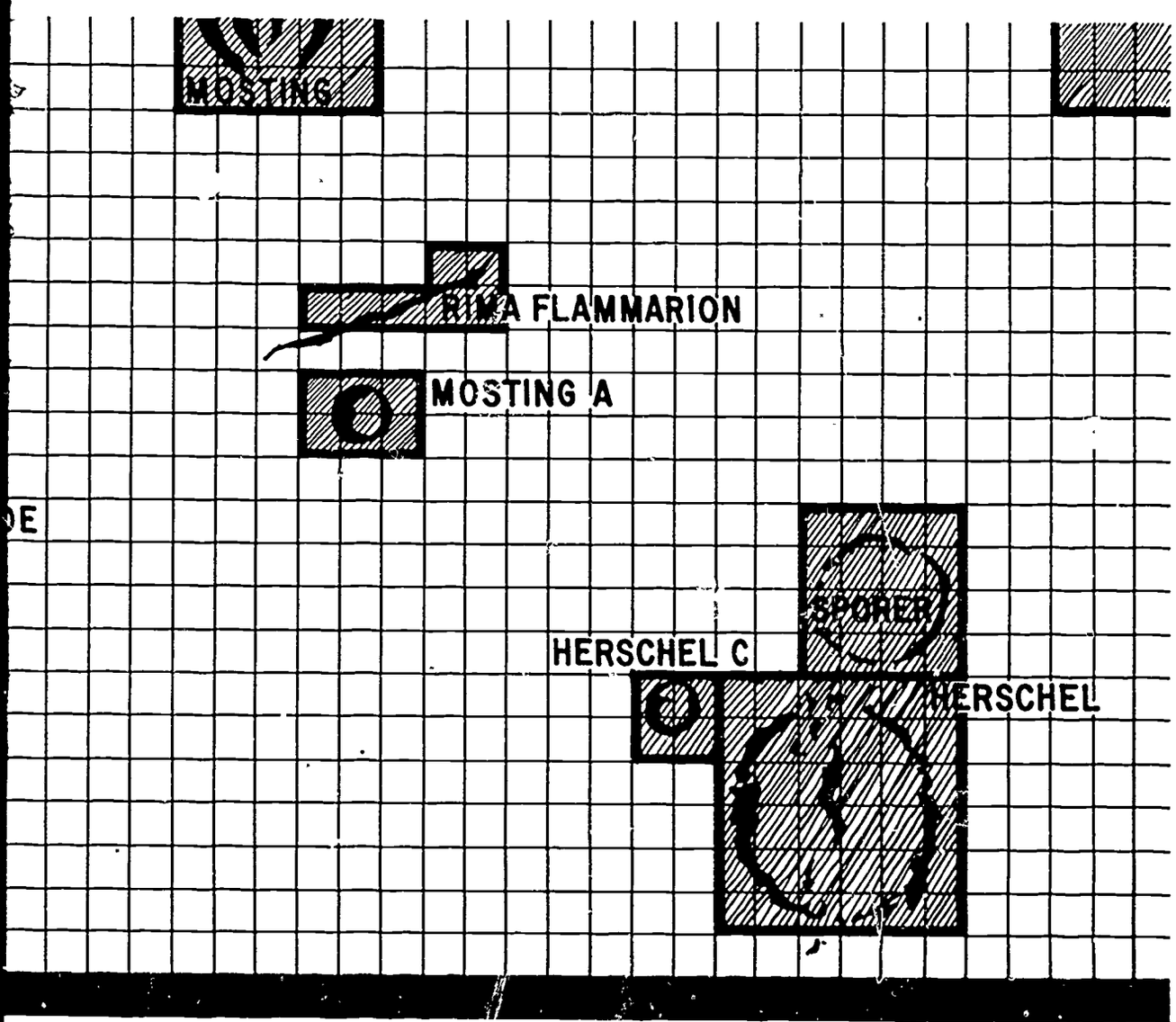
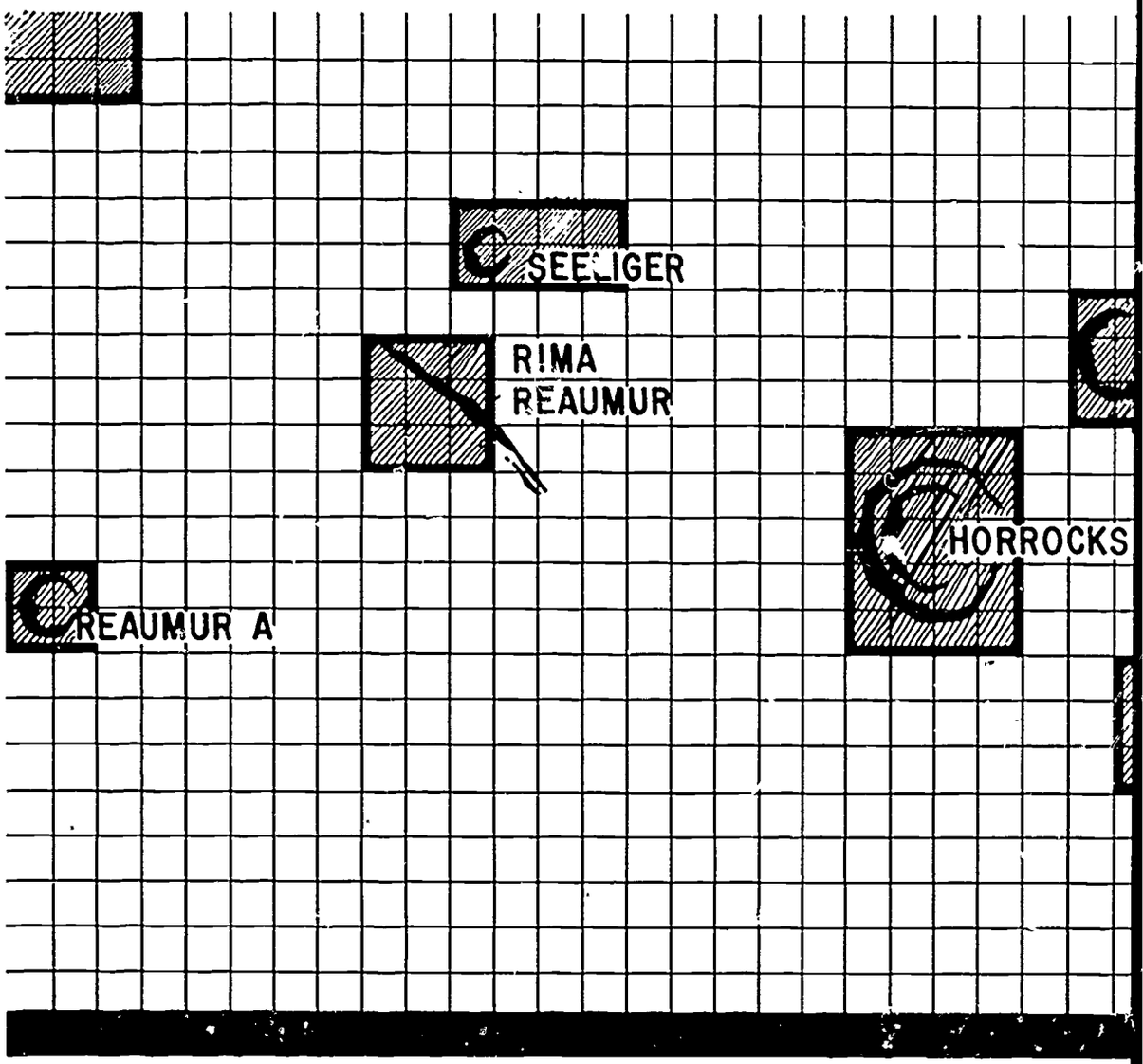
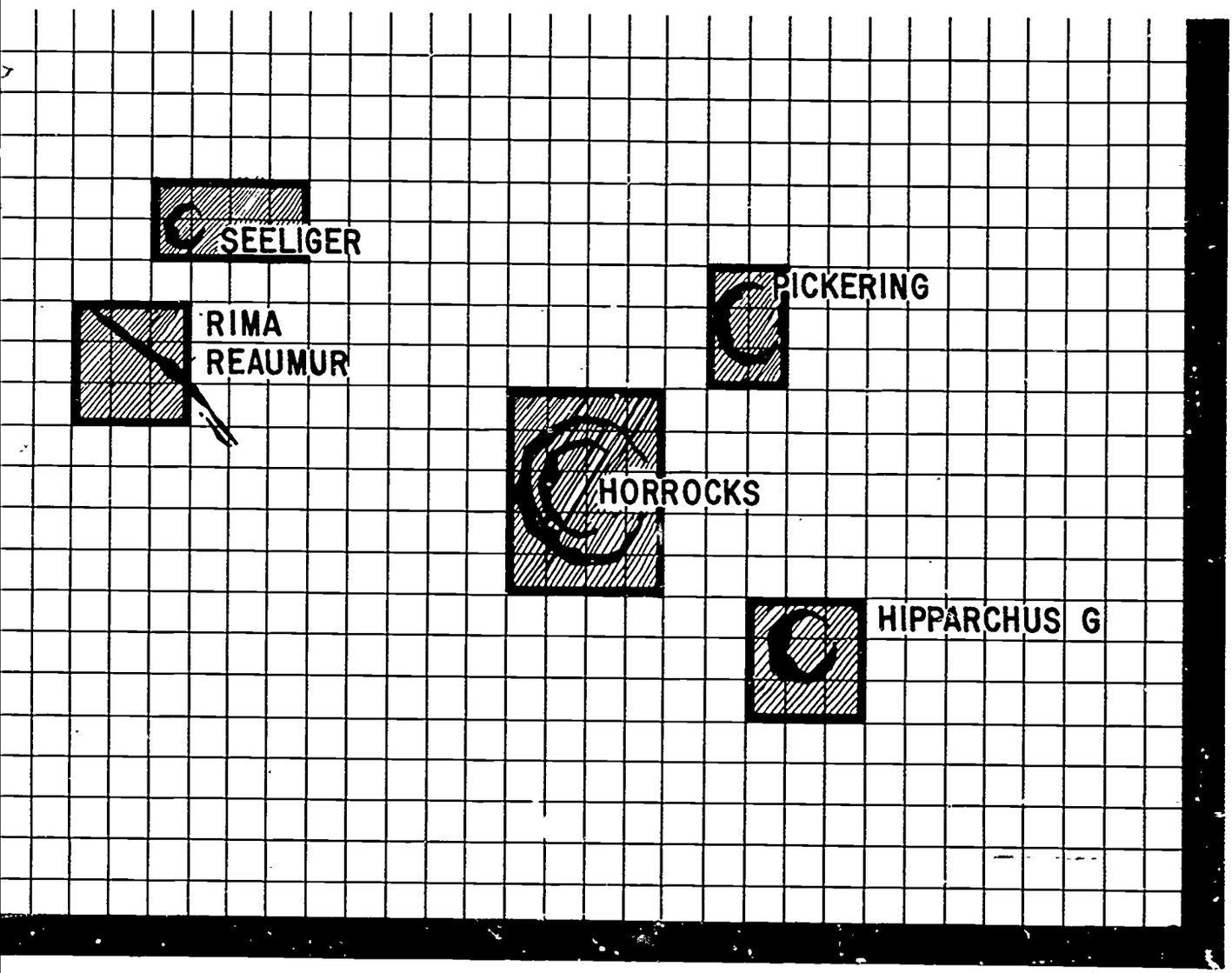

MOSTING
RIMA FLAMMARION
LALANDE B
MOSTING A
LALANDE
HERSCHEL C

LEFT BOTTOM


MOSTING
RIMA FLAMMARION
MOSTING A
SPORER
HERSCHEL C
HERSCHEL


SEELIGER
RIMA
REAUMUR
HORROCKS
REAUMUR A



RIGHT BOTTOM

CARDS FOR LUNAR EXPLORERS

You photographed a small volcano close by your present location. (5 points)	You collected dust samples. (5 points)	You c
You photographed a small crater. (5 points)	You collected some dust samples. (10 points)	You m some
You photographed the sun rising over a ridge of peaks. (5 points)	You collected some core samples. (5 points)	You m
You photographed a small rima. (5 points)	You collected some moon rocks. (5 points)	You d uncha
You photographed rock formations. (5 points)	You collected some moon rocks. (5 points)	You c

CARDS FOR LUNAR EXPLORERS

	You collected dust samples. (5 points)	You collected some small pebbles. (5 points)
	You collected some dust samples. (10 points)	You measured the height of some lunar mountains. (5 points)
	You collected some core samples. (5 points)	You measured density of moon dust. (5 points)
	You collected some moon rocks. (5 points)	You discovered a small uncharted crater. (5 points)
	You collected some moon rocks. (5 points)	You collected good core samples. (10 points)

CARDS FOR LUNAR EXPLORERS

You set up a solar flare measuring device. (10 points)	You collected some crystalline rocks. (10 points)	You s to re
You transmitted valuable T.V. pictures to scientists on earth. (10 points)	You collected some silica particles. (10 points)	YOUR BY A YOU M 5 HOU
You measure the length of a small rima (10 points)	You planted a vapor measuring probe. (10 points)	YOUR BATTE YOU C
You correctly measured the local lunar magnetic field. (10 points)	You collected rock samples of lunar geologic activity. (10 points)	YOUR MOTOR YOU C
You performed a successful seismographic experiment. (10 points)	You set up a telescope to photograph mars. (15 points)	YOUR A LEA RETUR

CARDS FOR LUNAR EXPLORERS

th.	You collected some crystalline rocks. (10 points)	You set off a small explosion to record shock waves. (15 points)
	You collected some silica particles. (10 points)	(EMERGENCY) YOUR OXYGEN TANK WAS PUNCTURED BY A MICRO-METEORITE. YOU MUST RETURN TO BASE WITHIN 5 HOURS.
	You planted a vapor measuring probe. (10 points)	(EMERGENCY) YOUR LUNAR ROVING VEHICLE'S BATTERIES ARE SHORTING OUT. YOU CAN TRAVEL ANOTHER 120 MILES
	You collected rock samples of lunar geologic activity. (10 points)	(EMERGENCY) YOUR LUNAR ROVING VEHICLE'S MOTOR HAS A WORN BEARING. YOU CAN RIDE ANOTHER 100 MILES.
	You set up a telescope to photograph mars. (15 points)	(EMERGENCY) YOUR OXYGEN TANK HAS DEVELOPED A LEAK IN THE REGULATOR VALVE. RETURN TO BASE WITHIN SIX HOURS

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Doug Eidsmore

Subject: Math

Activity Name: Math Challenge

Participation: Four players

Time: Several rounds per class period

Theme

Four players are each dealt eight cards face down. Numerals are printed on four of these cards. An arithmetic operator -- a (-), (÷), or (x) is printed on the other two cards. Two cards are used in the playing strategy. One has the word "high" written and one has the word "low" written on it. Players decide whether to try to be the player with the highest or lowest number resulting from the mathematical computation. Players go through rounds of betting similar to poker. Before each round they must expose cards. Successful players are those who can estimate correctly the solution to their "Math problem" and as information is revealed during the game by turning cards over, can estimate results of opposing players "math problems".

Instructional Objectives

Each student is to:

1. Lay down cards with a numeral on each, in an ordered sequence progressing from the unit to tens place and finally to the operator without making an error in ten rounds.

2. Correctly estimate (at least 10 times) the result of mathematical operation between two, two place numbers and multiplication, division, and subtraction signs.

Schedule

No schedule is needed. At least one classroom period should be spent playing the game. The game can be played several times by each student. It may be desirable to rotate partners. Also, a variation to the game is suggested following the directions and your students may want to play this.

Bibliography

1. School Math Study Group, Mathematics for the Elementary School, Yale University Press, Volumn 6.

Preparation

1. A set of game cards must be made; a set of thirty numeral cards, ten operator cards, six "high" cards, and six "low" cards. Cards should be about 2 inches by 3 inches and be fairly heavy (numerals should not show through). The requirements for the cards are:

Numeral Cards	Operator Cards	High-Low Cards
(30) cards with a single numeral written on each one. There should be 3 of each numeral from 0 to 9.	(10) cards, 9 with one of the mathematical operators (x, -, and ÷) written on them, and one wild card with the word WILD written on it. There should be three of each operator card.	(6) cards with HIGH written on them. (6) cards with LOW written on them.

Writing on the cards should be done in large block letters with a felt tip pen. The colors of each deck should be different.

2. Play money, poker chips, or matches are needed to be used in betting. A minimum of fifty chips are needed per player. If play money is used, it should be in small denominations, such as, ones, fives, and tens.

Directions

1. A player is selected to be the dealer. Each player is given his share of chips and the cards are dealt. Each player gets one HIGH card and one LOW card.

2. The numeral cards are dealt face down and arranged as shown. (Four cards per player).

3. Two operator cards are dealt to each player face down and placed between the numeral cards.

4. The sequence in which the cards are dealt should not be changed. The remaining cards are placed aside and are not to be looked at by any player.

5. Each player now looks at his own cards, being careful not to show them to other players.

6. Players decide whether to go HIGH or LOW. A multiplication sign and large numbers would warrant going low.

7. Betting is opened. Each player must "open" with a previously agreed value.

8. Now the players simultaneously discard the operator card that they won't be using face up in the center of the table. By exposing a card that they won't be using, each player reveals information to the others. For example, if a player keeps a multiplication card and has high numbers and notices that someone else has turned in a multiplication sign, he can be fairly confident of winning and should bet accordingly.

9. After reviewing the discarded operation cards, players bet starting with the player on the dealer's left.

10. After the round of betting is complete, players simultaneously expose the two units place cards, revealing more information. Players who want to drop out may do so now.

11. Players bet again and then turn over one of the tens place cards.

12. Players bet again and then turn over the remaining tens place card. All numeral cards are now face up.

13. Players now simultaneously expose a HIGH or LOW card. A HIGH card if they are going HIGH, and a LOW card if they are going LOW.

14. Players bet for the last time and then turn over the only remaining card, the operator card.

15. Players now solve their math problems to determine the winners. There will be two winners in most games: a HIGH winner and a LOW winner. The two winners then divide up the loot.

16. VARIATIONS - There are may possible variations to this game, for example, use one operation sign at a time (+, −, ÷, or x) and players try to go high or low all doing the same sort of computations.

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Doug Eidsmore

Subject: Discovery

Activity Name: Ascent; a mountain climbing simulation

Participation: 10-20 players

Time: Two to three class periods

Theme

Players assume roles of mountain climbers who are attempting to climb a fictitious mountain. They must prepare for the climb by purchasing supplies from a supply list. The decisions they must make in purchasing supplies affects their success in climbing the mountain. Stations are set up at different places in the school or classroom that must be occupied by a staff member or student. Their success in gaining the elevation is determined at each station and is dependent upon the decisions they made in purchasing supplies, luck, and skill.

Instructional Objectives

Each student is to:

1. Demonstrate decision making by choosing six items from a supply list.
2. Find the sum of ten two-place numbers.
3. Read a map for 30 seconds and take a recall test based on the map.
4. Describe how to start a fire, attempt to tie a square knot.
5. Behave appropriately during the activity; waiting in line at each station, participating in the activity of each station including rolling dice, determing scores, etc.
6. Each student is to participate in a discussion of the simulation once it is complete. During this discussion, the majority of students should agree that recreational drugs are not necessary for survival, at least when climbing a mountain.

Materials

1. One score sheet for each player.
2. One mountain climber supply list per player.
3. One dope smoker chance sheet per player.
4. One set of directions for each of the stations 1-5.
5. One set of dice for each station.

DIRECTIONS

1. Explain game "theme": You are to climb The Great White Mountain that rises snowcapped from the Dark Forest. You must buy equipment, food, clothes, and if you desire, some high quality Panama Red to keep you in good spirits during the climb. You can carry a limited amount of money with which to purchase supplies. You can buy food, matches, clothes, boots, rope, dope, a map and a compass, and blankets from an outpost in the forest at the base of the mountain. You will find water in streams, lakes, and in the snow on the mountain top. You will have five days to make the climb.

2. Give each player $250 for supply purchases.

3. Pass out supply lists. Explain that it gets cold on the mountain top and that you will need food for five days.

4. Each student checks off six items that he feels are necessary to survive on the mountain.

5. Pass out matches and food cards to individuals and tell them about Steps 6, 7, and 8.

6. Explain that the climb will take 4 to 5 days and will cover 20 to 30 miles depending on the route taken.

7. Explain that the players will be sent to various stations around the school where various things will happen that determine their progress during the climb.

8. Winners are those who reach a height of 20,000 feet. Height is calculated at each station.

9. Send individuals to the first station.

10. A discussion of the simulation should follow completion of the activity. Students should also discuss the decisions they made in choosing supplies and the results of these decisions. If possible, have the class discuss the influence of drugs on survival.

PREPARATION

1. Recruit staff members and students to man each of the Five Stations. The staff member who mans the last station can also be in charge of preparing students for the game. Each person in charge of a station should be given a set of directions and activity for his station and have time to acquaint himself with the operations to take place at his station. He should also be aware of where the next station is so that he can send students there.

2. You will need to prepare matches and food supply cards. The students will carry these cards as they progress from station to station during the game. The matches card should contain 20 squares or circles that can be checked off to represent use of matches at each station. The food cards should contain squares or circles that can be checked off to represent use of a days supply.

NAME _____ MOUNTAIN CLIMB SUPPLY LIST LIMIT 10 ITEMS

CHECK	SURVIVAL ITEMS		
	MATCHES	20 each box - For fires, joints	$10
	KNAPSACK	To carry supplies	$20
	FOOD counts as one item	5 days	$25
	CANTEEN		$ 5
	HIKING BOOTS	Can travel faster	$25
	DOWN PARKA		$50
	(H) WOOL JACKET		$20
	SLEEPING BAG A	Good for 20°	$30
	SLEEPING BAG AA	Good for 0°	$45
	(H) SLEEPING BAG AAA	Good for -20°	$60
	(H) TENT		$30
	COMPASS and MAP		$10
	WARM SOCKS, HAT (H) SHIRT, PANTS		$40
	EXTRA WARM SHIRT PANTS, HAT		$60
	(H) ROPE	May need	$10
	PANAMA RED marijuana	5 days supply	$20

You must buy the four checked items and you must choose six more.

The (H) means the item is heavy.

DOPE SMOKER

1. Turn in 1 match.
2. Roll dice.

CHANCE SHEET

1	You get the munchies and eat an extra days food supply.
2	You get stoned and leave your compass behind. You must go back and get it. Subtract two miles.
3	You get tired of walking. Subtract two miles.
4	You get stoned and paranoid about freezing to death. Subtract one mile.
5	You get really loaded and get behind walking. Add one mile.
6	You groove on the scenery and are inspired to climb a little higher up. Add one mile.

STATION ONE DIRECTIONS

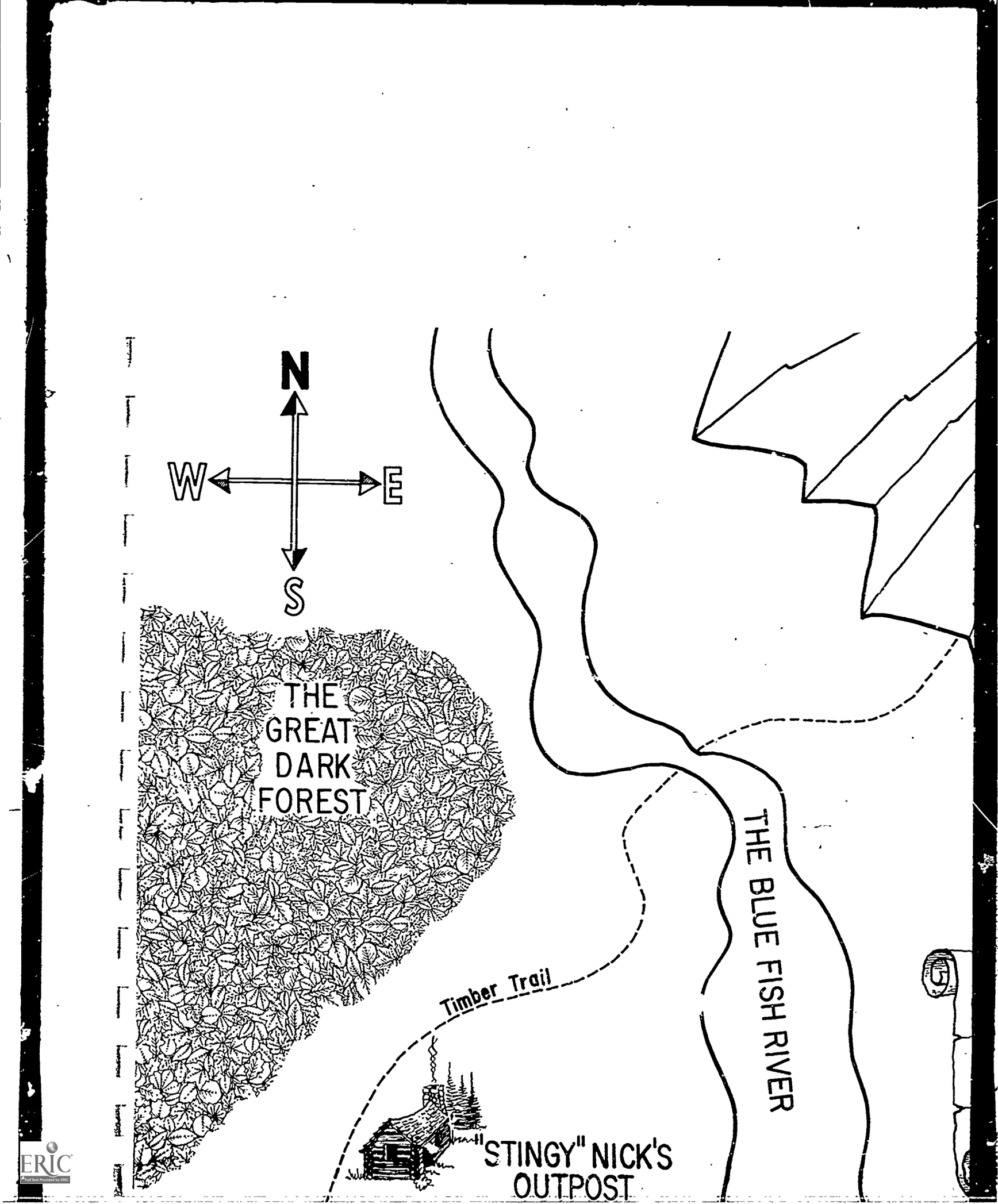
1. Explain that they have traveled through the great forest and have begun ascending the mountain.
2. Have player check off food card and cross off one match.
3. Have player roll dice to determine miles traveled.

   12, 11, 10, 9, = 8

   7, 6, 5, 4, 3, 2 = 7 (+)_____

4. Add 1 mile for hiking boots (+)_____
5. Subtract 1 mile for 3 heavy items (-)_____
6. Find total miles traveled _____ = (+) _____
7. Have player read map for 1 minute.
8. Give test orally.
9. Add score. (+) _____
10. Have dope smokers cross off one match, and then roll dice to determine plus or minus score. (+ or -) _____
11. Find sum of points. _____
12. Multiply times 500 = _____

Elevation Traveled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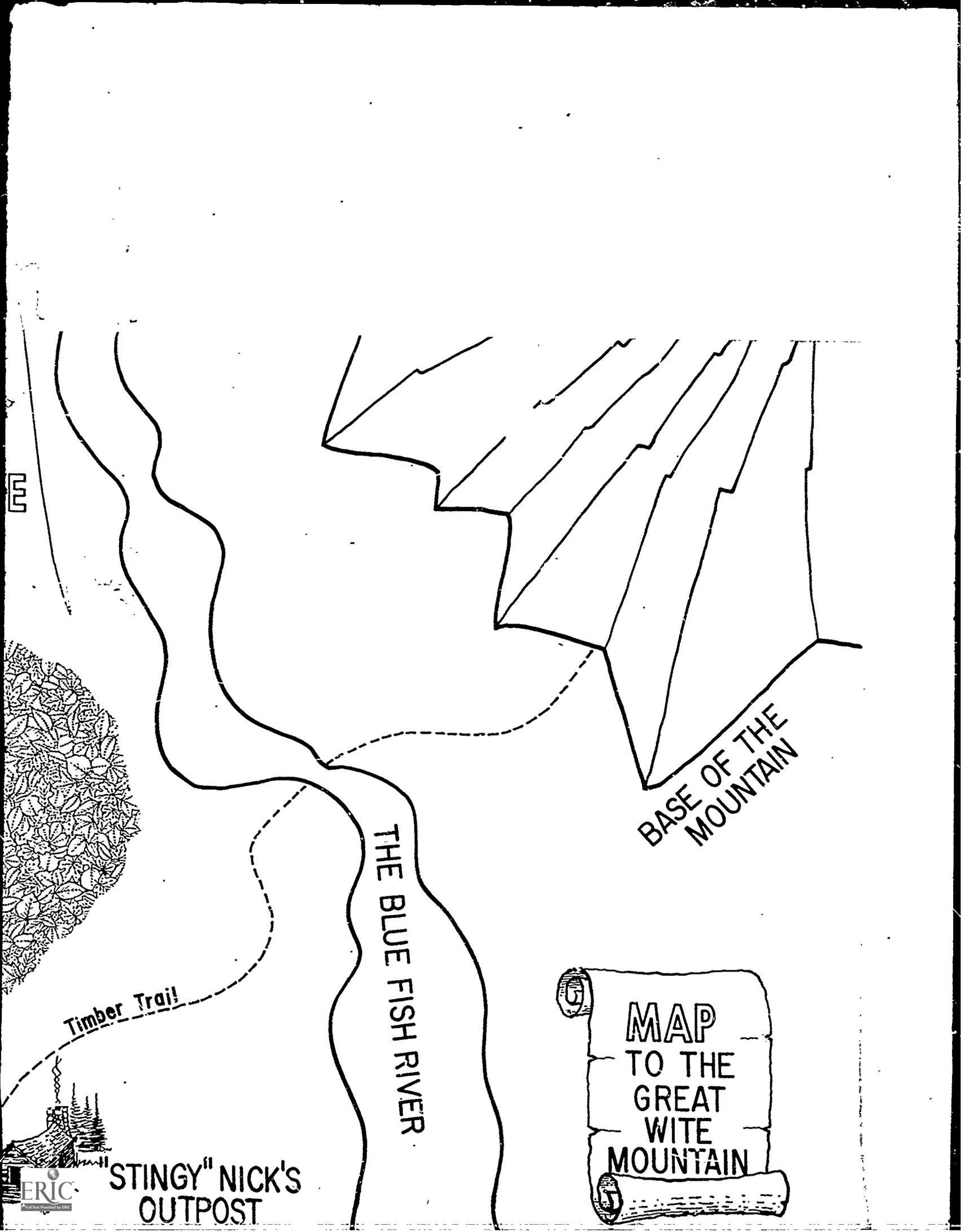
THE BLUE FISH RIVER
Timber Trail
"STINGY" NICK'S OUTPOST


E
BASE OF THE MOUNTAIN
THE BLUE FISH RIVER
Timber Trail
"STINGY" NICK'S OUTPOST
MAP TO THE GREAT WITE MOUNTAIN

STATION ONE ACTIVITY

1. Player views map for one minute.

2. Give test orally.

3. TEST

   1. Who owns the outpost? . . . . . "Stingy" Nick
   2. What is the name of the forest? . . . . . The Great Dark Forest
   3. What word is misspelled? . . . . . WHITE (WITE)
   4. Does the river run from the North to the South or from the East to the West? . . . . . North to East
   5. True or False, The Timber Trail crosses the Blue Fin River at its narrowest point. . . . . False, it is the Blue Fish River

4. For a perfect score, enter 2 on score sheet.

5. For one wrong, enter 1 on score sheet.

STATION TWO DIRECTIONS

1. Explain that they have reached the timberline of the mountain. They have been able to start fires with the wood on the mountain. After today, wood will be scarce and they must rely on warm clothes and canned heat to stay warm.
2. Have player check off food card and cross off three matches.
3. Have player roll dice to determine miles traveled.

   12, 11, 10 = 7
   9, 8, 7, 6, 5 = 6
   4, 3, 2 = 5 (+) _____

4. Add one mile for hiking boots. (+) _____
5. Subtract one mile for 3 heavy items. (-) _____
6. Find total miles traveled. _____
7. Give fire test.
8. Add score from test. _____
9. Have dope smokers cross off one match and then roll dice to determine plus or minus score. (+ or -) _____
10. Find sum of points.
11. Multiply times 500 = _____

Elevation Traveled

STATION TWO FIRE TEST

1. Have student describe "How to start a fire", orally. Time limit, one minute.

2. Description should cover the following:

   * Gather dry wood
   * Small sticks and leaves first
   * Kindling next
   * Larger and larger pieces after that
   * Shou.. be on bare spot or ` rocks.

3. SCORE: All of the above = 2

   All but two of the above = 1

4. Enter score on score sheet.

5. Have player roll dice to see how many matches he uses in starting a fire.

   6, 5 = 1
   4, 3 = 2
   2, 1 = 3

   Cross these off match card.

STATION THREE - SOUTH FACE DIRECTIONS

1. Explain that they have begun ascending the south face of the mountain. From now on, it is going to start getting really cold and accidents may happen. Player can freeze to death or fall from the face of the mountain.

2. Have player check off food card and cross off three matches.

   NOTE: If a player has used all his food, have him put a big "X" on the card.

3. Have player roll dice to determine miles traveled.

   12, 11, 10, 9 = 7
   8, 7, 6, 5 = 6
   4, 3 = 5
   2 = 4 +_____miles

4. Add one point for rope. +_____

5. Have player tie a square knot.
   If successful, add one mile. +_____

6. Find sum of miles. +_____

7. Have player roll one die to determine temperature at night.

   1, 2, 3 = 30°
   4, 5 = 20°
   6 = 0°

   If temperature is 30°, player is okay.

   If temperature is 20°, player must have a sleeping bag or he freezes to death.

   If temperature is 0°, player must have a "AA" sleeping bag or an "A" sleeping bag and warm clothes or he freezes to death.

8. Have dope smokers cross off one match and roll dice to determine plus or minus points.

_____

9. Sum miles and points and multiply times 400 to find elevation gained.

_____

x 400 = _____

Elevation Gained

STATION FOUR - EAST SIDE OF SPIRES DIRECTIONS

1. Explain that players have reached a narrow valley on the southeast face of the mountain. They must now plan the last days climb to the summit. It is bitter cold now during the day and night and many rocks are covered with ice and s.. w. It is becoming very hazardous.

2. Have players cross off one day o' food. If they are out, have them write a large "X" across the card. If a player already has a large "X", he is eliminated. (He has gone two days without eating and no longer has the energy to continue.)

3. Have players cross off three matches. If they are out of matches, they are eliminated; they did not have matches to light a fire and froze to death.

4. Have player roll one die to determine accidents that occur.

   1, 2, 3, 4 = Nothing

   5 = Slips and sprains ankle, subtract 2000 feet from present elevation.

   6 = Snowledge collapses, player falls to his death.

5. Have surviving players roll dice to determine miles traveled.

   12, 11, 10, 9 = 8

   8, 7, 6, 5 = 7

   4, 3, 2 = 6 Miles traveled _____

6. Add one mile for rope. _____

7. Have player roll one die to determine temperature at night.

   1, 2, 3 = 20°

   4, 5 = 0°

   6 = -20°

   If temperature is 20°, player must have a sleeping bag or he freezes to death.

   If temperature is 0°, player must have a "AA sleeping bag or an "A" sleeping bag and warm clothes or he freezes to death.

   If temperature is -20°, player must have a "AAA" sleeping bag or a "AA" sleeping bag and a tent or he freezes to death.

8. Give player planning test. (Shortest route is "C") Distance = 8 miles

9. Add test score.

10. Dope smokers cross off one match and roll dice to determine plus or minus points = _____

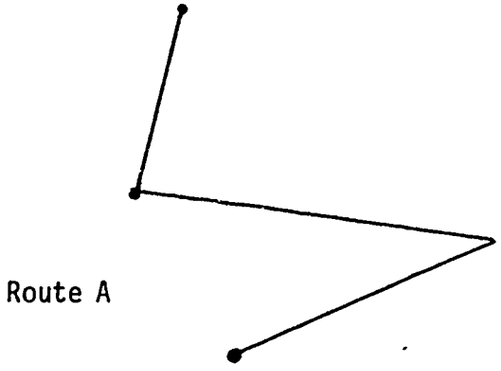
11. Find Sum. = _____

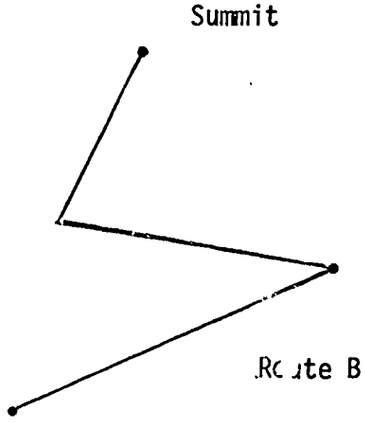
12. Multiply times 400 = _____

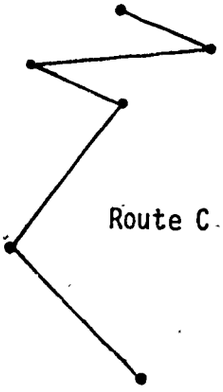
Elevation Gained

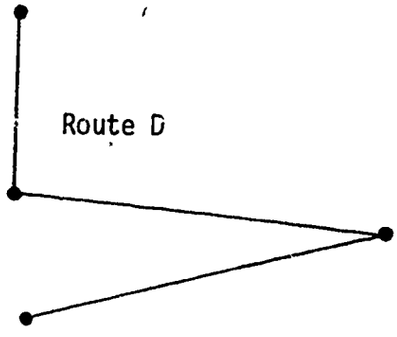
STATION FOUR PLAN - ASCENT TO SUMMIT

TEST: (1) Determine which route is shortest.









SCALE 1 inch = 2 miles

(2) How far is it?

One point for a correct answer in each part.

STATION FIVE - DASH TO SUMMIT DIRECTIONS

1. Explain that they must now make a last desperate dash to the summit before their food supply is gone. They leave all necessary equipment behind keeping only warm clothes and rope if they have some.

2. Have player cross off one day of food. If a player has an "X" on his card, he is eliminated. (He has gone two days without eating and no longer has the energy to continue)

3. Have players cross off three matches. If they run out they are eliminated. They did not have matches to light a fire and freeze to death.

4. Have player roll dice to determine any accidents.

   1, 2, 3, 4 = Nothing

   5 = Frostbite - Subtract 1000 feet from present elevation.

   6 = Rope snaps, player falls to his death.

5. Tell player he collapsed on a narrow ledge and fell asleep.

   Because of the bitter cold, he has a strange dream and imagines he sees and talks to an abominable snowman. The snowman appears to be floating in the swirling snow in space a few feet from the edge of the ledge. He beckons for the player to step off the ledge. Give the snowman test.

6. Have player roll dice to determine miles traveled. _____

   12, 11, 10, 9 = 9

   8, 7, 6, 5 = 8 _____

   4, 3, 2 = 7

7. Add one mile for rope. _____

8. Dope smokers roll dice and cross off one match. _____

9. Find sum. _____

10. Multiply sum times 400 to determine elevation gained. _____

STATION FIVE - DIALOGUE WITH ABOMINABLE SNOWMAN

Player says: "You're not real, go away!"

Snowman: (Staff member) "I am too real, prove I'm not real."

Players Response: "You're not real because you are floating in space, etc."

Snowman: "So, snowmen can float in space."

Eventual response must be: "I don't have to prove you are real. I know, I created you!" . . . or "I'm hallucinating" . . . or "I'm nuts" . . or "You're just a vision" etc.

If not, player falls back to sleep and freezes to death.

ASCENT SCORE SHEET

OUTPOST ELEVATION = 5000 Feet		
	ELEVATION GAINED	ELEVATION REACHED
DAY ONE		
DAY TWO		
DAY THREE		
DAY FOUR		
DAY FIVE		

SUMMIT EQUALS 20,000 Feet

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Mike Chester

Subject: English

Activity Name: Computer Poetry Simulation

Participation:

Time: (3-5 days) One hour per day

Theme:

In this simulation, the students will simulate the stepwise logic of a computer programmed to write poetry. The computer poetry theme is based on the existence of actual computer programs that enable computers to write poems (see bibliography). These programs tend to generate surprising word combinations and startling imagery. The computer programmer contributes to the activity of the poems through his selection of a syntax pattern and through his selections of the words stored in the computer memory. Through a more or less random process, the computer draws upon these words and inserts them into the preassigned syntax.

In the computer poetry simulation, the students are provided with a general syntax, a set of word lists ("memory banks"), and dice. They will use these materials to generate their own computer poems.

The syntax ("poetry program" sheets) used by the students is comparable to the logic of the computer program; the dice tosses to be made by the students are comparable to the random operation of the computer as it draws words from its memory.

Instructional Objectives

1. Student will follow a numerical address system in order to select words for specific locations in the poem syntax, and is to draw from the correct memory bank in at least 40 out of 43 selections.

2. Student will interpret at least one line of his own computer poem during a general discussion.

3. Student will choose words according to their grammatical functions in order to assign them to the appropriate "memory banks" of a poetry computer, making no more than 6 errors in 72 placements.

Computer Poetry Simulation

Schedule

This is a five-phase simulation, and it can be carried out in five days, one phase of the simulation occurring each day. At a more accelerated pace, the simulation can be carried out in three days. These two alternate calendars (and, also, the occurrence of behavioral objectives) are shown in the following table:

Phase	Activity	Behavioral Objective	Slower Calendar	Faster Calendar
1	Poem generation using pre-structured memory banks (individual activity)	1	day 1	day 1
2	poem interpretation (entire class)	2	day 2	
3	building new memory banks (individual activity)	3	day 3	day 2
4	poem generation using new bank (individual activity)	1	day 4	day 3
5	poem interpretation (entire class)	2	day 5	

Bibliography

Computer Poetry or, Sob Suddenly, The Bongos are Moving by F. P. Tullius

Harper's Magazine, December 1963, Page 24f.

Computer Poetry Simulation

Phase 1

A. Materials

1. Two blank "poetry program" sheets (Verses 1 and 2) per student.
2. Two prestructured "computer memory" sheets (sheets A and B) per student.
3. One six-sided, standard game dice per student.
4. Pencils
5. For the teacher: sample case of completed poem (Versas 1 and 2).

B. Sequence of events

1. Supply all phase 1 materials to the class.
2. There should be a brief classroom discussion of computer poetry before the play begins.
3. Each student is to trace his way through the 10 sentences of the "poetry program" sheets. Each blank space in the poem refers the player to a specific one of the 12 memory banks. The player rolls his dice in order to make a random selection of one of the six words in the bank. Having made the selection, he enters the word into the blank place in the poem, and then goes on to the next blank space.
4. By the time that he has finished all 10 sentences, the student will have generated a poem. Some of the lines will undoubtedly sound strained or impossible. But there will undoubtedly be other lines that are vivid, startling, and evocative. The students should not expect that all 10 of their lines will work out well.
5. Each student will need his completed poem for phase 2.

Computer Poetry Simulation

Phase 2

A. Materials

1. Each student is to receive his own poetry program worksheets from Phase 1.

B. Sequence of events

1. On the second day, the students are to interpret the poems that they have generated. The discussion can involve the whole class; or, the teacher may prefer to assign students to smaller groups.

2. Each student is to take a turn to interpret his own poem, or at least one line from his own poem. Students should also be encouraged to discuss each other's poems. Interpretations should be aimed at explaining the imagery, mood, or meaning of the lines. These interpretations may be supplemented by drawings, pantomines, etc.

3. Students should also be free to change some of the words in their poems, if they see opportunities to make improvements.

4. The students' poems are once more to be retained for use in a subsequent phase of play.

Phase 3

A. Materials

1. Each student receives his own filled out "poetry program" sheets (verses 1 and 2) again.

2. Each student receives 2 blank " computer memory" sheets (sheets C and D):

3. Each student also receives (as he did in Phase 1) two prestructured "computer memory" sheets (Sheets A and B).

Computer Poetry Simulation

Phase 3 (cont'd)

B. Sequence of events

1. In this phase, the students are to develop their own memory banks, by entering six words in each of the 12 empty banks of sheets C and D.

2. The earlier prestructured banks (A and B) are an important guide to the student now. He will refer to them in order to structure the new memory banks in the same way -- that is, with words that are able to fulfill the same general functions as those in the old banks.

3. For example, the prestructured bank 1 contained six adjectives. Now, the student will select six adjectives of his own choosing for the new bank 1.

4. In terms of classical grammar, the functions of the 12 banks are as follows:

1, 2 adjectives	8 transitive verb, present stem
3, 4 singular nouns	9 3rd person singular of bank 7 verbs
5 plural nouns	10 3rd person singular of bank 8 verbs
6 adverbs	11 past tense of bank 7 verbs
7 intransitive verbs, present stem	12 present participle of bank 8 verbs

5. However, the student should develop his own banks largely through analogy. For instance, when he enters a word in bank 6, he should check to see that it does "the same kind of thing" in a sentence as the earlier bank 6 words (forever, angrily, freely, brightly, bitterly, lovingly).

6. The poem that he generated earlier is an additional guide to the student. For instance, to choose a new bank 7 word, he should imagine the new word in a bank 7 location of the poem to see if it seems to fit.

7. The teacher should explain the uses of analogy to the class, telling them how to guide their word selections. The teacher has the option of presenting grammatical concepts as an added guide.

Computer Poetry Simulation

Phase 3 (cont'd)

8. The students should be especially aware of the fact that their word choices will determine the kinds of poems that they will generate next. Each student's new poem will have its own special style, depending on the student's originality in choosing words.

9. Note: The tone of this phase can vary widely between (on the one hand) the class where wide-open self-expression is absolutely encouraged, and (on the other hand) the class in which verbal restraint is expected.

   a. To the school that prefers a wide-open situation: The open quality of this simulation will provide the students with a chance to express themselves over a wide range of feelings involving their explorations of rebelliousness, anger, love, and sexuality. These dimensions can be explored by the students through the use of all forms of language -- profane, slang, and regular English. This simulation should help the students to let go with their verbal expressions over a fantastic spectrum of possibilities.

   b. To the school that expects verbal restraint: Words with innocuous dictionary meanings can assume startling significance in special verbal contexts. To avoid surprises of this sort, the teacher may wish to select the words that go into the transitive verb bank (banks 8, 10, 12). A circumspect choice of transitive verbs by a teacher who is fairly well in touch with colloquial speech should suffice to keep the simulation tame enough for most standards.

10. The students are to proceed in filling out their word banks with additional guidance from the teacher as needed.

11. The newly-completed memory banks are to be retained for the next pahse of the simulation.

Computer Poetry Simulation

Phase 4

A. Materials

1. Identical to Phase 1, except that now the students are to receive their own recently completed "computer memory" sheets (C and D) from Phase 3 instead of the prestructured sheets.

B. Sequence of events

1. The same as in phase 1, except that the newly-generated "computer memory" sheets are to be used this time.

Phase 5

A. Materials

1. Each student is to receive his own poetry program worksheets from Phase 4.

B. Sequence of events

1. Another interpretative activity, idential to Phase 2, but using the more recently generated poems.

NOTE:

This game format may be used as a basis for follow-up activities. Students may choose the best word from the word banks and then generate a poem or use the poetry program form to write a poem without word banks. The students could also make their own poetry program forms, word banks, and develop completely original poems.

POETRY PROGRAM

1. Bank 1 Bank 2 Bank 5 Bank 11 UNDER THE Bank 2 Bank 3 ;

2. THE Bank 1 Bank 4 IS THE Bank 3 OF Bank 5 .

3. THE Bank 3 Bank 9 AROUND THE Bank 1 Bank 4 ,

4. AND I AM Bank 2 WHEN I Bank 8 THE Bank 1 Bank 3 .

5. Bank 1 Bank 5 WILL Bank 7 Bank 6

6. WHEN I Bank 7 UPON THE Bank 2 Bank 1 Bank 3

7. Bank 12 THE Bank 5 THAT Bank 7 BY THE Bank 1 Bank 4 ,

8. Bank 12 THE Bank 5 IN THEIR Bank 1 AND Bank 2 Bank 3 ,

9. SHOULD I Bank 8 Bank 5 PAST THE Bank 4 ?

10. THE Bank 3 THAT'S IN THE Bank 4 Bank 10 THE Bank 5 .

POETRY PROGRAM

1. TOOTHY Bank 1 SULLEN Bank 2 ALBATROSSES Bank 5 SHOWERED Bank 11 UNDER THE WAXED Bank 2 ROBOT Bank 3 ;

2. THE WILLOWY Bank 1 SHOPPER Bank 4 IS THE BIRD'S NEST Bank 3 OF FACES Bank 5 .

3. THE GHOST Bank 3 HOWLS Bank 9 AROUND THE FEATHERED Bank 1 BIRD'S NEST Bank 4 ,

4. AND I AM FOAMY Bank 2 WHEN I STRETCH Bank 8 THE TOOTHY Bank 1 HURRICANE 3 .

5. CARELESS Bank 1 ELEPHANTS Bank 5 WILL WOBBLE Bank 7 BITTERLY Bank 6 .

6. WHEN I SHOWER Bank 7 UPON THE SULLEN Bank 2 CARELESS Bank 1 ROBOT Bank 3 ,

7. PAINTING Bank 12 THE UMBRELLAS Bank 5 THAT WHISPER Bank 7 BY THE TOOTHY Bank 1 LADY Bank 4 ,

8. PAINTING Bank 12 THE ALBATROSSES Bank 5 IN THEIR CARELESS Bank 1 AND FOAMY Bank 2 BEAK Bank 3

9. SHOULD I PAINT Bank 8 ALBATROSSES Bank 5 PAST THE EARLOBE Bank 4 ?

10. THE OWL Bank 3 THAT'S IN THE LADY Bank 4 DRIVES Bank 10 THE BATH TUBS Bank 5 .

COMPUTER
MEMORY "A"

BANK I

Word

1. Careless
2. Feathered
3. Toothy
4. Baggy
5. Gloomy
6. Willowy

BANK 2

Word

1. Sea-going
2. Waxed
3. Glassy
4. Foamy
5. Forgetful
6. Sullen

BANK 3

Word

1. Owl
2. Robot
3. Blister
4. Beak
5. Ghost
6. Hurricane

BANK 4

Word

1. Lady
2. Earlobe
3. Shopper
4. Pilot
5. Bird's nest
6. Motor

BANK 5

Word

1. Albatrosses
2. Umbrellas
3. Elephants
4. Parachutes
5. Faces
6. Bath tubs

BANK 6

Word

1. Forever
2. Angrily
3. Freely
4. Brightly
5. Bitterly
6. Lovingly

COMPUTER
MEMORY "B"

BANK 7

Word
1. Whisper
2. Gobble
3. Fly
4. Wobble
5. Howl
6. Shower

BANK 8

Word
1. Love
2. Flap
3. Paint
4. Drive
5. Stretch
6. Plant

BANK 9

Word
1. Whispers
2. Gobbles
3. Flies
4. Wobbles
5. Howls
6. Showers

BANK 10

Word
1. Loves
2. Flaps
3. Paints
4. Drives
5. Stretches
6. Plants

BANK 11

Word
1. Whispered
2. Gobbled
3. Flew
4. Wobbled
5. Howled
6. Showered

BANK 12

Word
1. Loving
2. Flapping
3. Painting
4. Driving
5. Stretching
6. Planting

COMPUTER
MEMORY "C"

BANK 1	BANK 2	BANK 3
Word	Word	Word
1.	1.	1.
2.	2.	2
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.

BANK 4	BANK 5	BANK 6
Word	Word	Word
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.

COMPUTER
MEMORY "D"

BANK 7	BANK 8	BANK 9
Word	Word	Word
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.

BANK 10	BANK 11	BANK 12
Word	Word	Word
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Contributed by: Mike Chester

Subject: Reading and Science

Activity Name: Grasslands Simulation

Participation: Two Students

Time: Three to Four Class Periods

Theme

Students work in pairs, in the Grasslands Simulation, trying to balance ecological conditions in the grasslands. The activity centers around a card deck that includes land cards representing various terrain conditions (long grass, short grass, desert), fauna cards (grasshoppers, meadowlarks, and cattle), and weather cards. The goal of the simulation is to find out how many cattle the grasslands can support before over-grazing destroys the land.

The two students of each team will build card arrays and fill out data sheets in order to arrive at a balanced solution to the grazing situation.

The various cycles of card play last for two days. On the third day, the students carry out an analysis of their findings, using scatter-diagrams, followed by a programmed text relating (in greater detail) to the life cycle of the grasslands flora and fauna.

Instructional Objectives

Each student is to:

1. Work with a partner to fill out grassland data sheets, making no more than one significant procedural error on any data sheet;
2. Consult grassland data sheets to fill out a schoresheet, drawing a reasonable conclusion as to ideal cattle population on the grasslands;
3. Complete a programmed text ("Grasslands Ecology") making no more than two errors throughout the text.

Bibliography

The Web of Life by John H. Storer; Signet Books, 1953

SCHEDULE

Phase	Activity	Behavioral Objective	Slower Calendar	Faster Calendar
1	initial card play	1	day 1	day 1
2	continued card play	1	day 2	day 2
3	data analysis	2	day 3	day 3
4	programmed text	3	day 4	

PHASE 1

A. Materials

Each two-student team is to receive:

1. a 90-card deck, consisting of -- 12 land cards
   6 weather cards
   16 meadowlark cards
   36 grasshopper cards
   20 cattle cards
2. a set of 8 data sheets

Each student is to receive a "table of grassland changes"

For the teacher (and optionally for students) -- 1. rules of play
2. sample data sheets

B. Sequence of Events

1. The teacher should study the rules of play before the simulation is carried out. It is advisable to play a few trial rounds with the cards while consulting the rules.

2. As is often the case with game procedures, the rules are simple -- but their precise presentation is lengthy and detailed. Therefore, the rules are not designed for the student to read.

3. The teacher should start the simulation by describing the grassland situation to the class. Basically, the threat to the grasslands follows this pattern:

   a. cattle overgraze, shortening the grass

   b. meadowlarks, which need long grass to nest in, are driven away

   c. grasshoppers begin to thrive because there are less meadowlarks to keep them in check

   d. the short grass sends out new shoots very late in the season (as a way of "fighting back" against the heavy cropping)

   e. these additional new shoots feed the grasshoppers better than ever, leading to further grasshopper increase

   f. finally, the enormous grasshopper swarms destroy the already weakened, trampled, overgrazed grasses, paving the way for the desert

4. The students should understand their ultimate goal in the simulation -- to find out how many cattle the grasslands can maintain before being destroyed. A possible ideal cattle population would be the largest one that did not destroy the land; this population would allow man to realize his maximum benefit from cattle raising without going to destructive levels.

5. Divide the students into pairs and assign their materials to them.

6. Explain and demonstrate the way the game is played.

7. When everyone seems to understand the basic rules of play, let the students start the simulation.

8. In this phase of play, the students will be using 20 cattle cards, and will be gradually becoming familiar with the situation. It is unlikely that they will reach the point (in the first classroom hour) where they are ready to change the deck composition (see rules of play #19 - #23).

9. At the end of the period, the data sheets that have been worked are to be saved for the later phases of play.

PHASE 2

A. Materials

1. same as in Phase 1.

B. Sequence of events

1. The students are to continue play as in Phase 1, but with new deck compositions (see rules of play #19 - #23).

PHASE 3

A. Materials

1. Each pair of students get back all the data sheets that they filled out in the first two phases.

2. Each student receives a "summary data" sheet.

3. For the teacher: a sample "summary data" sheet.

PHASE 3 (cont'd)

B. Sequence of events

1. Each student is to summarize all of the data sheets that he worked on by entering the results onto his summary data sheet.

2. This activity can be carried out cooperatively by the two students of each pair--their data sheets should be the same so far as results for various numbers of cattle are concerned.

3. However, each student should reach his own conclusion concerning the maximum number of cattle cards that the deck could sustain. This is a decision process that is not always absolute, because the results of the card play were by nature statistical, so that there may be reversals (adding a cattle card and causing less wreckage of the land) and marginal results.

4. The students are to translate their card-deck conclusions into more pictorial terms by assuming that each cattle card represents one head of cattle per acre of grasslands.

5. After each student has reached his independent conclusions, the summary table should be copied onto a chalkboard and classwide results tallied. From this tallying, along with discussion, and perhaps voting, the class should try to establish an optimum cattle density.

PHASE 4

A. Materials

1. Each student receives a programmed text ("Grasslands Ecology").

B. Sequence of events

1. The class is told that they are going to be filling out a programmed text concerning the balance of nature in the grasslands.

2. They should know that the programmed text will draw to a large extent on the card game that they have played, they should also know that it is a finer-grained approach, dealing with more facts, more animals, and more relationships.

3. After completing the text, each student is to put a single check on the margin (in a box) wherever the text relates indirectly to the facts involved in the card game, and two checks wherever it relates very directly to those facts.

RULES OF PLAY

1. This simulation is played cooperatively by two players.

2. One player is the "dealer" -- he deals the cards. The other is the "sorter" - he sorts the card stockpiles that are not in play.

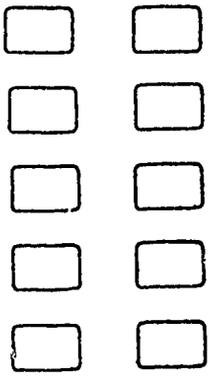
3. Aside from their two specialized roles (which are merely mechanical functions), the players work together in all analytic and decision-making aspects.

4. The cards are delivered to the players in four separate bundles:

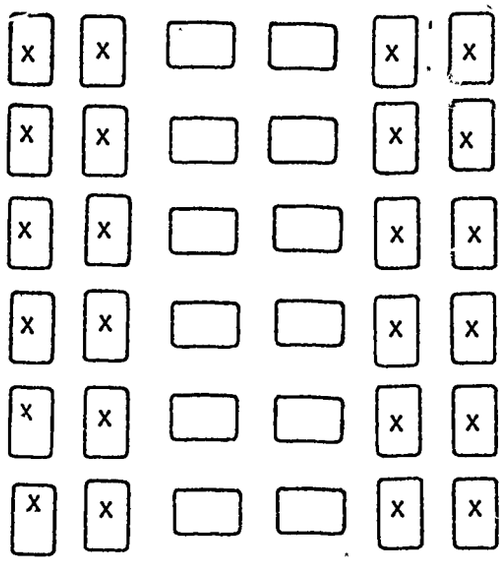
   a. land deck -- 12 cards
   b. meadowlark stockpile - 12 cards
   c. grasshopper stockpile -- 16 cards
   d. starting deck, consisting of: 6 weather cards, 4 meadowlark cards, 20 grasshopper cards, 20 cattle cards

5. Each land card has a long grass side and a short grass side. On the cards, the two grass conditions are labeled and illustrated. In all diagrams, the long grass is represented by a white rectangle,  and the short grass by a shaded rectangle, 

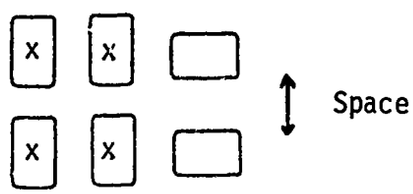
6. The dealer lays out the 12 land cards, long grass side up, in the following array:



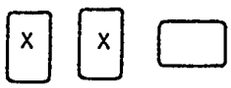
7. Then, having thoroughly shuffled the starting deck, the dealer deals the cards of the starting deck. He does this by placing a pair of the cards, face up, next to each land card. The resulting array (with each starting-deck card marked by an "x" would look like this:



7.1 Notice that a certain minumum spacing is needed between the horizontal land cards in order to make room for the vertical cards that are placed next to them:



8. Each triplet of cards has the potential to change the layout of land cards and the composition of the starting deck . The basic triplet that can cause the changes is:

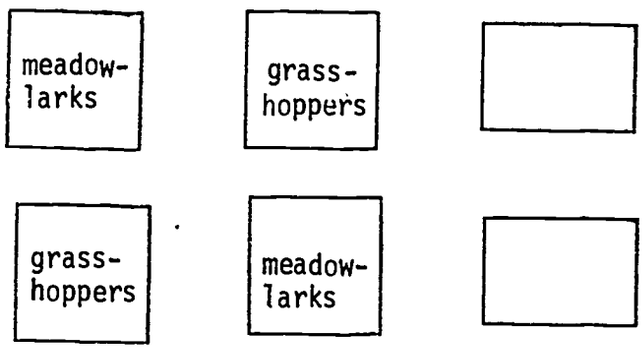


(two cards from starting deck and adjacent land card)

Basic Triplet

9. Not all triplets result in changes. The triplets that do cause changes (and the kinds of changes that they make) are summarized in the "Table of Grassland Changes", which is provided to each player.

9.1 The changes never depend upon the order in which the cards are arranged within the triplet -- for instance,



That is, it does not matter, in the use of the table of changes, whether the grasshopper card is on the left and the meadowlark card on the right, or vice versa.

10. The application of the above rules and the presentation of additional rules are best shown in an illustrative sequence of play. The illustrative sequence makes use of the following symbology:

W = Weather
M = Meadowlark
G = Grasshopper
C = Cattle

The Table of Grassland Changes is consulted to make the proper changes in the cards. The Table is arranged within two sections, the first for triplets that occur with a long grass card and the second with triplets that occur with a short grass card. The Table works as follows:

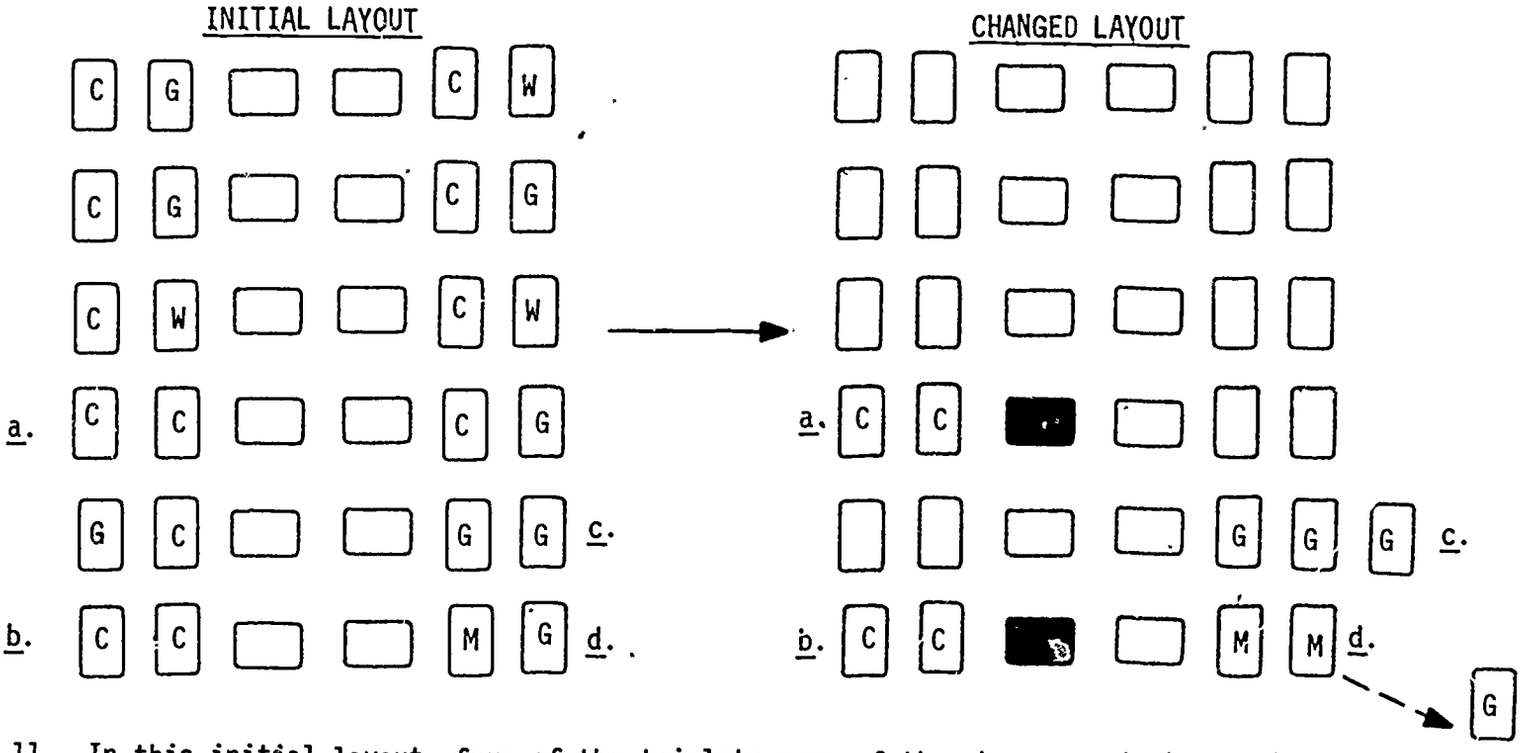
Consulting the Long Grass Table, it can be seen that if a Grasshopper Card is adjacent to another Grasshopper Card and a Long Grass Card, these three cards become a Long Grass Card and three Grasshopper Cards; for example, the population of grasshoppers is increasing.

If a Meadowlark Card is adjacent to a Grasshopper Card and Long Grass Card, these three cards become a Long Grass Card and two Meadowlark Cards; for example, the meadowlarks are eating the grasshoppers and multiplying.

If a Cattle Card is adjacent to another Cattle Card and Long Grass Card, these cards become a Short Grass Card and two Cattle Cards; for example, the cattle are eating the grass.

Now, consulting the Short Grass Table, it can be seen that if a Grasshopper Card is adjacent to another Grasshopper Card and a Short Grass Card, these cards become four Grasshopper Cards and the Short Grass Card is removed simulating a desert.

If a Weather Card is adjacent to a Grasshopper Card and to a Short Grass Card, these cards become a Long Grass Card, a Grasshopper Card, and a Weather Card; for example, the good weather has strengthened the field allowing the short grass to grow and become long grass.



11. In this initial layout, four of the triplets were of the change-producing variety. The changes are as follows:

    a,b. two cattle cards change long grass to short grass (overgrazing)

    c. two grasshopper cards (in long grass) become three grasshopper cards

    d. meadowlark-grasshopper pair (in long grass) becomes a pair of meadowlark cards, and the grasshopper card is removed from the deck. (meadowlarks eat grasshoppers.. and multiply.)

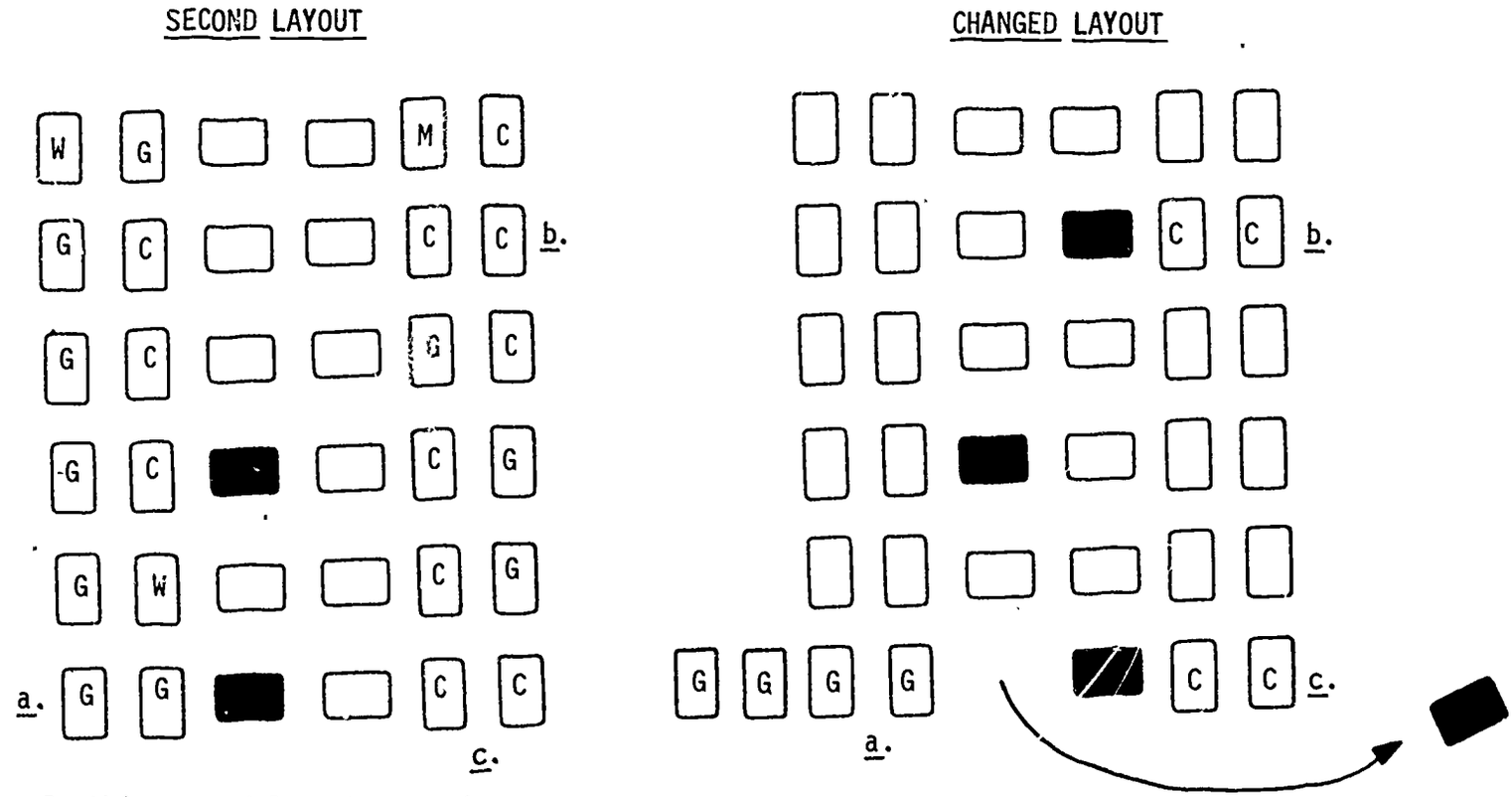
12. The players leave the cards in their initial layout while they make the changes. Having consulted the "table of grassland changes", the players make the changes in the following way:

    a,b. flip over land cards to short grass side

    c. take another grasshopper card out of the stockpile and add it to the layout

    d. put a grasshopper card back into the grasshopper stockpile and take a meadowlark card from the meadowlark stockpile and add it to the layout.

13. After the changes have been made, the 12 land cards are left in place; but the other cards are picked up and shuffled back into the starting deck. After that is done, there is a second deal. Suppose that the second layout is as follows:



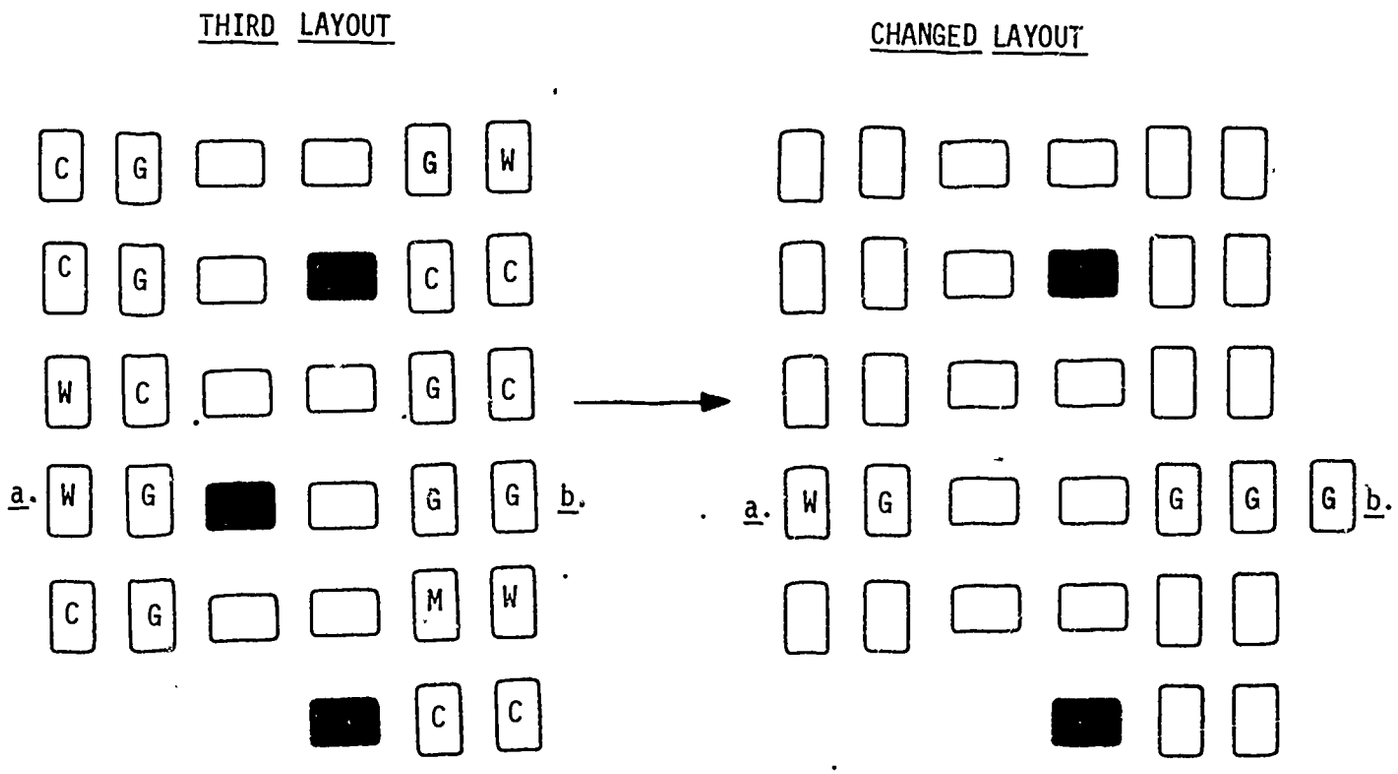
14. In this second layout, the changes are:

a. in a short grass situation, grasshoppers thrive (2 cards become 4), and the short grass becomes desert (land card drops out of game).

b,c. two cattle cards change long grass to short grass (overcropping).

14.1 Notice that, in the second layout, two short grass cards remained, as a result of the play during the initial round. Now, changes that occurred during round #2 will be evident in the third layout.

15. Suppose that the third layout is like this:



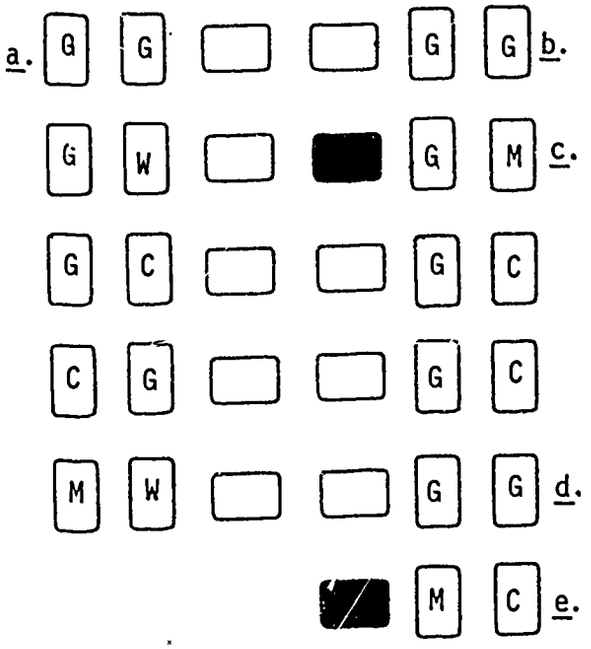
a. weather restores long grass...

b. grasshopper card added...

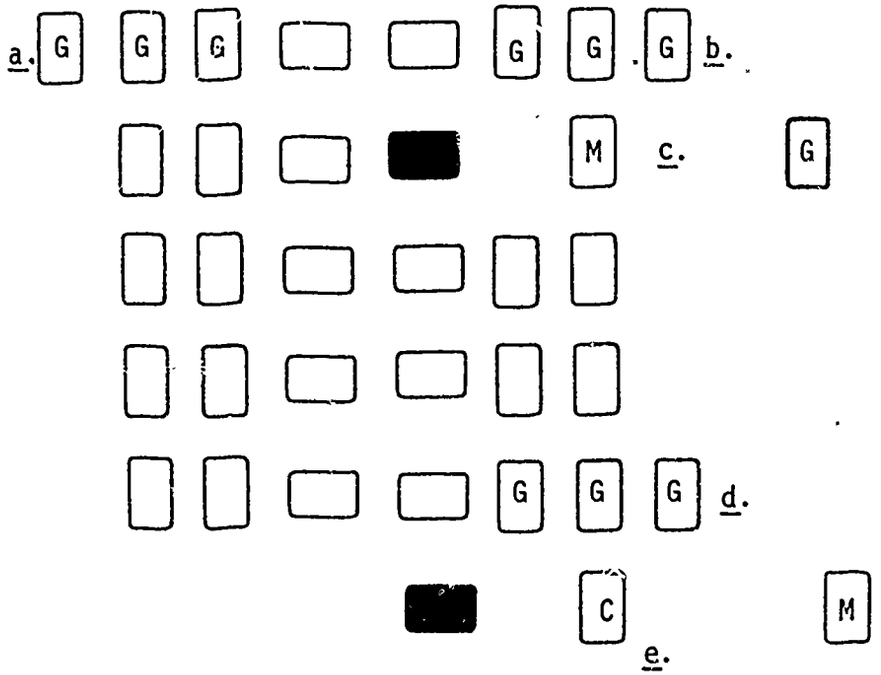
15.1 notice that no cards are dealt next to the desert region (absent land card)

16. And, suppose that the fourth layout is:

FOURTH LAYOUT



CHANGED LAYOUT



a,b,d. grasshopper card added...

c. meadowlarks driven out by cattle and short grass...

e. meadowlarks eat grasshoppers, but do not multiply in short grass

17. At this point (end of 4th round) the players should enter the grassland conditions onto their data sheets. Table 1 shows the way the data sheet should look after these four sample rounds.

- number of cattle cards used (20) entered at top
- round tally shows that 4 rounds have been played
- the number of grasshopper cards & meadowlark cards are found by subtracting the stockpile contracts from the total number of grasshopper cards and meadowlark cards in the deck, as shown on the data sheet.
- long grass, short grass, and desert conditions are copied from the changed layout at the end of round 4.

18. Using these procedures, the players continue the simulation, entering data every four rounds, until one of the following things happens:

    a. all 12 land cards show LONG GRASS at the end of round 8.

    b. 3 or more cards have become DESERT, at the end of any round.

    c. 6 or less LONG GRASS cards remain at the end of any round.

    d. 16 rounds have been completed.

    Case (a) implies that the land was not overgrazed and did not support too many cattle.
    Case (b) or case (c) implies that the land was overgrazed, and did support too many cattle.

19. If the 20-cattle deck led to overgrazing or a marginal case, the two players should decide upon a new deck composition, using a much lesser number of cattle cards.

20. In this new cycle of play, the players will have to rebuild their playing deck, land array, and stockpiles.

    a. grasshopper and meadowlark stockpiles must be restored to their initial levels (grasshopper-16, meadowlarks-12); all other grasshopper cards and meadowlark cards are to be in the starting deck.

    b. the new number of cattle cards are to be put into the starting deck; all surplus cattle cards are to be stockpiled.

    c. all 12 land cards are to show LONG GRASS.

    d. a new data sheet (with the new cattle-card number entered at the top)

21. If the new deck still results in overgrazing, the players should agree upon a further reduction for the third cycle of play. If the new deck does not lend to overgrazing, the player should slightly increase cattle-card population for the third cycle.

22. In general, the players will adjust cattle levels in successive cycles in order to find the highest number of cattle that the land can maintain without being destroyed. When the players have found the level that they believe to be correct, the gaming phase of the simulation ends.

GRASSLANDS SIMULATION

Summary Data Sheet

CATTLE CARDS	CATTLE	GRASSLANDS SURVIVE	MARGINAL	GRASSLANDS DESTROYED
20	200			
19	190			
18	180			
17	170			
16	160			
15	150			
14	140			
13	130			
12	120			
11	110			
10	100			
9	90			
8	80			
7	70			
6	60			
5	50			
4	40			
3	30			
2	20			

Circle the cattle population that you think the area can maintain. Each cattle card equals 10 cattle.

TABLE OF GRASSLAND CHANGES

LONG GRASS TABLE

	WEATHER	MEADOWLARKS	GRASS-HOPPERS	CATTLE
CATTLE	NO CHANGE	NO CHANGE	NO CHANGE	SHORT GRASS 2 CATTLE
GRASS-HOPPERS	NO CHANGE	LONG GRASS 2 MEADOW-LARKS	LONG GRASS 3 GRASS-HOPPERS	NO CHANGE
MEADOWLARKS	NO CHANGE	LONG GRASS 1 MEADOW-LARK	LONG GRASS 2 MEADOW-LARK	NO CHANGE
WEATHER	NO CHANGE	NO CHANGE	NO CHANGE	NO CHANGE

SH

	WEATHER	MEAD
CATTLE	LONG GRASS 1 CATTLE 1 WEATHER	SHOR 1 C
GRASS-HOPPERS	LONG GRASS 1 GRASS-HOPPER 1 WEATHER	SHOR MEADO
MEADOWLARKS	LONG GRASS 1 MEADOW-LARK 1 WEATHER	SHOR MEADO
WEATHER	LONG GRASS 1 WEATHER	LONG 1 ME LA 1 WE

TABLE OF GRASSLAND CHANGES

GRASS TABLE

S	GRASS-HOPPERS	CATTLE
	NO CHANGE	SHORT GRASS 2 CATTLE
	LONG GRASS 3 GRASS-HOPPERS	NO CHANGE
	LONG GRASS 2 MEADOW-LARK	NO CHANGE
	NO CHANGE	NO CHANGE

SHORT GRASS TABLE

	WEATHER	MEADOWLARKS	GRASS-HOPPERS	CATTLE
CATTLE	LONG GRASS 1 CATTLE 1 WEATHER	SHORT GRASS 1 CATTLE	NO CHANGE	NO CHANGE
GRASS-HOPPERS	LONG GRASS 1 GRASS-HOPPER 1 WEATHER	SHORT GRASS 1 MEADOWLARK	DESERT 4 GRASS-HOPPERS	NO CHANGE
MEADOWLARKS	LONG GRASS 1 MEADOW-LARK 1 WEATHER	SHORT GRASS 1 MEADOWLARK	SHORT GRASS 1 MEADOWLARK	SHORT GRASS 1 MEADOWLARK
WEATHER	LONG GRASS 1 WEATHER	LONG GRASS 1 MEADOW-LARK 1 WEATHER	LONG GRASS 1 GRASS-HOPPER 1 WEATHER	LONG GRASS 1 CATTLE 1 WEATHER

TABLE I

CATTLE CARDS = 20

WEATHER CARDS = 6

Tally of Rounds

(1-4)	(5-8)	(9-12)	(13-16)
1111			

DATA

CARDS	AT START	AFTER Round 4	AFTER Round ___	AFTER Round ___	AFTER Round ___
grasshopper	20	25			
meadowlark	4	4			
long grass	12	9			
short grass	0	2			
desert	0	1			

G = 36 - Stockpile

M = 16 - Stockpile

CATTLE CARDS = ☐ WEATHER CARDS = 6

tally of rounds

DATA

CARDS	AT START	AFTER Round ___	AFTER Round ___	AFTER Round 12	AFTER Round 16
grasshopper					
meadowlark					
long grass					
short grass					
desert					

Number of grasshopper cards = 36 - Stockpile

Number of meadowlark cards = 16 - Stockpile

GRASSLANDS ECOLOGY

1. Praires are flat areas where tall grasses grow. Many animals feed on these grasses.

2. Before the white man came to America, there were large animals living in these grasslands. There were antelope that fed on the grass and also on desert plants. There were elk that fed on the grass and also on the leaves of trees. There were buffalo that fed only on grass.

* * *

To take care of their special food needs, the antelope lived near the border between

desert and woods ☐

desert and grasslands ☐

woods and grasslands ☐

* * *

The elk lived near the border between

desert and woods ☐

desert and grasslands ☐

woods and grasslands ☐

* * *

But, the buffalo roamed over all parts of

the desert ☐

the woods ☐

the grasslands ☐

3. These large animals trampled the ground with their hooves. This trampling made the ground hard and packed. Water would run off the hard ground instead of seeping below to feed the roots of the grasses. But, there were also small animals such as gophers, kangaroo rats, and ground squirrels, that dug tunnels in the ground and made the soil loose again.

* * *

So, the trampling by the large animals and the digging by the small animals

balanced each other to keep the grasslands healthy ☐

combined to destroy the grasslands ☐

* * *

4. The different kinds of small animals had different feeding habits. The gophers mainly ate the grass roots. The kangaroo rats ate mainly the grass leaves. Even though their tunnels helped the grasses, their feeding would have destroyed the grasslands. But hunting animals kept these small animals thinnned out. These hunting animals, also known as "predators", included hawks, owls, snakes, and coyotes.

The hunting animals helped to

save the grasses ☐

destroy the grasses ☐

5. The buffalo and the other large animals fed on the tender top leaves of grass, leaving behind the tougher lower leaves. This partial feeding left the grasses

completely eaten away ☐

alive to grow some more ☐

6. If there had been too many of these buffalo and other large animals, they might have eaten away all the top leaves and they would have had to feed on the lower leaves, too. But these animals were kept in check by large predators, especially

snakes ☐

wolves ☐

7. There were also insects, especially grasshoppers that lived in the grass, eating the tender, new shoots. The grasshoppers were kept in check by small hawks and by meadowlarks.

These birds helped to

protect the new grass shoots ☐

destroy the new grass shoots ☐

8. So, the big grazing animals, the small tunneling animals, the insects, and the various predators lived in the grasslands

in a state of natural balance ☐

in a way that damaged the land ☐

in complete peace with one another ☐

9. This beautiful balance was ruined by the carelessness of man. To begin with, cattle ranchers brought large herds of cattle to the grasslands. The ranchers protected their cattle by killing wolves and and other large predators. The result was that

chere was no natural check ☐
on the cattle

the cattle produced only tough, ☐
lean meat

10. There were so many cattle on the land that they did what the buffalo before them had not done. They

10. (Cont'd)

trampled the land and they

cropped the grass very low ☐

fed only on the tender top leaves ☐

11. When the cattle cropped the grasses low, they drove out the meadowlarks that used to nest in the long grasses. The departure of the meadowlarks resulted in

an increase in grasshopper population ☐

a decrease in grasshopper population ☐

12. Also, hunters shot many of the small grasshopper-eating hawks.

13. There was a third reason for the increase in grasshoppers. The short-cropped grasses fought for survival by

growing new shoots very late in the season ☐

now growing very many new shoots ☐

14. With all of these new advantages, the grasshopper population grew enormously. The swarming grasshoppers and the trampling, low-grazing cattle combined to destroy the grasses completely.

15. But, the change from grasslands to desert did not happen right away. Faster-growing grasses that produced very large crops of seeds took the place of the original grasses. These seeds led to a great increase in seed-eating rodents such as

gophers ☐

kangaroo rats ☐

ground squirrels ☐

16. The rodents increased rapidly because people were

bringing in new predators ☐

killing off various predators ☐

17. The new grasses did not have such strong root systems as the old grasses did. The weak roots did not hold the soil in place very well. The result was that rain washed away a great quantity of

grass seed ☐

soil ☐

This loss is called "erosion".

18. Under the impact of rodents, cattle, grasshoppers, and soil erosion, the new grasses also were destroyed.

19. Tough plants such as jimson weed, loco weed, and burro weed began to take root, with large stretches of hard, barren land between them. The land was already beginning to look like

a prairie ☐

a desert ☐

20. Then, rainfall carried away more soil, forming deep gullies in the ground. There were no

seeds ☐

roots ☐

leaves ☐

to protect the ground anymore.

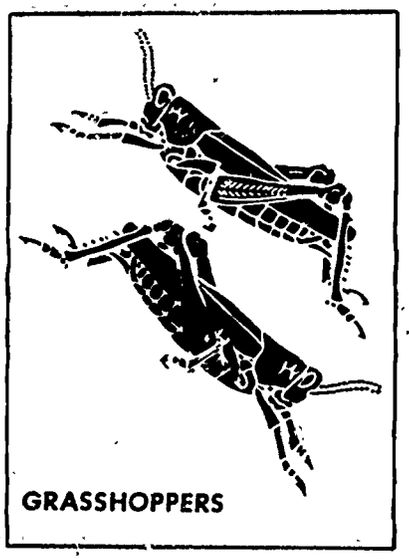
21. The hard, barren land did not hold moisture well either. So, there was notwater in the ground to rise up in mists to make new rain clouds. The result was

more rain ☐

less rain ☐

22. And finally, it was all desert. Even the cattle and the grasshoppers and the rainfall that had caused so much trouble were gone.


GRASSHOPPERS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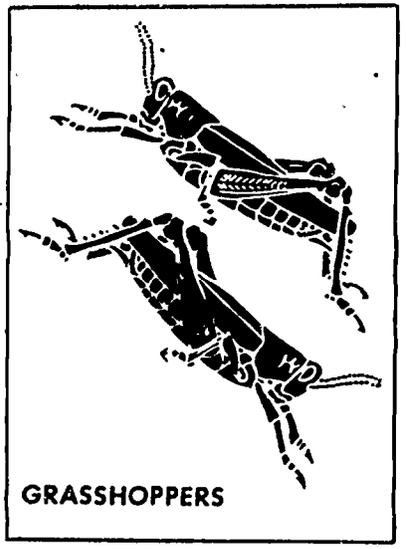
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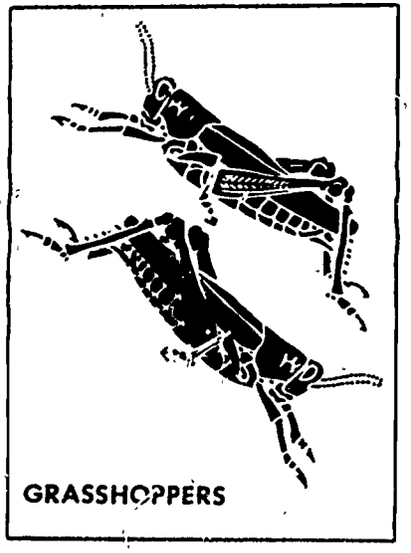
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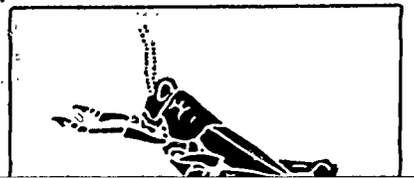

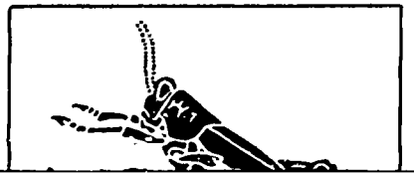


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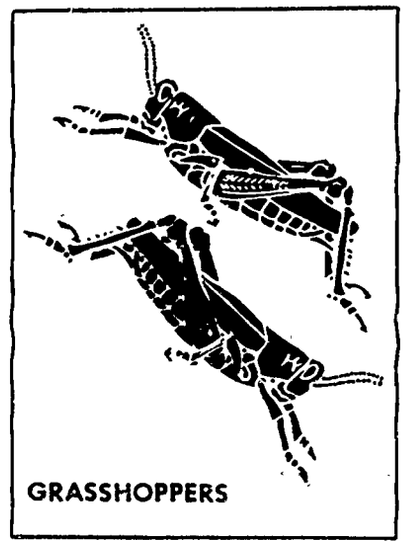
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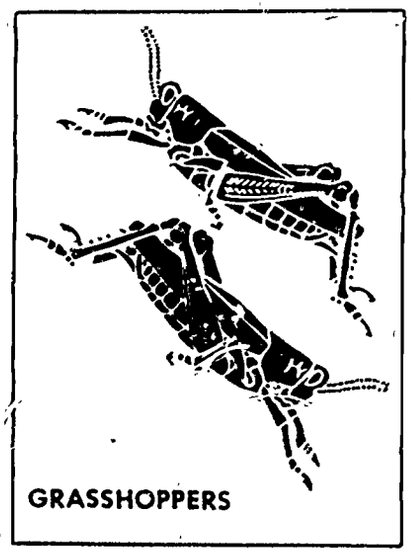
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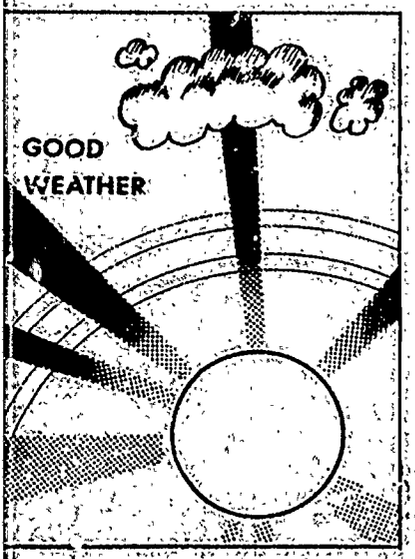
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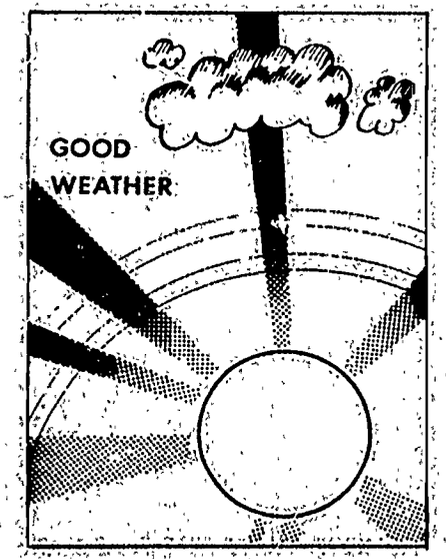
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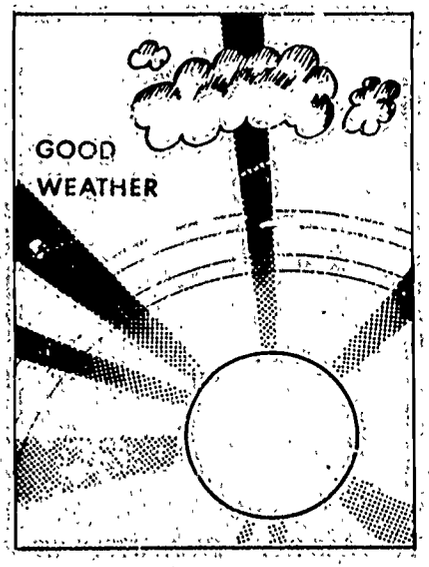
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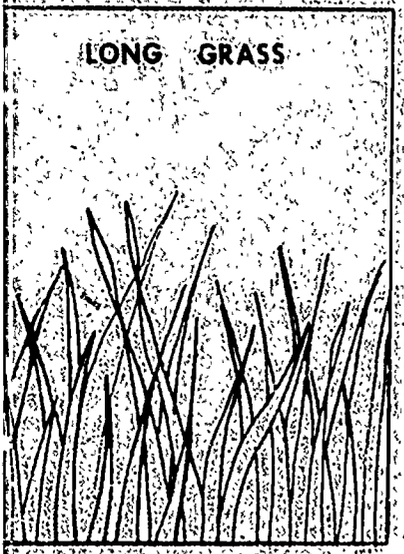
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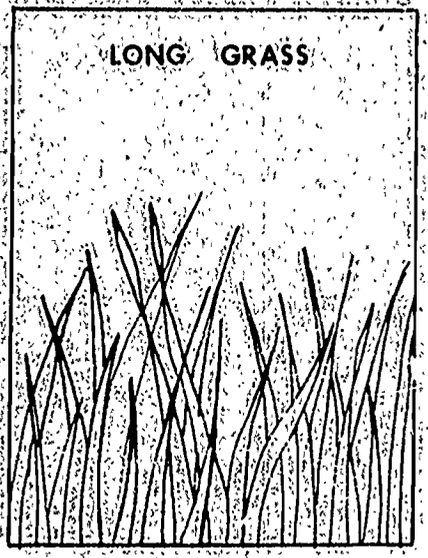
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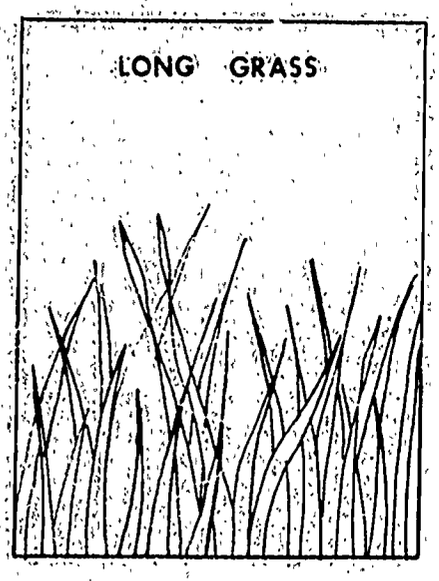
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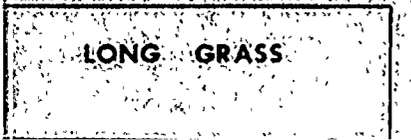
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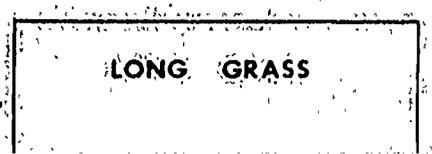
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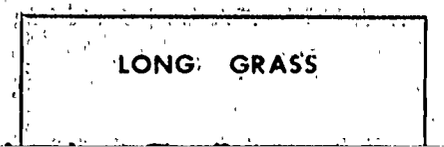
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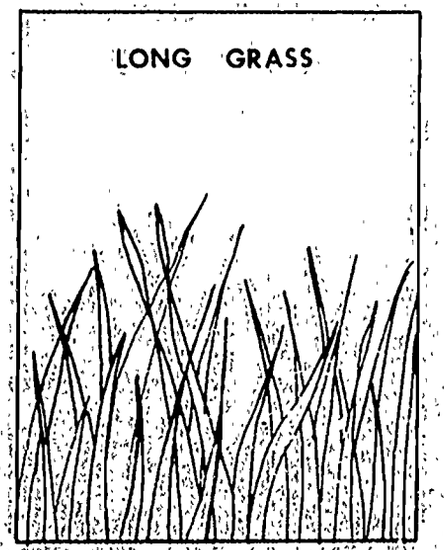
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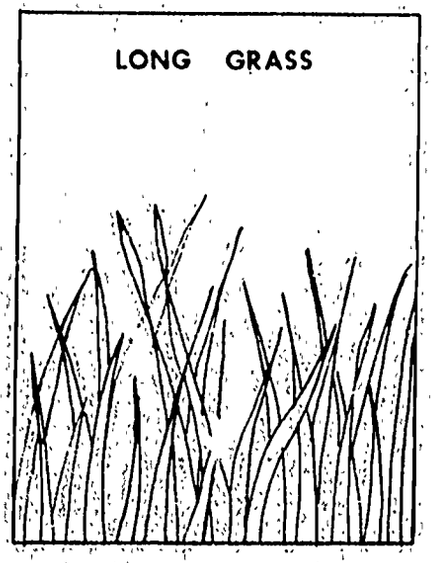
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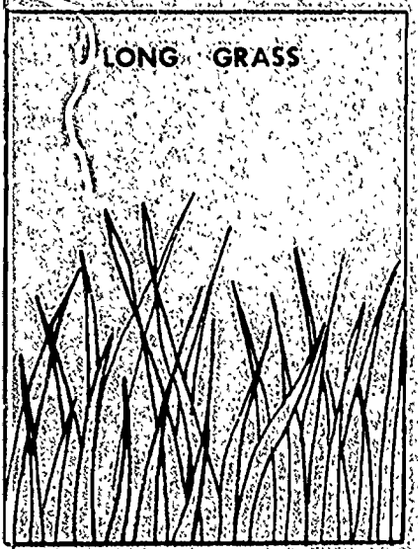
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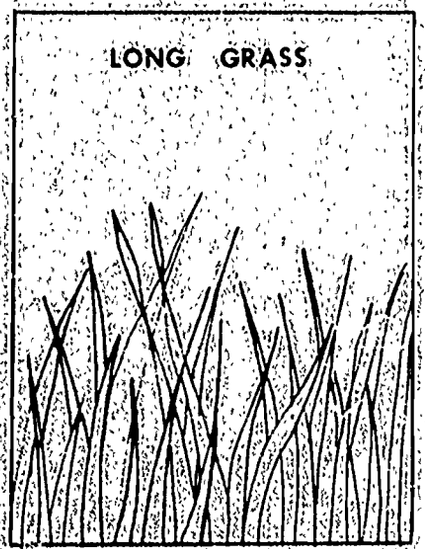
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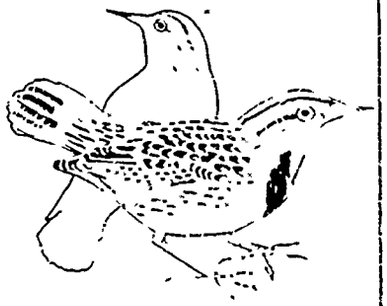
MEADOW LARKS



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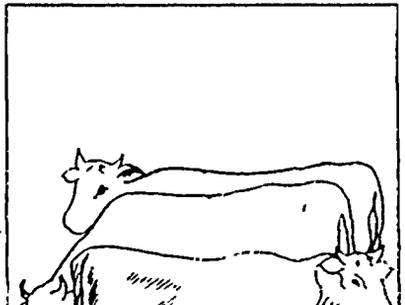

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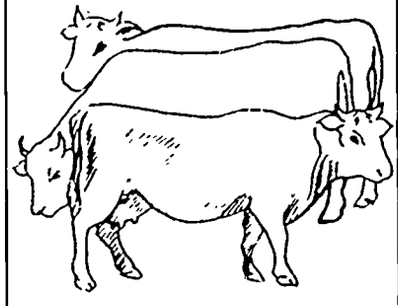
MEADOW LARKS



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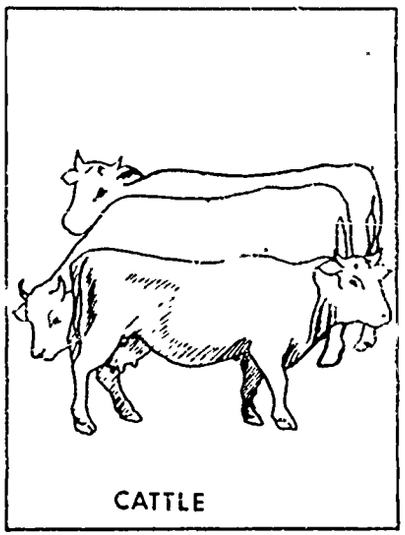
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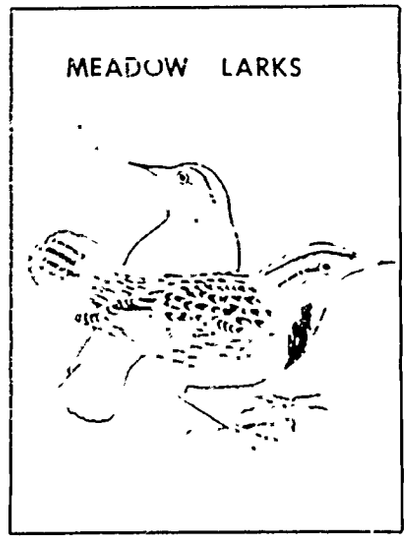
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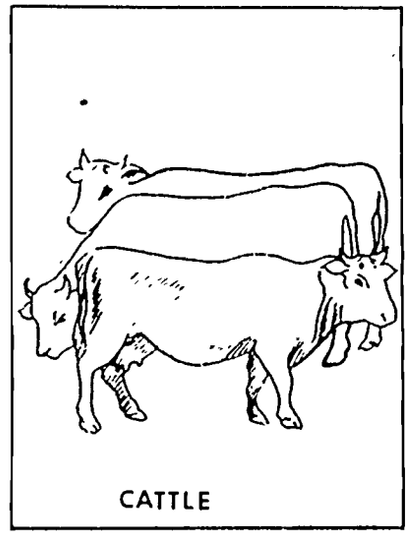
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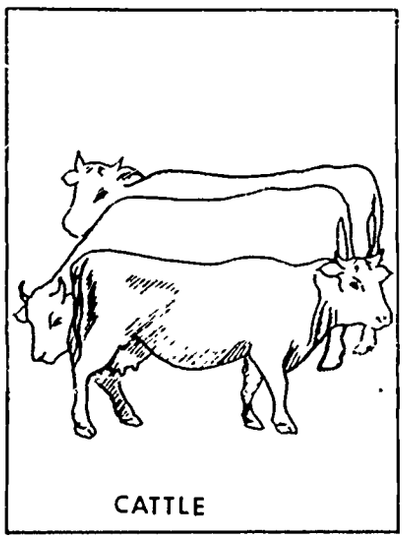
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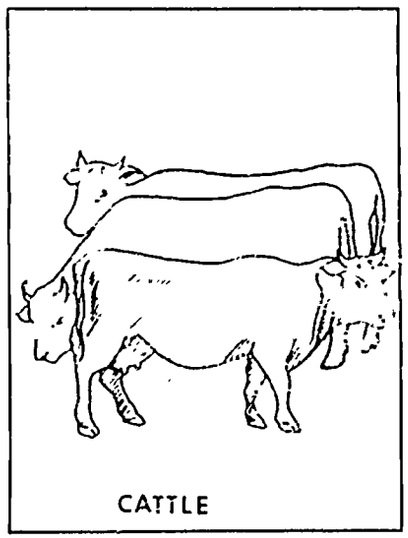
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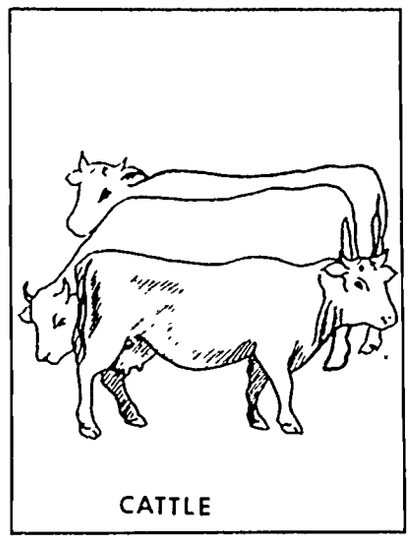
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Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Mike Chester

Subject: Science

Activity Name: Marine Bio-Rummy

Participation: Two to four players

Time: One day activity

Theme

This is a card game in which the players "collect" various sea creatures. The collection process takes place in the form of "melds"* as in pinochle, rummy, and gin rummy. In order to meld appropriate card groups and to score the melds correctly, a player must consult a meld chart and a marine biology list.

Instructional Objectives:

Each student is to:

1. read a meld chart and a marine biology list with accuracy sufficient to verify his own melds and his opponents' melds in the verbal exchange of the game.

2. tabulate and add his melding scores with an error of 10% or less.

3. inter-relate various marine forms through the melding process according to their zoological description or natural history.

Bibliography

Fishes of the World by Allan Cooper; Grosset & Dunlap, 1971.

Abyss by C.P. Idyll; Crowell, 1964.

Ocean Life by Norman B. Marshall; MacMillan, 1971.

General Zoology by Tracy I. Storer; McGraw-Hill, 1951.

*meld: a specified set of cards that gives a point score to the card player who holds them (for instance, in pinochle, a meld of 4 aces is worth 100 points)

to meld: to place a meld on the table and to claim the corresponding point score.

Marine Bio-Rummy

Materials

1. a deck of 54 fauna cards (2 each of the 27 specimens shown on the "melding chart") at each game table
2. a "melding chart" for each student
3. a "marine biology list" for each student
4. pencils
5. for the teacher: a set of marine bio-rummy rules

Sequence of events

Having studied the game rules, explain them to the class. Arrange the class in groups for the play of the game. Ideally, there should be three players at each game table; however, the game could be played by two players, or by four or more players.

Students should examine the game materials, the marine biology cards, the melding chart, and should read the marine biology list. This list explains the relationships of the various creatures in the different melds.

Marine Bio-Rummy

GAME RULES

1. This game can be played by 2-4 players; however, 3 is the ideal number.

2. One of the players is chosen to be the dealer. He shuffles the 54-card deck and deals 5 cards to each player, including himself. The deck is left face-down at the center of the table, as a stockpile.

3. The player to the dealer's left is the first to play--and the play proceeds, in clockwise order.

4. On his turn, the first player draws a card from the top of the deck, increasing his hand to 6 cards.

5. Then, if the player has a meld, he may lay down the cards of the meld, face-up on the table. As he does so, he identifies the meld aloud, referring either to the "melding chart" or the "marine biology list." For instance, he may announce "mollusks," or he may say "these three," indicating a meld on his chart.

   5.1 There are 16 different kinds of meld on the melding chart, with each meld containing from 2 to 5 cards.

   5.2 A player may not meld between turns and may make only one meld on his turn. However, he may add to an existing meld in a subsequent turn.

   5.3 The two-card melds are indicated on the chart as two cards joined by a two-headed arrow.

   5.4 Melds containing three or more cards are indicated on the chart as vertical or horizontal rows of cards joined by line segments.

   5.5 Four-card and five-card melds may be melded (initially) as three-card melds. The player may add fourth and fifth cards later, if the opportunity arises, in order to increase meld value.

5.6 Most of the cards are involved in more than one meld. For instance, the moray eel is in a 3-card eel meld, a symbiotic meld with the wrasse, and a predator/prey meld with octopus. A player might meld the three eel cards, and later play the octopus card to form the moray-octopus meld (or vice versa). The same logic would apply to the moray-wrasse meld.

5.7 A player may not duplicate any of his own melds. Once he has melded (for example) the three arthropod cards, he may not form a second arthropod meld, using the three duplicate arthropod cards. However, another player may make the duplicate meld.

6. After melding, the player discards a single card. This card is placed face-up alongside the main face-down deck. All subsequent discards are placed (face-up) on the first discard to form a discard pile. The discards should be maintained in the sequence of their play--that is, the discard deck is not to be shuffled.

7. The players continue to draw, meld, if possible, and discard in turn.

8. When the turn comes back to a player who has just melded (on his last turn), he always is to draw enough cards to bring his hand back to a 6-card level. For example, if his preceding meld was 4 cards, then (after his discard) he would be left with a one-card hand. On his turn he would draw five cards. On the other hand, a player who did not meld on his last turn would need to draw only one card to jump to the six-card level.

9. When a player draws a single card, he may draw either the top card of the discard pile (if he especially wants that card) or the top card of the stockpile. When a player is drawing two or more cards, he may draw entirely from the discard pile or entirely from the stockpile or he may draw some cards from each pile.

9.1 However, the cards that he takes must be uppermost in each pile. A player may draw the top 2 (or 3, 4, 5, or 6) cards from the discard pile but may not dig down to take some cards while by-passing higher ones. The same rule applies to the stockpile.

9.2 A player may examine the past discards as he makes his decision about drawing from the discard pile; but he may not shuffle the discard pile or take it into his possession in the process.

9.3 A player making a mixed draw (drawing on both the discard pile and the stockpile) must make all his draws from the discard pile first, before drawing on the stockpile.

10. One of the melds on the "melding chart" has 3 possible structures. The meld in question is the three-card deep-sea specialists meld. It consists of deep-sea squid, deep sea spider, and any one of the three fish from the deep-sea fish meld. The fish card used in the former meld may also be part of the latter meld.

11. When the stockpile has been exhausted, the players continue to play, drawing from the discard pile. The game ends in one of the following ways:

    a. There are not enough discards left for some player to restore his hand to a six-card level when his turn comes.

    b. After several plays, it becomes clear to all players that the discard pile does not offer anybody any melding possibilities--time is called.

12. Time should be called from 10-15 minutes before the class hour ends, so that the players will have time to derive their scores.

13. In order to determine his score, the player should arrange all his melds in the general format of the melding chart (but, generally, with gaps in the array, unless he has managed to meld a complete 27-card array). Any melds that he can identify in this array, even if he did not announce them in the course of play, are scorable. To tabulate his score, the player should carry out the following process:

    13.1 He puts a check mark on the melding chart next to each card that he has melded.

    13.2 He enters his meld score next to each description (of one of the melds that he holds) on the marine biology list.

14. The teacher should collect both the marked melding chart and the marked marine biology list from each student in order to review the consistancy of the entries made there.

MARINE BIOLOGY LIST

Points

ARTHROPODS (animals with jointed skeletons on the outsides of their bodies). Deep sea spider, chinese land crab and horseshoe crab.
A 300 - Point meld for all three.

CREATURES THAT LEAVE THE WATER (those with special abilities to crawl or climb ashore or to fly in the air) The flying fish and flying squid both can soar above the sea for lengths of hundreds of feet; the mudskipper and the chinese land crab are both able to wander across mudflats and climb trees.
A 500 - Point meld for any three of these
A 900 - Point meld for all four.

DEEP-SEA FISH (fish that are specially large-mouthed, compared to their body sized, to help them catch their prey in the dark, thinly-populated abyss) The deep sea angler uses a luminous lure, attached to a stalk, to attract smaller fish. The viper fish has a bony, skeletal jaw that snaps closed on its prey; this jaw can close quickly because it is not slowed down by water pressure as it would be if there were flesh on the jaw bones. The gulper is almost all mouth with only a thin, wispy body to nourish, so its occasional large meal is all that it needs to stay alive.
A 400 - Point meld for all three.

DEEP-SEA SPECIALISTS (fish and other animals specially adapted to life in the abyss) This meld includes the three deep-sea fish listed above. Other examples are: the deep sea spider, which is very thin and long-legged so that it can walk on ooze without sinking in; and a deep-sea squid with lights and hooks on the ends of its very long tentacles, so that it can catch on its prey at a distance.
A 500 - Point meld for three of these, counting only one fish; that is, the deep sea spider and the deep-sea squid must both be in the meld.

MARINE BIOLOGY LIST

Points

EELS - Electric eel, snipe eel, and moray eel.
A 350 - Point meld for all three.

FISH WITH CARTILAGE SKELETONS - Shark, roughtail stingray, and chimera.
A 250 - Point meld for all three.

LOWER GROUPS OF ANIMALS - (lower on the life scale than the fish, arthropods, and mollusks in the rest of the deck) Portuguese man 'o war, basket starfish, and bristle worm.
A 300 - Point meld for all three.

MOLLUSKS - (animals with soft bodies and usually with either shells or tentacles or both) Murex, octopus, deep-sea squid, and flying squid.
A 250 - Point meld for any three of these.
A 500 - Point meld for all four.

PARTNERSHIPS (animals that help each other - or, a one-sided partnership where only one is helped in the partnership)

1. Neon goby and grouper: the neon goby gets its meals by cleaning the grouper's teeth.
   A 250 - Point meld for both.

2. Wrasse and moray eel: the wrasse gets its meals by cleaning the moray's teeth.
   A 250 Point meld for both cards.

3. Shepherd fish and Portuguese man 'o war: the shepherd fish hides amidst the stingers of the portuguese man'o war to avoid enemies.
   A 200 - Point meld for both cards.

MARINE BIOLOGY LIST

Points

4. Pilot fish and shark: the pilot fish follows sharks -- probably to eat leftovers of the shark's meal (as a jackel does with a lion)
A 200 - Point meld for both cards.

5. Remora and shark: the remora attaches itself to the shark (using the sucker on top of its body) to hitch rides.
A 200 - Point meld for both cards.

PREDATOR-PREY PAIRS

1. Horseshoe crab and bristle worm (horseshoe crabs eat bristle worms)
A 100 - Point meld for both cards.

2. Moray and octopus (moray eels eat octopuses)
A 100 - Point meld for both cards.

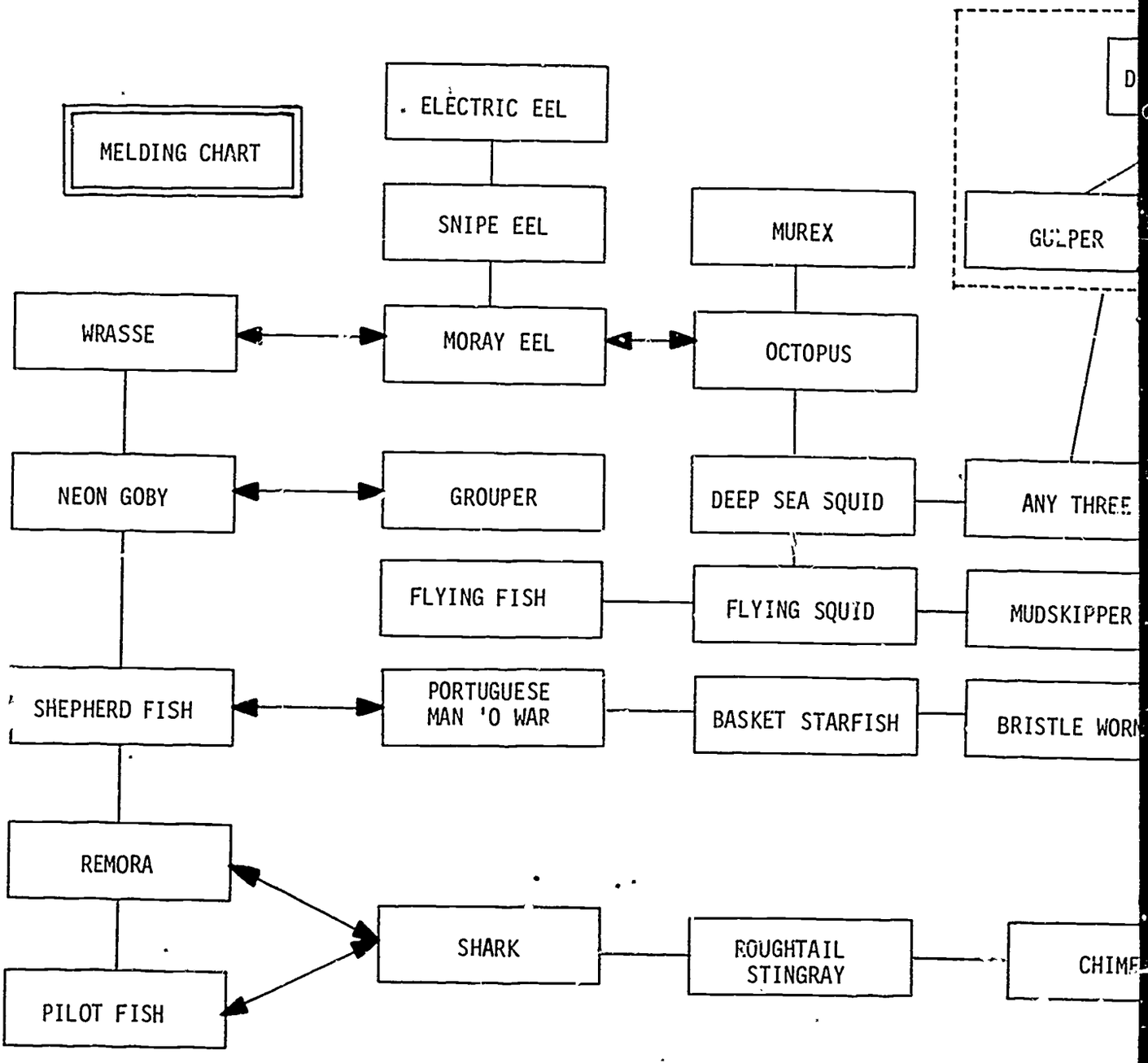
SMALL FISH DEPENDENT ON LARGER ANIMALS (there are 5 of these smaller fish -- see "partnerships")

A 300 - Point meld for any three

A 600 - Point meld for any four

A 1,000 - Point meld for all five.

TOTAL POINTS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SNIPE EEL
MUREX
GULPER
WRASSE
MORAY EEL
OCTOPUS
NEON GOBY
GROUPER
DEEP SEA SQUID
ANY THREE
FLYING FISH
FLYING SQUID
MUDSKIPPER
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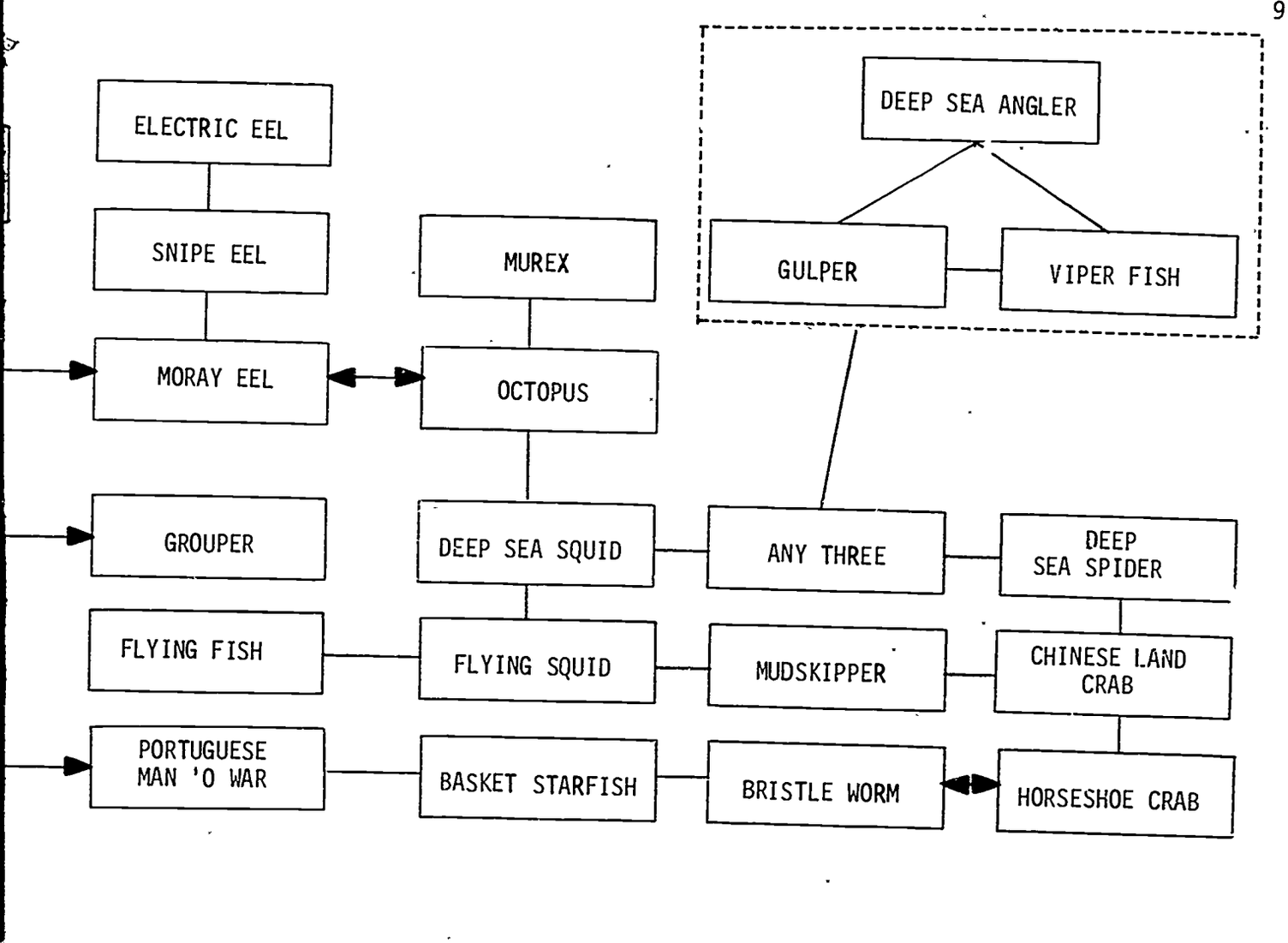
BASKET STARFISH
REMORA
SHARK
ROUGHTAIL STINGRAY
PILOT FISH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GULPER
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SNIPE EEL
MUREX
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OCTOPUS
GROUPER
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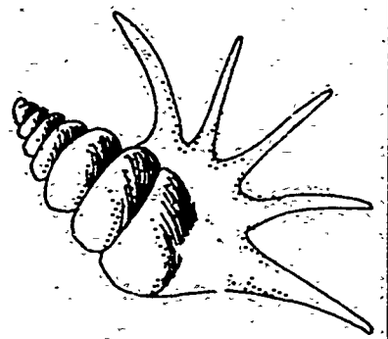
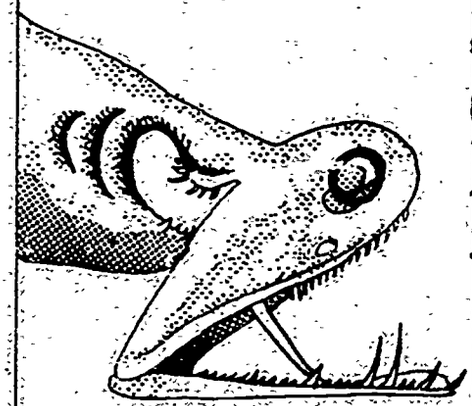
ANY THREE
DEEP SEA SPIDER
FLYING FISH
FLYING SQUID
MUDSKIPPER
CHINESE LAND CRAB
PORTUGUESE MAN 'O WAR
BASKET STARFISH
BRISTLE WORM
HORSESHOE CRAB
SHARK
ROUGHTAIL STINGRAY
CHIMERA

SNIPE EEL

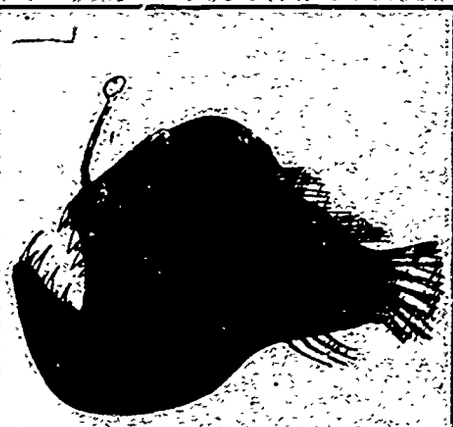


MUREX

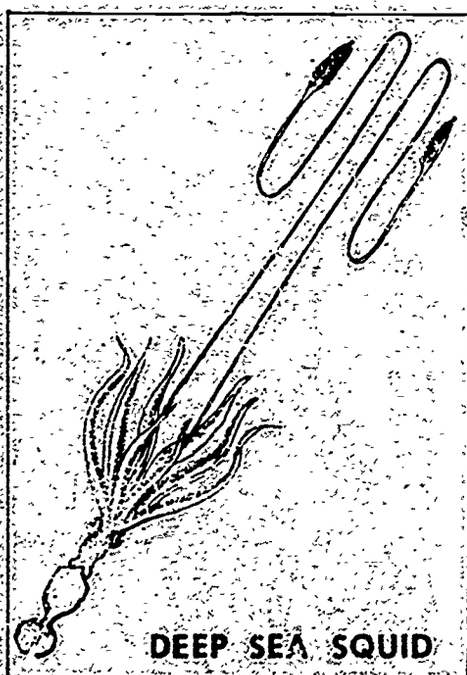
VIPER FISH



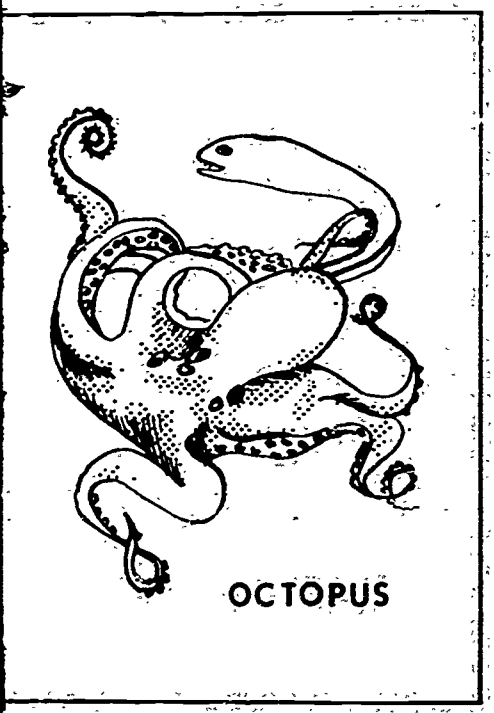
MUDSKIPPER



DEEP SEA ANGLER

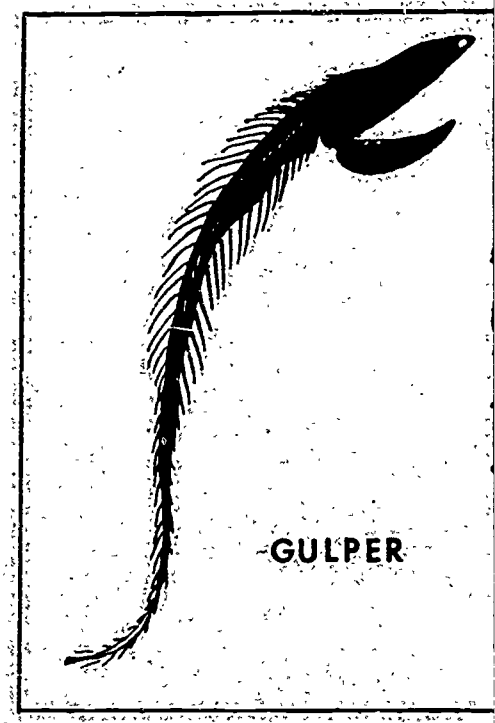


DEEP SEA SQUID

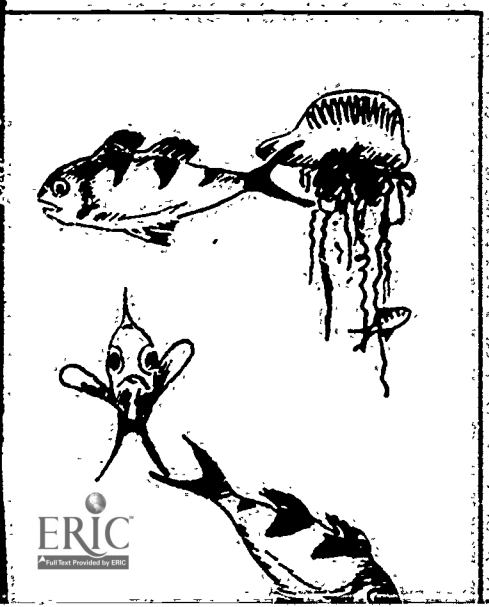


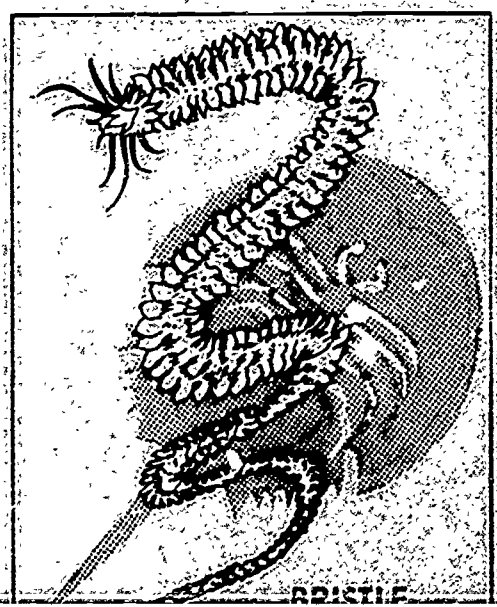
OCTOPUS

MORAY EEL



GULPER





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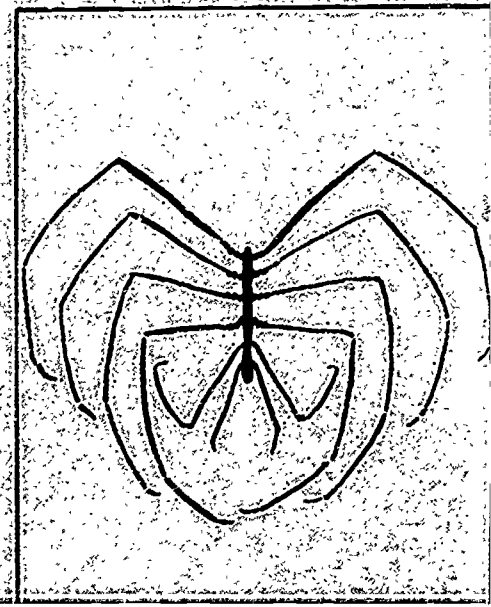
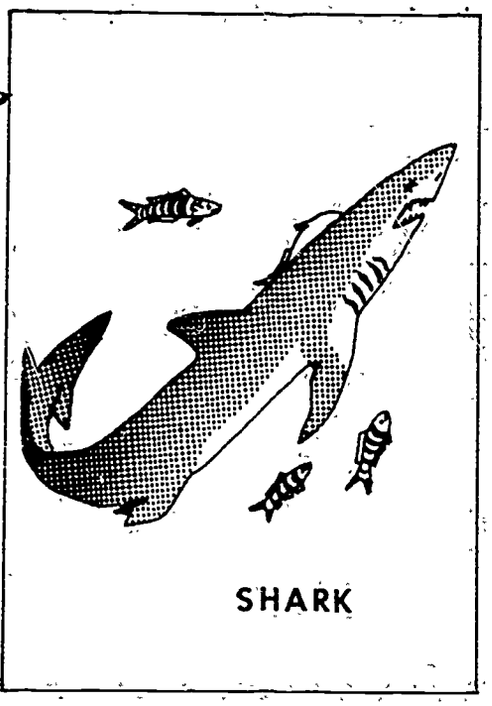
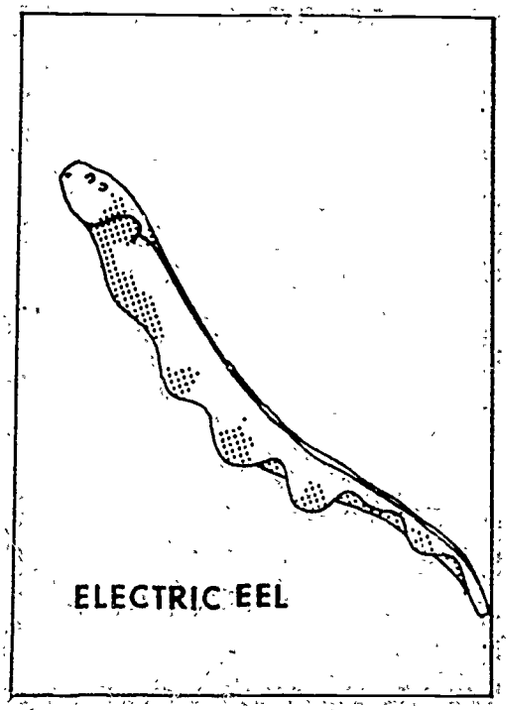


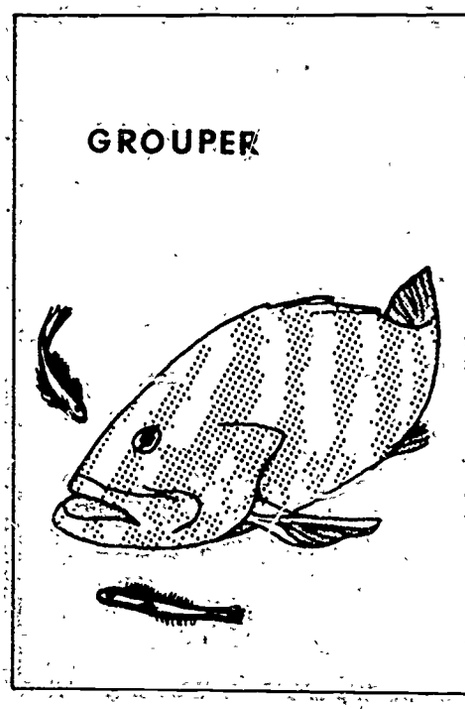


SHARK

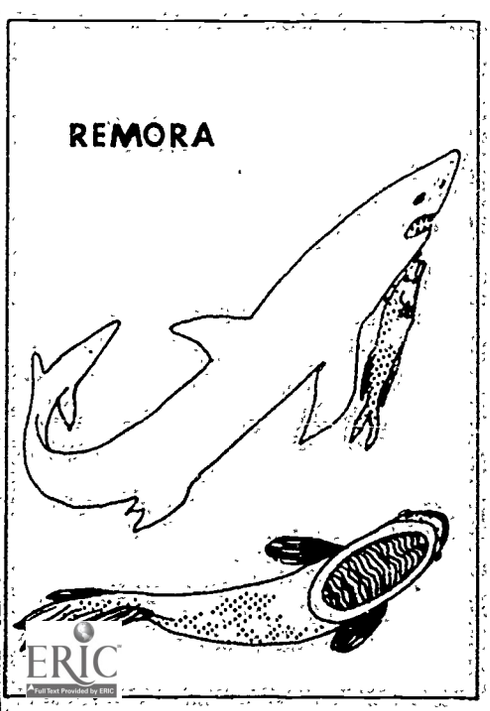


ELECTRIC EEL

GROUPER



REMORA



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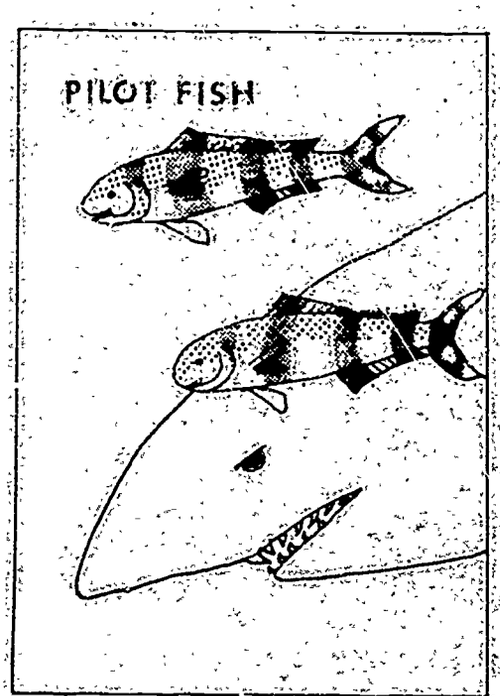
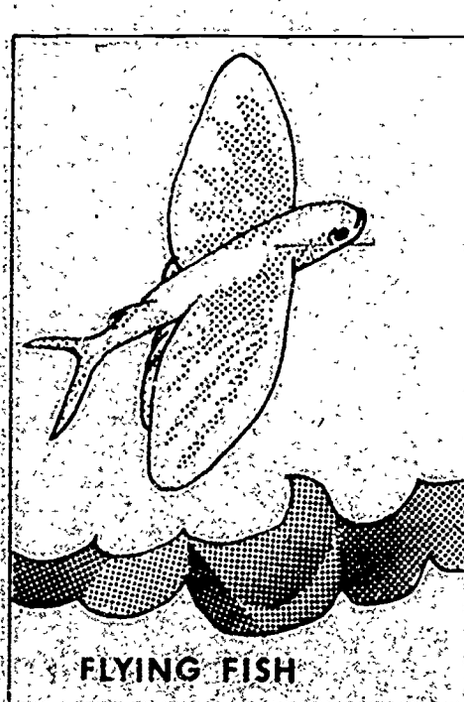
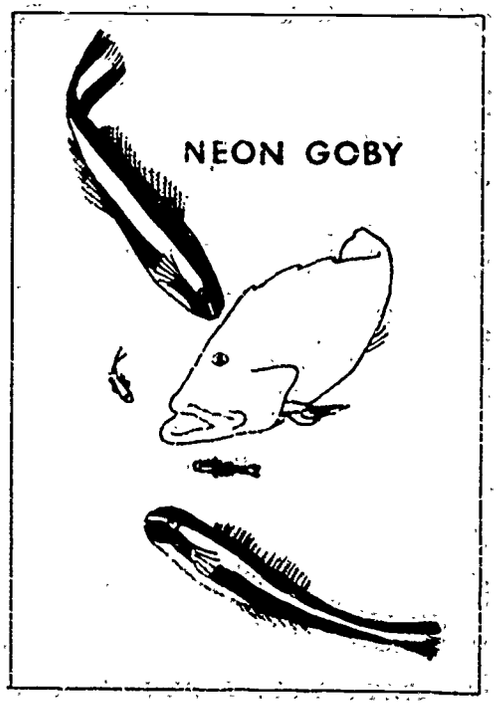




FLYING FISH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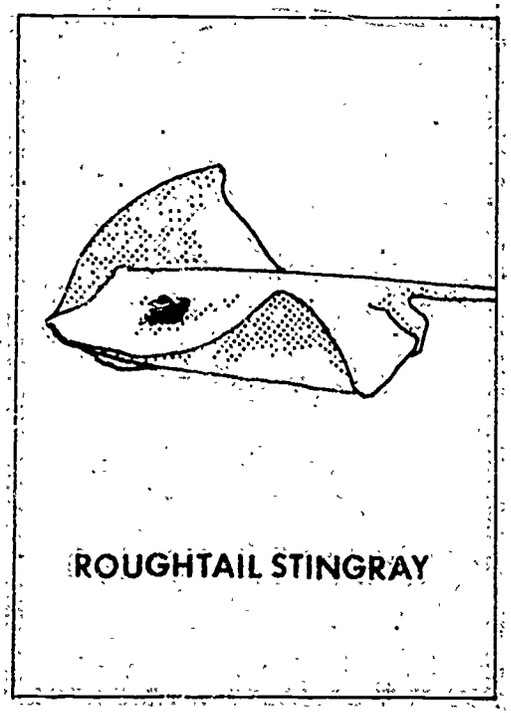
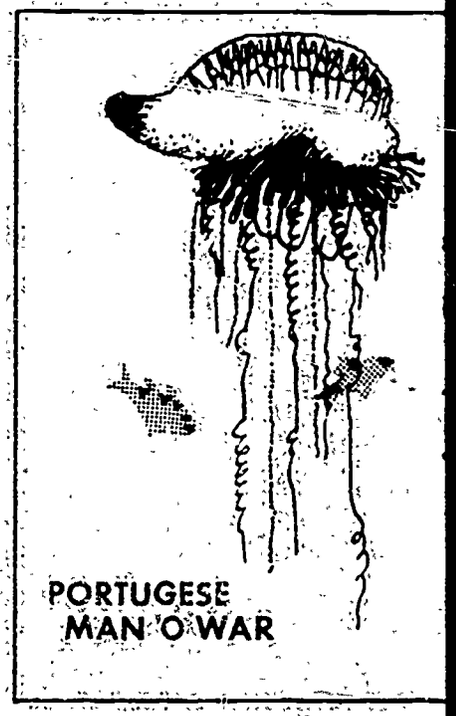
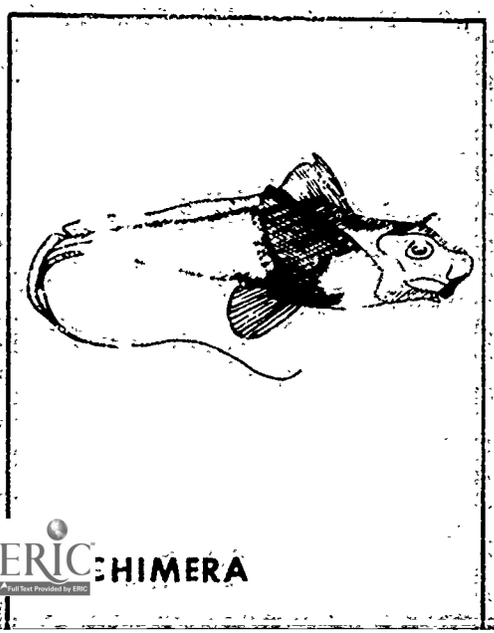

ROUGHTAIL STINGRAY

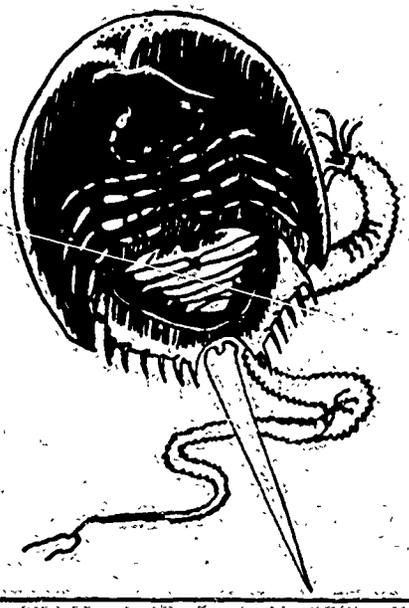

PORTUGESE
MAN O'WAR


CHIMERA

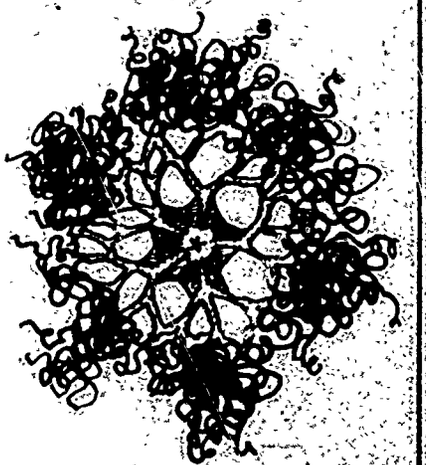

CHINESE LAND CRAB


FLYING
SQUID

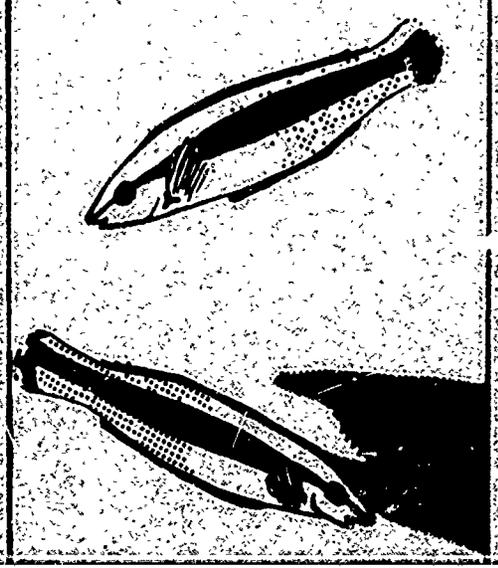
HORSESHOE CRAB



BASKET STAR FISH



WRASSE



Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Doug Eidsmore

Subject: U.S. History

Activity Name: Historical Pairs

Participation: 2 players

Time: One class period

Theme

Two players are each dealt five cards with dates or events on them. The players take turns forming pairs of events and dates using an American History Events list as a guide. The player who forms the most pairs wins. The instructional gaming technique can be used for other historical periods or for subjects other than history where knowledge of paired facts is desirable, i.e., countries and their capitols, foreign words and their English meanings, etc.

Instructional Objectives

Each student is to demonstrate an increased knowledge of specific U.S. Historical facts by the third playing of the game by forming pairs of events and dates with:

1. A decrease in the number of incorrect pairs from the first playing.

2. A decrease in the number of times the Events List is used from the first playing.

Preparation

Type or use a felt pen to make up the game cards. One set of cards contains dates; the other, events. Use the American Events List to make the cards. A good size is about 3 1/2 inches by 2 inches.

Bibliography

1. Hofstadter, The United States, Prentice Hall Inc., Engelwood Cliffs, New Jersey, 1957.

2. Wish, Contemporary America, Harper and Row, New York, 1955.

Directions

1. Divide students into pairs. Give each pair a set of cards (events and dates) and an American History Events list.

2. One player shuffles the deck thoroughly mixing the events and dates. Then deal five cards face up to each player. The remaining cards are placed face down on the table.

3. The player who did not deal the cards begins play. Using the events list as a guide, the player checks to see if he can form any pairs with his cards. If he can, he does so. He also checks to see if a pair can be formed with one of his cards and one of his opponents cards.

   After forming a pair, the player draws new cards so he always has at least five cards. He keeps forming pairs and drawing cards until he can no longer make any new pairs. It is then the next players turn. He draws cards to replace any of his cards that his opponent may have used to form pairs until he has at least five cards.

4. If a player can not form a pair, he draws cards until he can. Player may only possess 10 cards. Once this limit is reached, the player must return one card to the deck before drawing a new card. Players keep drawing and discarding, if necessary, until they form at least one pair during their turn. Players may form as many pairs as they can during a turn, drawing new cards after each turn.

5. If a player forms a "bad" pair, he must return both cards to the deck and must also give one of his "good" pairs to his opponent.

6. The game ends when all pairs are formed. The winner is the player with the most pairs.

NOTE: This game should be included within standard U.S. History course work. It has little value if the meaning of the events are not known by the student.

Suggested Activities and Alternatives

1. Have players draw a time-line with the pairs they have formed.

2. Construct a deck for the same historical period for other locations; i.e. Europe or South America, etc. Have players draw a new time line parallel to the American Time Line with the pairs they have formed. Discuss events and relationships between the two time lines.

3. Construct a deck for other subjects. The deck should contain about 50 pairs. The game can be simplified by reducing the number of pairs to 30 or 40.

AMERICAN HISTORY EVENTS LIST

DATES	EVENTS
1492	COLUMBUS DISCOVERS NEW WORLD
1519	CORTEZ BEGINS CONQUEST OF MEXICO
1522	MAGELLAN SAILS AROUND THE WORLD
1607	JAMESTOWN COLONY FOUNDED
1620	PILGRIMS LAND AT PLYMOUTH ROCK
1643	NEW-ENGLAND CONFEDERATION
1763	FRANCE EXPELLED FROM THE NEW WORLD
1765	ENGLAND PASSES THE STAMP ACT
1775	SHOT HEARD ROUND THE WORLD
1776	DECLARATION OF INDEPENDENCE
1783	AMERICA WINS FREEDOM
1787	CONSTITUTIONAL CONVENTION
1789	GEORGE WASHINGTON BECOMES FIRST PRESIDENT
1803	LOUISIANA PURCHASE
1804	LEWIS AND CLARK EXPEDITION
1812	SECOND WAR WITH ENGLAND
1820	MISSOURI COMPROMISE
1823	MONROE DOCTRINE
1825	ERIE CANAL OPENED
1828	ANDREW JACKSON ELECTED PRESIDENT
1846	WAR WITH MEXICO
1850	CALIFORNIA ADMITTED AS A FREE STATE
1854	REPUBLICAN PARTY ORGANIZED
1857	DRED SCOTT DECISION

DATES	EVENTS
1859	JOHN BROWNS RAID
1860	LINCOLN ELECTED PRESIDENT
1861	CIVIL WAR BEGINS
1863	EMANCIPATION PROCLAMATION
1865	LINCOLN IS ASSASSINATED
1869	TRANSCONTINENTAL RAILROAD COMPLETED
1890	SHERMAN ANTI-TRUST ACT
1893	CHICAGO WORLDS FAIR
1898	SPANISH AMERICAN WAR
1901	McKINLEY ASSASSINATED - ROOSEVELT BECOMES PRESIDENT
1917	U.S. ENTERS WORLD WAR I
1920	SENATE REJECTS U.S. ENTRANCE TO LEAGUE OF NATIONS
1929	STOCK MARKET COLLAPSES
1933	FDR INAUGURATED
1941	JAPANESE ATTACK PEARL HARBOR

DATES	EVENTS
1945	ATOMIC BOMB DROPPED ON HIROSHIMA
1947	MARSHALL PLAN
1950	U.S. ENTERS KOREAN WAR
1956	SUEZ CRISIS
1957	RUSSIANS LAUNCH SPUTNIK
1962	CUBAN MISSILE CRISIS
1966	WAR IN VIETNAM EXPANDED
1969	U.S. LANDS FIRST MAN ON MOON

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Mike Chester

Subject: Reading, History

Activity Name: Egyptian Archeology Game

Participation: Two to four players

Time: Two to four class periods

Theme

The students play a board game that simulates the work of Egyptian archeologists. The rolls of dice and the drawing of cards represent various archeological finds. The players enter symbols onto a scoreboard to represent their archeological finds. A scoring system assigns point values to the discoveries made. After the play of the game, students interpret the cards that they collected in the courses of play, building story concepts around the events and discoveries that take place inside the ancient tomb.

Instructional Objectives

Each student is to:

1. Participate in the play of the game, making no errors in the symbolic notations that he enters onto his "Discovery Sheets."

2. Give written or oral (teacher's option) interpretations of every card collected in the game, involving either practical deductions or imaginative extensions relating to the findings described on the cards.

Schedule

Phase	Activity	Instructional Objective	Fast Calendar	Slow Calendar
1	play at gameboard	1	day 1	days 1 and 2
2	card interpretation	2	day 2	days 3 and 4

Egyptian Archeology Game

Bibliography

The Pyramids of Egypt, by I.E.S. Edwards, Penguin Books, 1947.

Gods, Graves, and Scholars, by C W. Ceram, Alfred A. Knopf, 1968.

The March of Archaeology, by C.W. Cera,. Alfred A. Knopf, 1970.

Phase 1

A. Materials

1. An Egyptian Archaeology gameboard at each game table.
2. At each gameboard:
   one deck of 18 game cards
   one Egyptian Archaeology "scoreboard"
   one pair of dice
3. For each student:
   one "Egyptian Archaeology Data Sheet" (2 pages)
   one "Symbols and Scoring" sheet
   one game piece
4. For the teacher:
   one set of "Rules of Play"
   one "Discovery Sheet" (Sample)

B. Sequence of events

1. Supply all phase-1 materials to the class.
2. Tell the class to read their "Egyptian Archaeology Data Sheets" and "Symbols and Scoring Sheets" as background and encourage class discussion.
3. Explain the rules of play to the class. Demonstrate the rules, using gameboard, scoreboards, cards, worksheets, etc. (Study the game rules ahead of time; they are simple, but listed in considerable detail to eliminate ambiguity. Once you have learned the rules, you will find them far simpler to demonstrate than they were to read.)
4. Assign 2-4 players to a gameboard. (Three players is the ideal number.)
5. Let the play begin.
6. Since discussion may have used a significant part of the first hour, it is likely that phase 1 will need to be continued on a subsequent day. In that case, tell students to leave the gameboard set up for continued play exactly where they left off.
7. Each player is to keep the cards he collected in phase 1 for use in phase 2.
8. At the end of the game, the players are to calculate their scores. High player wins.

Phase 2

A. Materials

1. Each student's game cards that he collected in phase 1.
2. Each student should also have all of the paper materials that he had in phase 1.
3. For the teacher: "Interpretation Notes."

B. Sequence of events

1. Tell the students that each person is to "explain" all of the cards that he collected in the game.

B. Sequence of events (cont.)

2. The explanation consists of giving an imaginary cause, elaboration, or sequel for each event or discovery described o n each of the student's cards. The explanation can be either written or spoken, as you prefer. Or, you may prefer to have the students write about some cards and tell about others. Since strange events are described on many of the cards, expect grotesque elaborations.

3. Tell the students to try to combine two or more cards in a single imaginary framework. They may also want to confer with one another to find common factors relating to cards they hold.

4. Students should refer to their "Egyptian Archaeology Data Sheets" for background, as needed.

5. Encourage imaginative, versatile interpretations.

6. See "Interpretation Notes" for some possible lines of thought. You may want to quote one or two of these to the class if people are having difficulty getting started.

RULES OF PLAY

1. Players put their pieces on START.

2. The 18-card deck is spread out (as much as space allows), face-up on the table near the gameboard.

3. Dice are rolled for first turn. High roller goes first, and play proceeds clockwise around the board.

4. A player may move the total number of spaces shown on the two dice, or less--if he prefers. However, he must roll at least a 7 in order to open the stone portcullis between adjacent chambers, symbolized as a small rectangle on the boundary between chambers. Passage through open apertures (for instance, where the corridor meets chamber 11) does not require a 7. Initial entrance into the tomb does require a 7 or higher.

5. The goal of the play is to make archaeological finds. To make his finds, a player announces that he is rolling dice to "search" rather than to "move." On a "search" turn, both dice must be rolled, but only the higher of the two dice counts.

6. When a players' piece is in a certain chamber, he searches for things in that chamber only. He consults the "scoreboard" for that chamber in order to interpret his rolls. For example, if the higher die is a "6", the player in chamber #1 has found ornaments.

7. The "scoreboard" is a map of the tomb on which artifacts (rather than gameboard paths) are displayed. Along with each artifact are two check squares. The player who rolls the dice initials a check square corresponding to the artifact that he has "found." His initial (or initials) show that he made the discovery.

8. While he is "searching," the player's piece remains stationary.

9. The searching player keeps the dice, and continues rolling until he announces a "move" instead of a "search," or until his turn ends automatically -- see #11.

10. When the searching player rolls a "repeat" (for instance, if a mummy has already been found in a particular chamber, and the player rolls a "mummy" on the dice," he initials the second square for that artifact.

11. When the searching player rolls a second repeat (for instance, rolling a "mummy" when two mummies have already been found in that chamber), his turn ends and he must pass the dice to the next player.

12. When the player's turn occurs again, he must decide to "search" or to "move" depending on whether: he thinks he is likely to roll another "2nd repeat;" the value of the possible finds left in the chamber; the condition of other chambers; the position of other players, etc.

13. When a player "finds" an artifact, he also draws the card from the deck that matches that artifact. If that card has already been taken, he draws a "mystery card." The card-draw occurs only in the earliest part of the game, as the small deck is rapidly exhausted. Then, the gameboard play continues without the card draw.

14. There are scores for both artifacts found and for cards collected -- see "Symbols and Scoring" sheet.

15. After all chambers have been explored, the game may be ended. But if this happens while there is still time and player interest, new sets of blank scoreboards should be passed out, and a new cycle of play be started. However, in that case, players should keep the cards and scoreboards from the first cycle of play. When scoring is done, results from all cycles should be combined.

16. Tactics enter the game in the player's choice of route and of the priorities that he assigns to the various chambers, based upon the spectrum of opponents' actions and upon the potentialities of each chamber according to the dice rules.

INTERPRETATION NOTES (Phase two)

The events and discoveries represented on the cards are so strange that the students are likely to interpret them in terms of time travel, re-awakening mummies, and murder mystery themes.

In case students are unable to get started on interpretations, the following are a few possible interpretations, some of which may be told to the class to help them understand the process. On the other hand, the class may not need this help, but may be interested in these possibilities after their work is finished.

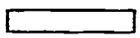
CARDS	INTERPRETATIONS
You have found an ancient Egyptian skeleton. But, when you look at the teeth, you find that it has had modern dental work.	A mad dentist has been breaking into the tomb to fill the mummies' teeth.
You have found a completely dismantled four-wheeled chariot. When you put the chariot together, the two left wheels turn out to be larger than the two right wheels.	a. You put them together wrong. The big wheels belong in the back, the small wheels in the front. b. This chariot is designed to travel only in circles.
You find a live snake in the chamber. But this tomb has been sealed for many centuries.	a. There is a hole somewhere. b. The snake came in with the archeologists.

EGYPTIAN ARCHAEOLOGY

DATA SHEET

1. The tomb you are exploring is cut into the side of a cliff.

2. Many mummies of ancient Egyptian Kings and Queens are buried in this tomb.

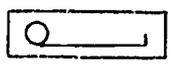


3. The stone coffin in which a mummy is buried is called a "sarcohpagus".

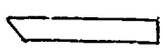
4. In ancient Egypt, the internal organs of the dead king or queen are removed and put into large stone jars called "canopic jars".

5. There are four canopic jars, each having a lid shaped like a head. The jars and the organs that are put into them are:

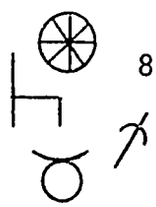
Lid of jar	Organs in jar
Man's head	Liver
Ape's head	Lungs
Jackel's head	Stomach
Falcon's head	Intestines



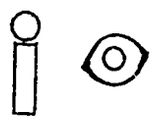
6. The body is then dried out, wrapped in many yards of bandage, and put into the sarcophagus. preserved in pitches and resins.



7. The ancient Egyptians believed that the dead king or queen would travel into the sky. So, they often put a "sun boat" in the tomb that the dead ruler could use to sail through the sky.



8. Many other valuable and useful things were also put into the tombs for the dead ruler's use. Chariots, furniture, implements, and many jeweled ornaments were sealed inside the tombs. Some of the ornaments were designed in the shapes of "scarabs" - sacred Egyptian beetles.



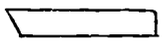
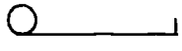
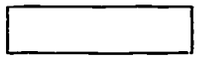
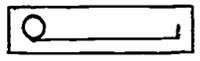
9. The insides of the tombs also were decorated with statues, and wall paintings, and wall writings called "hieroglyphics."

10. But in the thousands of years that have passed, the ancient tombs have often been broken into by robbers. Many of these robberies took place during times of disorder in ancient Egypt. Others have been more recent.

11. The robbers stole ornaments and jewels from the tombs. They opened the sarcophagi to steal bracelets, rings, and necklaces from the bodies of the dead rulers. To do this, they often unwrapped the mummy and left it on the floor of the tomb to become a skeleton.

12. The imaginary tomb in this game is about 3300 years old - from the time of the 18th dynasty of ancient Egypt. In it are the buried kings and queens, the decorations and implements, the destruction caused by grave robbers, and unknown mysteries.

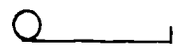
SYMBOLS AND SCORING

WALL PAINTINGS 	15 points for most found
STATUES 	15 points for most found
ORNAMENTS 	10 points for most found
IMPLEMENTS 	10 points for most found
FURNITURE 	5 points for most found
BONES 	5 points for most found
CHARIOT 	5 points each
BOAT 	5 points each
CANOPIC JARS 	5 points each
MUMMY 	10 points each
SARCOPHAGUS 	10 points each
MUMMY IN SARCOPHAGUS 	20 points each

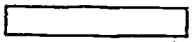
Add one point for every card collected

18-CARD DECK for

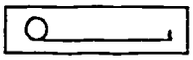
EGYPTIAN ARCHAEOLOGY GAME



You unwrap a mummy and find that it is only 3 days old. You recognize the mummy as one of your expedition guides.



This sarcophagus was completely sealed and has never been opened. But, when you open it, there is no mummy inside.



You open the sarcophagus and unwrap the mummy. It turns out to be the mummy of a Viking warrior.

MYSTERY CARD #1
You have been sneezing all day. But, when you came into this chamber, your sneezing suddenly stopped.

MYSTERY CARD #2
You keep feeling a cool wind blowing from somewhere inside the tomb.

MYSTERY CARD #3
You find a live snake in the chamber. But this tomb has been sealed for many centuries.

MYSTERY CARD #4
There are 9 people in your expedition. All 9 of you went into the ancient tomb. But 10 people were seen coming out.

MYSTERY CARD #5
You keep hearing a strange clicking sound, like someone throwing dice.

MYSTERY CARD #6
You see the mysterious shape of someone in white bandages running along a passageway.

A wall drawing of an Egyptian queen shows that she had brown eyes. But, another wall drawing of the same queen shows that she had blues eyes.

A statue moans as if it were alive. Later you find out that it has a panel in the back and is hollow inside.

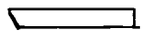
You have found a gold drinking cup. But it has little slits in the side, so that liquid would run out of it.

When you come into the chamber, a bow (that is on a rack in the corner) shoots an arrow that just misses you. Tests show that the bow and arrow are 3300 years old.

You find a chair leaning in a corner. It is perfectly built, except that it has only one leg, right in the middle, that comes to a point.

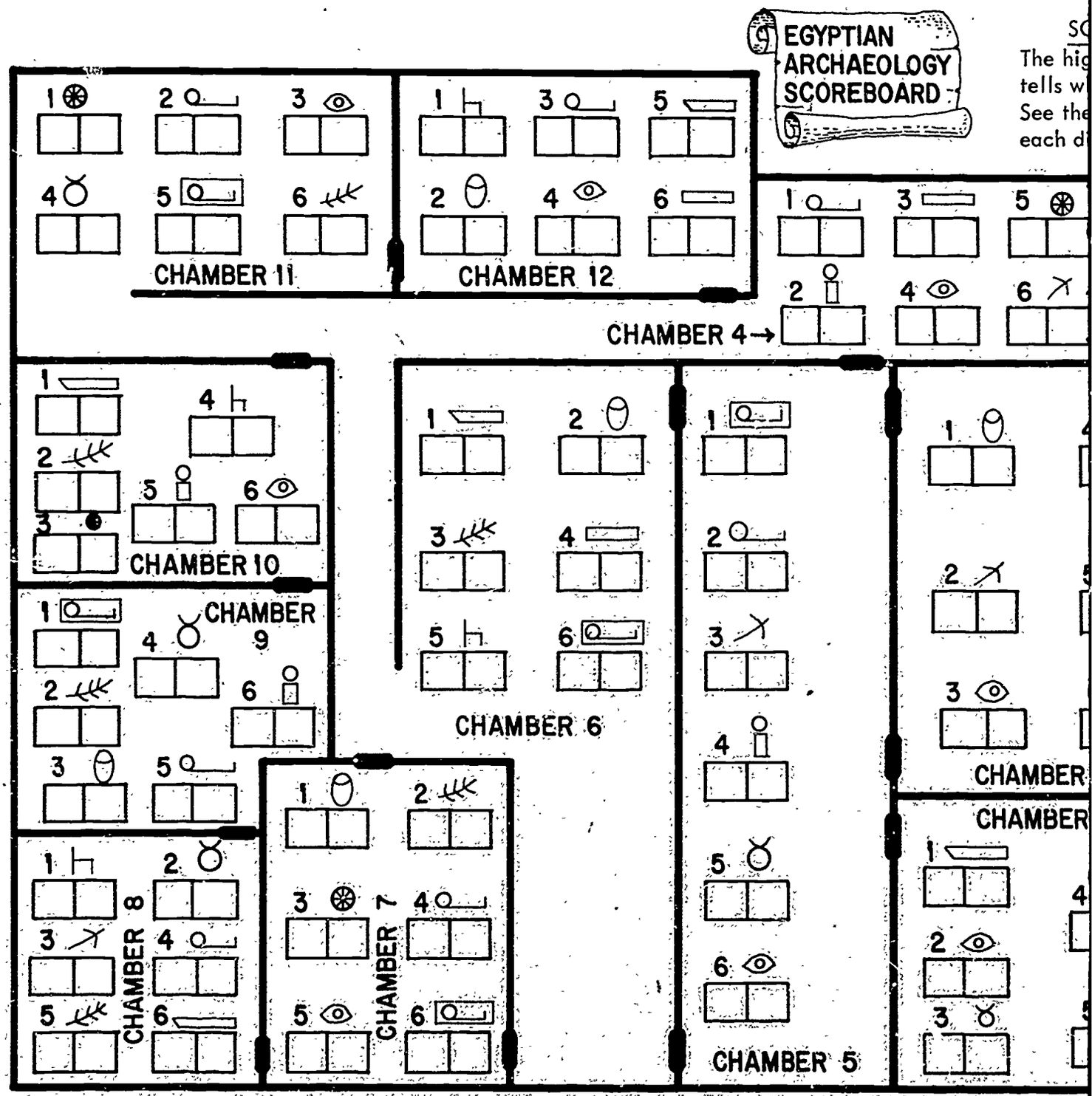
You have found an ancient Egyptian skeleton. But, when you look at the teeth, you find that it has had modern dental work.

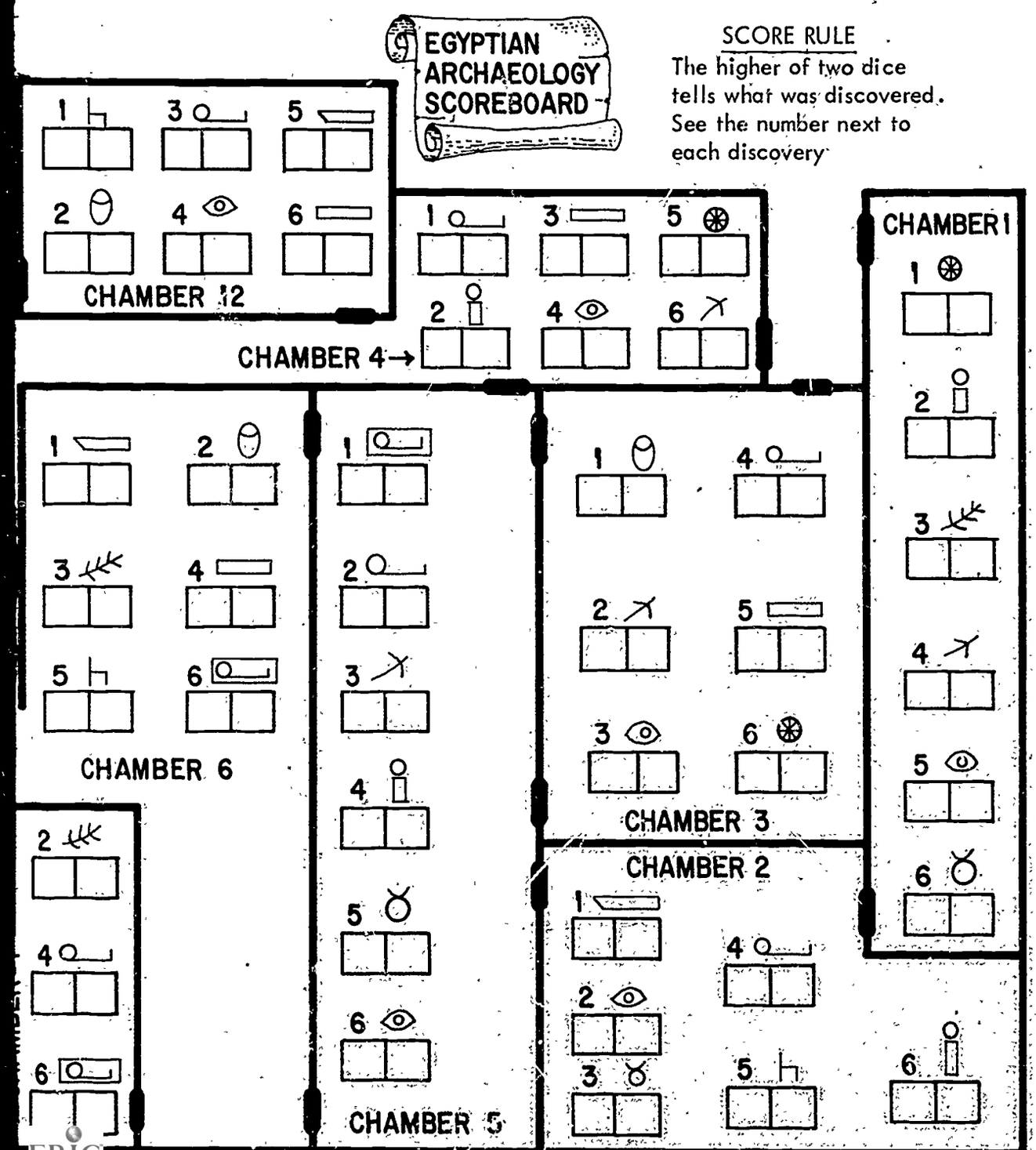
You have found the parts of a chariot. When you put the chariot together, the two left wheels turn out to be bigger than the two right wheels.

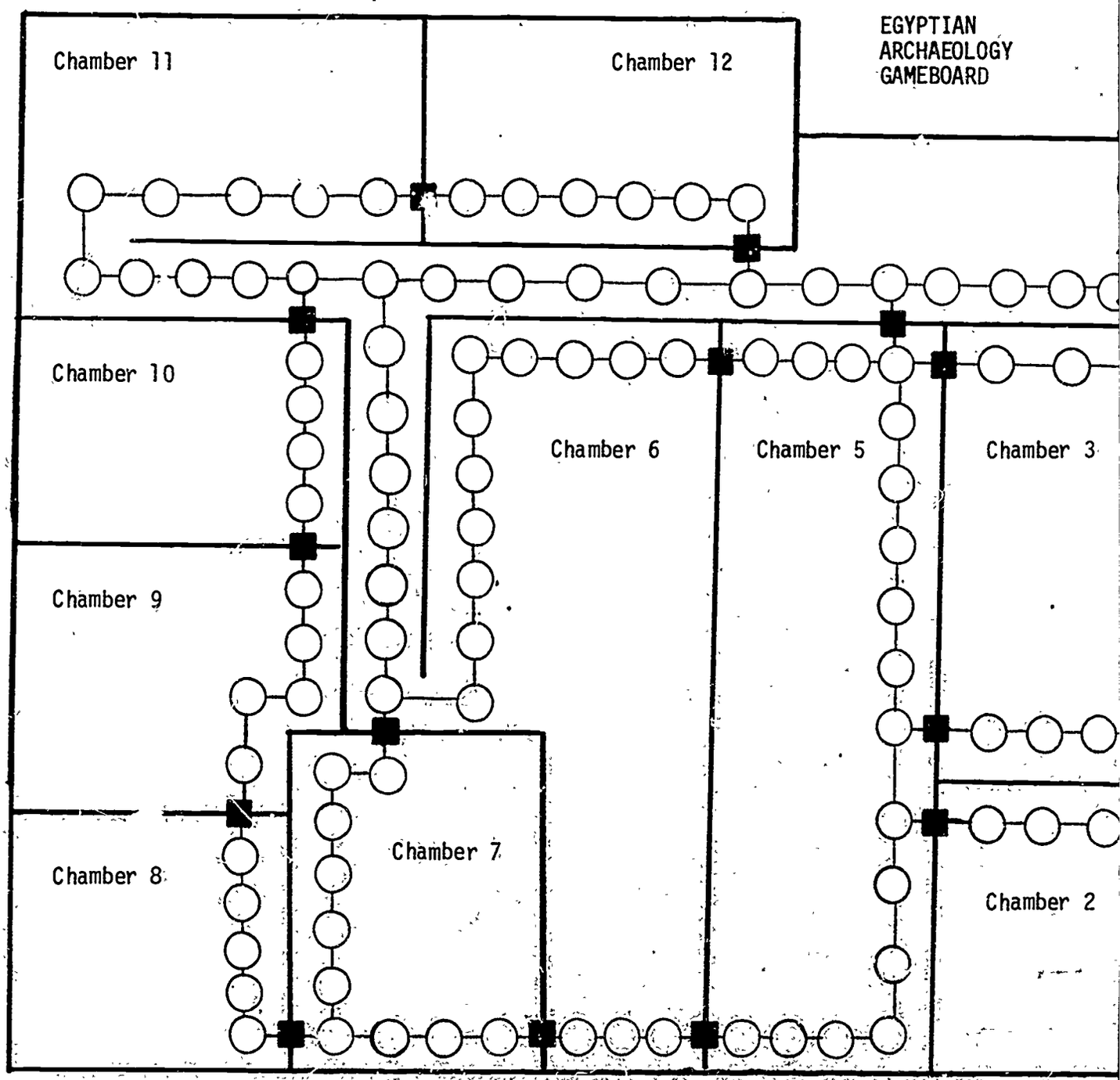


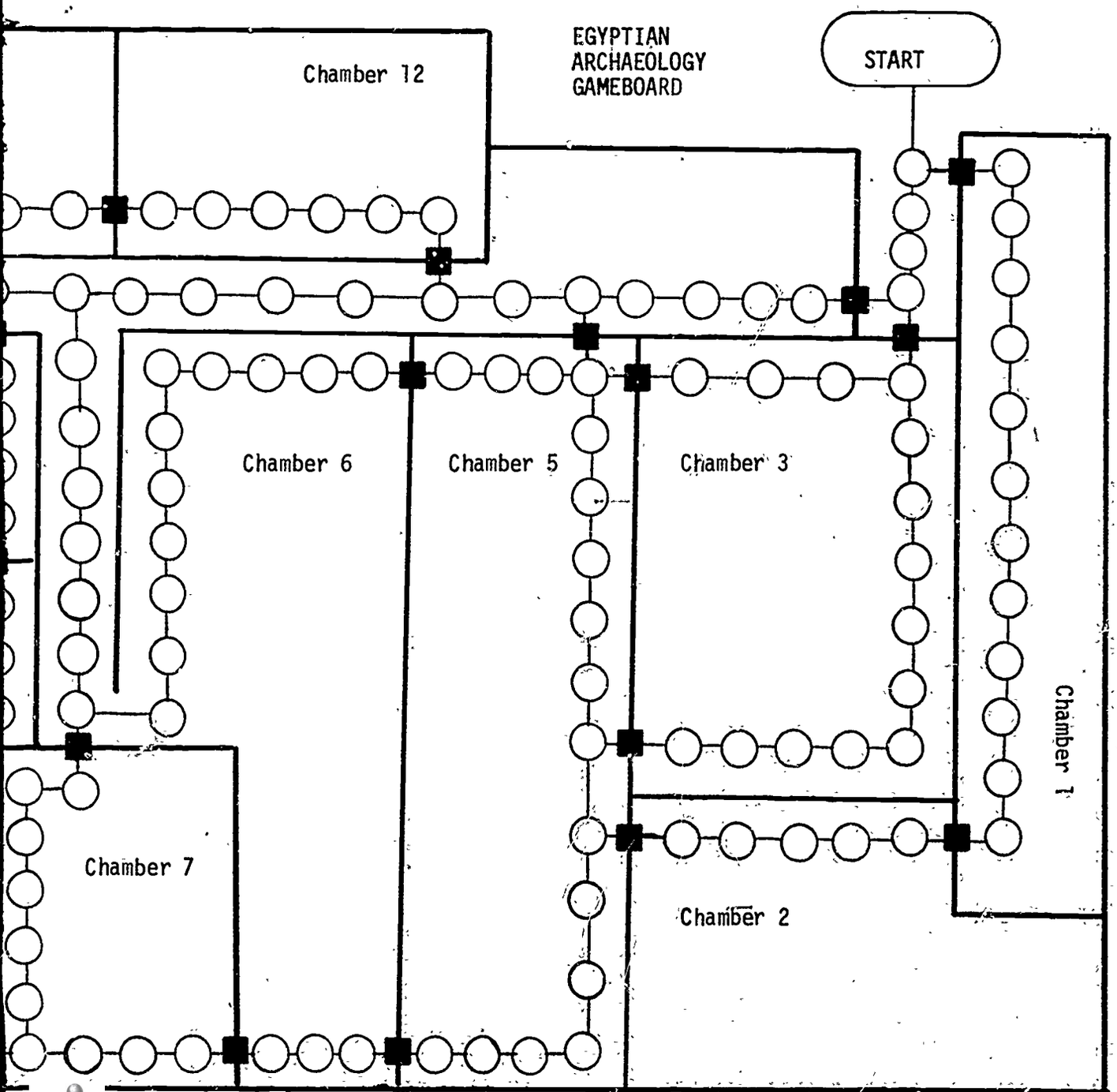
The boat is in fine condition, except that a neat hole, about six inches in diameter, is drilled in its bottom.

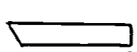
The faces on the lids of these canopic jars are laughing.

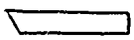

EGYPTIAN ARCHAEOLOGY SCOREBOARD
CHAMBER 11
CHAMBER 12
CHAMBER 4→
CHAMBER 10
CHAMBER 9
CHAMBER 6
CHAMBER 8
CHAMBER 7
CHAMBER 5

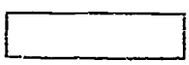
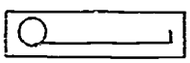

EGYPTIAN ARCHAEOLOGY SCOREBOARD
SCORE RULE
The higher of two dice tells what was discovered. See the number next to each discovery
CHAMBER 1
CHAMBER 2
CHAMBER 3
CHAMBER 4→
CHAMBER 5
CHAMBER 6
CHAMBER 12


EGYPTIAN
ARCHAEOLOGY
GAMEBOARD
Chamber 11
Chamber 12
Chamber 10
Chamber 6
Chamber 5
Chamber 3
Chamber 9
Chamber 7
Chamber 8
Chamber 2


EGYPTIAN
ARCHAEOLOGY
GAMEBOARD
START
Chamber 12
Chamber 6
Chamber 5
Chamber 3
Chamber 1
Chamber 7
Chamber 2

 A wall drawing of an Egyptian queen shows that she had brown eyes. But another wall drawing of the same queen shows that she had blue eyes.	 A statue moans as if it were alive. Later you find out that it has a panel in the back and is hollow inside.	 You have found a gold drinking cup. But it has little slits in the side so that the liquid would run out of it.	 When you co into the cha a bow (that on a rack i corner) sho arrow that misses you. show that t and arrow a 3300 years
 You have found an ancient Egyptian skeleton. But, when you look at the teeth, you find that it has had modern dental work.	 You have found the parts of a chariot. When you put the chariot together, the two left wheels turn out to be bigger than the two right wheels.	 The boat is in fine condition, except that a neat hole, about 6 inches in diameter, is drilled in its bottom.	 The faces o lids of the canopic jar are laughin

 A statue moans as if it were alive. Later you find out that it has a panel in the back and is hollow inside.	 You have found a gold drinking cup. But it has little slits in the side so that the liquid would run out of it.	 When you come into the chamber a bow (that is on a rack in the corner) shoots an arrow that just misses you. Tests show that the bow and arrow are 3300 years old.	 You find a chair leaning in a corner. It is perfectly built, except that it has only one leg, right in the middle, that come to a point.
 You have found the parts of a chariot. When you put the chariot together, the two left wheels turn out to be bigger than the two right wheels.	 The boat is in fine condition, except that a neat hole, about 6 inches in diameter, is drilled in its bottom.	 The faces on the lids of these canopic jars are laughing.	 You unwrap a mummy and find that it is only three days old. You recognize the mummy as one of your expedition guides.

 This sarcophagus was completely sealed and has never been opened. But, when you open it, there is no mummy inside.	 You open the sarcophagus and unwrap the mummy. It turns out to be the mummy of a Viking warrior.	MYSTERY CARD #1 You have been sneezing all day. But, when you come into this chamber, your sneezing suddenly stopped.	MYSTERY CARD #2 You keep feeling a cool wind blowing from somewhere inside the tomb.
MYSTERY CARD #3 You find a live snake in the chamber. But, this tomb has been sealed for many centuries.	MYSTERY CARD #4 There are nine people in your expedition. All nine of you went into the ancient tomb. But, ten people were scene coming out.	MYSTERY CARD #5 You keep hearing a strange clicking sound, like some-one throwing dice.	MYSTERY CARD #6 You see the mysterious shape of someone in white bandages running along a passageway.

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Mike Chester

Subject: Reading, Science

Activity Name: Salamander Study

Participation: whole class

Time: One class period

Theme

This is an activity based upon the long-toed salamanders of Santa Cruz County. (Ambystoma macrodactylum).

The students read a numbered list of statements regarding the salamanders, then enter the numbers onto a cartoon-map to indicate the pictorial event corresponding to each statement. Then, the students complete a multiple-choice, subjective quiz relating to the conservation of the salamanders. If time remains, students hold a discussion and carry out role-playing centered around controversies of salamander conservation.

Instructional Objective

Each student is to make correct matchings between written statements and cartoon events in at least 14 out of 18 instances.

Schedule

No calendar is needed, as this is a one-hour activity.

Bibliography

Spoken communication from Alan Holbert, Department of Biology, Cabrillo College, Aptos, California

Materials

Each student is to receive:

- Saga of the Long-toed Salamanders (a one page discussion)
- Salamander Scenes (an 18-item list of events)
- Salamander Map
- Salamander Quiz

Sequence of Events

1. Hold a class discussion, using the "Saga of the Long-Toed Salamander" as a basis for the discussion. Give the students a few minutes to read the paper before the discussion is opened.

2. Explain that the 18 items listed in "Salamander Scenes" are partly real, and partly imaginary. Items 15, 16, and 18 are totally fictional. The remaining items are either actual or have departed only slightly from the actual situation.

3. Each student is to enter the numbers 1 through 18 onto his Salamander Map to designate the 18 items of "Salamander Scenes." The approximately correct locations for the placements of these numbers are shown in "Salamander Map--Teacher's Key."

4. After comp ting their maps, the students are to work with the "Salamander Quiz." This is a multiple-c ce quiz, in which each student checks the responses that he favors. The responses are mainly a matter of opinion--however, the teacher will be able to discern coherent or incoherent patterns of response. In checking off the answers, as student is free to check as many responses to one question as he chooses. (None, one, some, or all items can be checked in each of the four sections, A-D, of the quiz.)

5. The four sections of the quiz have the following qualities:

   A. (cattle & spikerushes) ..... a realistic question, which most students will probably answer with the second response, in which the cattle are fenced off.

   B. (truck owner).... partly whimsical, but partly touching on serious issues of protecting nature, yet protecting the rights of a person accused of damaging the environment.

   C. (salamander song) .... intended entirely as whimsy.

   D. (Why should the salamanders be saved?) .... a realistic question, which most students will probably answer with several responses.

6. If time and interest remain after completion of the quiz, hold a class discussion relating to Section B of the quiz (what should happen to truck owner Newt Eftsoons?) Students will undoubtedly have mixed feelings, as they try to balance the protection of the salamenders against Newt Eftsoon's civil rights.

7. As an alternative to discussion, roles can be assigned, with one student becoming Newt Eftsoons, and others becoming district attorney, defending attorney, and jurors at Newt's trial or hearing.

SAGA OF THE LONG-TOED SALAMANDERS

Salamanders are small animals that look like lizards. But, they are actually very different from lizards. A salamander is a kind of "amphibian" -- an animal that (even though it comes onto the land) depends on ponds or lakes all its life. The main amphibians that exist today are frogs, toads, newts, efts, and salamanders. All of these creatures are a halfway step between fish and truly land-dwelling reptiles.

A salamander must lay its eggs in the water; also, it must stay moist in order to live -- that is why the skins of salamanders are covered by warty-looking moisture glands. Reptiles, on the other hand, do not depend on the water in these ways. Even swimming reptiles (for instance, crocodiles, alligators, turtles, and water snakes) lay their eggs on the shore and do not have to keep their skins moist.

The long-toed salamanders are a particular kind of salamander found only in Santa Cruz County, California. One special trait that these salamanders have is that the fourth toe of the front foot is unusually long. Scientists have not yet found out whether this long toe is of any special use to the salamanders.

These salamanders are a threatened species. They live near two ponds in Santa Cruz -- Valencia Lagoon and Ellicot Station -- and nowhere else in the world.

People who want to be sure that the long-toed salamanders survive have fought in court to prevent the use of these ponds for other purposes. If the ponds were destroyed, the salamanders would have no place to breed, and soon this rare species of animal would no longer exist.

SALAMANDER SCENES

1. There is a drainage of oils and gasoline from a newly-built hilltop gas station.
2. The drainage from the gas station flows into the nearby salamander pond, driving away the salamanders.
3. Meetings are held in which people argue about what protection should be given to the long-toed salamanders.
4. Nearby is a second pond -- still not damaged by man.
5. To the northeast of this pond, there is a chaparral hillside, where some of the long-toed salamanders live.
6. To the east of the pond is a willow grove. Probably most of the long-toed salamanders live in this grove.
7. Some of the long-toed salamanders may live in old gopher holes to the west of the pond.
8. This pond is on the property of a rancher, who lives in a nearby ranch house.
9. This rancher was interested in selling the pond area to a commercial trailer court.
10. But a court order prevented the sale, and the pond area was fenced off to keep people from disturbing the salamanders.
11. Rainfall is important to the salamanders, because it keeps the ponds full.
12. In the mating season, after the first spring rain, the salamanders migrate to the pond to breed.

(College students are studying the habits of the salamanders. Some examples of their studies are given in #13 and #14.)

13. Students measure the walking speed of salamanders on their way to the pond.
14. Students study salamanders in the dark, using red lanterns because the salamanders can't see red light.
15. Newt Eftsoons, the owner of a pickup truck, collects dozens of salamanders to "take them to a hidden pond in the mountains, where nobody will disturb them."

Salamander Scenes

16. The fish and game warden stops Newt Eftsoons and arrests him for handling the protected salamanders.

17. Cattle cause a problem by grazing on "spikerrushes" that are the main food of the salamanders.

18. A folk singer writes a song about the long-toed salamanders, with a tune something like the tune to "Little Boxes:"

"Salamanders in suspenders,
And they all wear long overcoats..."

Etc.

SALAMANDER QUIZ

A. What should be done about the cattle that are eating the spikerushes?

The cattle should be removed from the area. _____

The cattle should be fenced off from the pondside area where the spikerushes grow. _____

Nothing should be done. _____

B. What should be done about truck owner Newt Eftsoons?

He should be given the full penalty for interfering with the protected animals -- one year in jail and $1,000 fine. _____

He should be let off, because he was trying to help. _____

He should be given a lighter sentence: one month in jail and $100 fine. _____

C. The folk singer's salamander song is:

The worst song ever written. _____

Has nothing to do with salamanders. _____

Makes no sense _____

May help to raise money for salamander protection. _____

D. Why should the salamanders be saved?

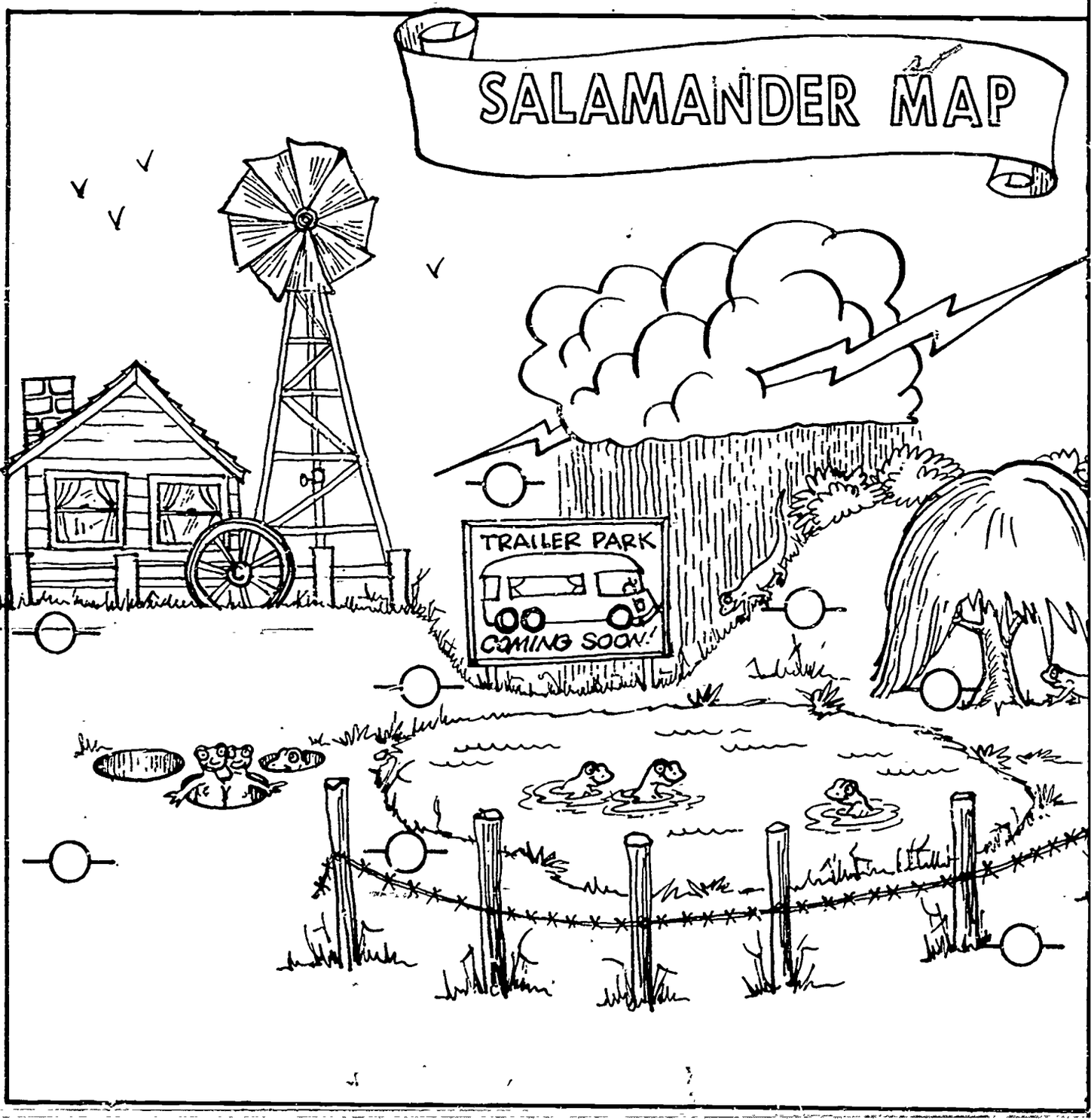
They should not be saved. _____

So scientists can learn about them. _____

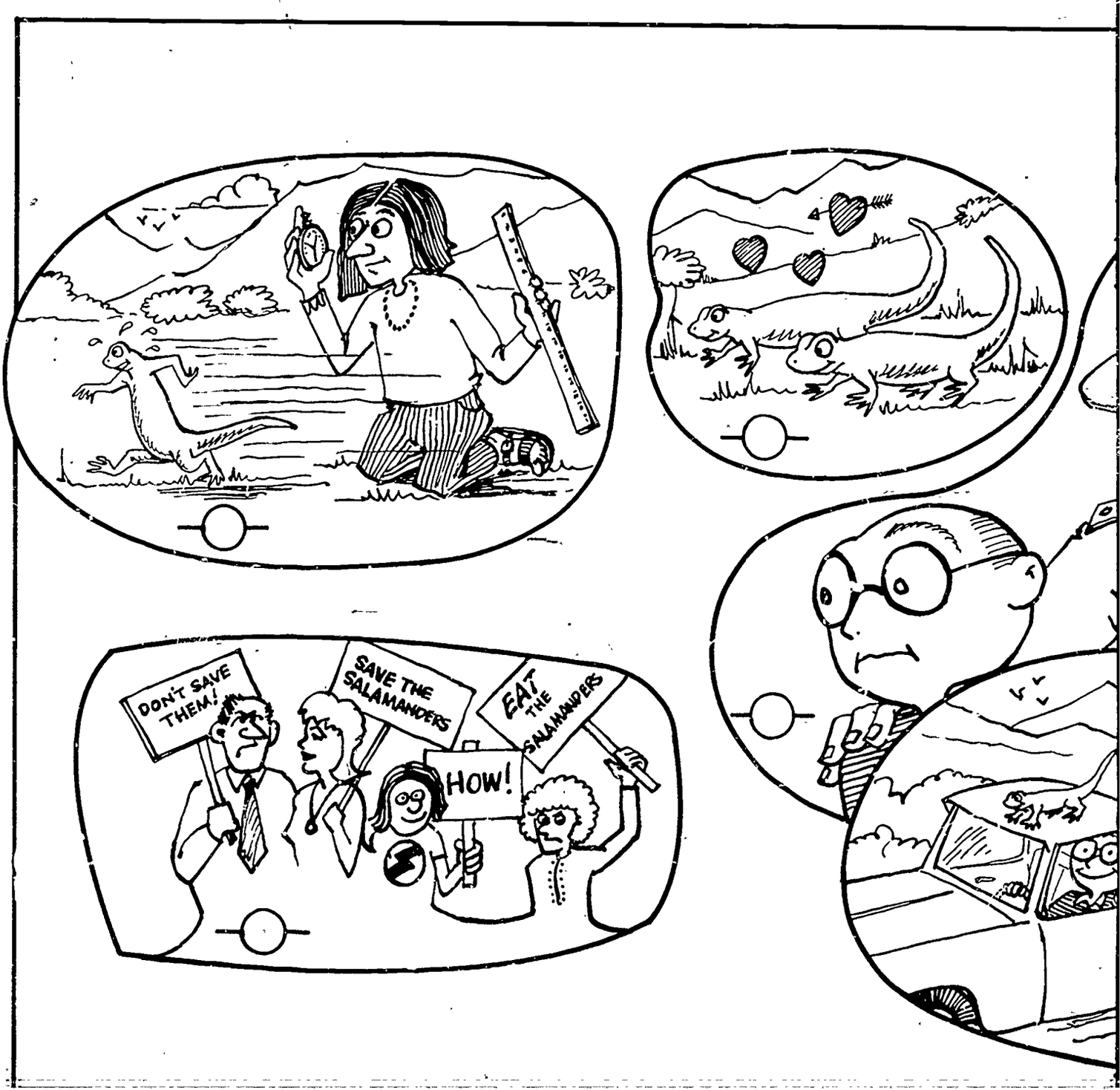
Because all of nature teaches us valuable lessons, and these salamanders can teach us useful or interesting things. _____

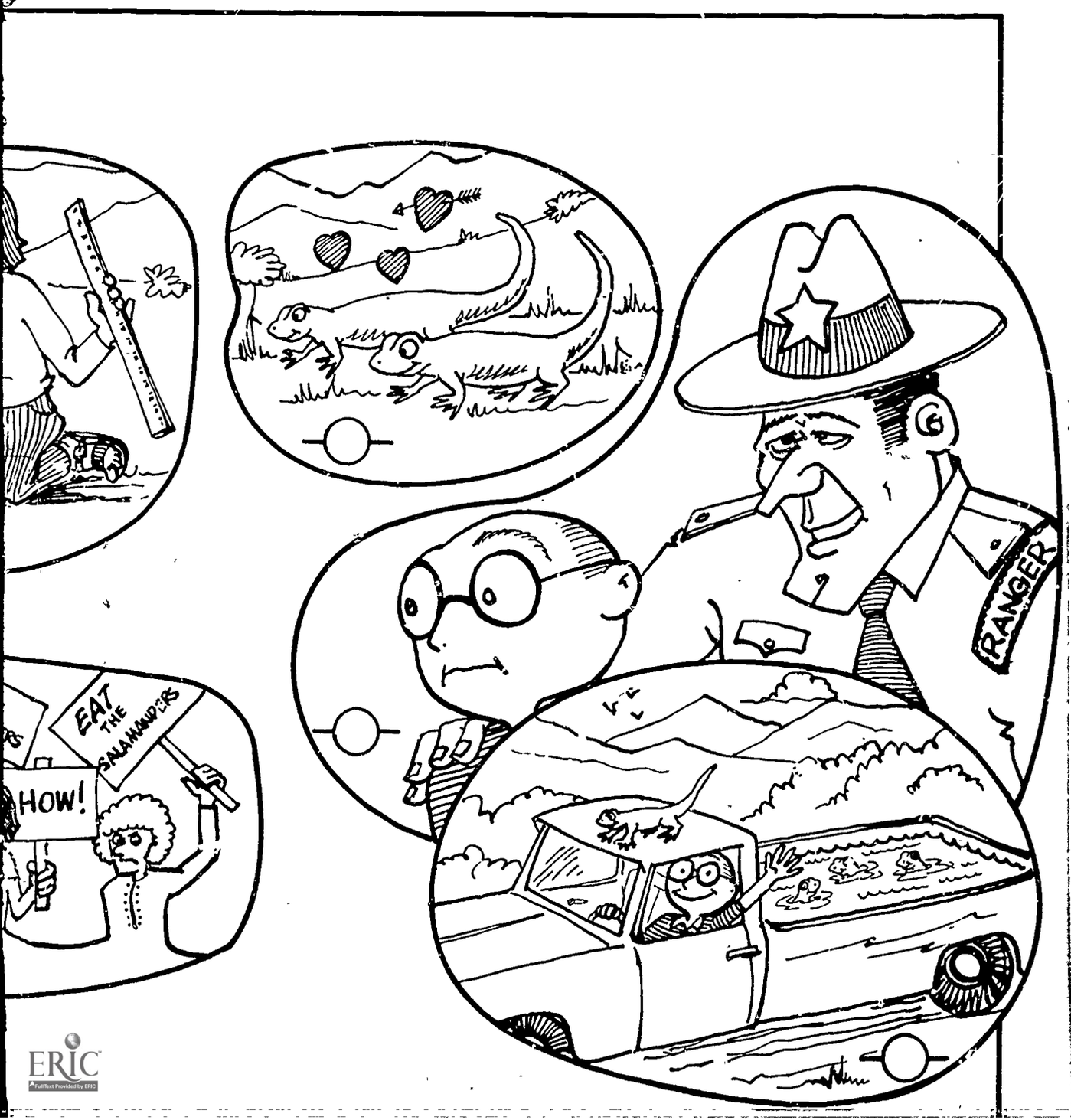
Because the balance of nature can be disturbed when some animals are destroyed. _____

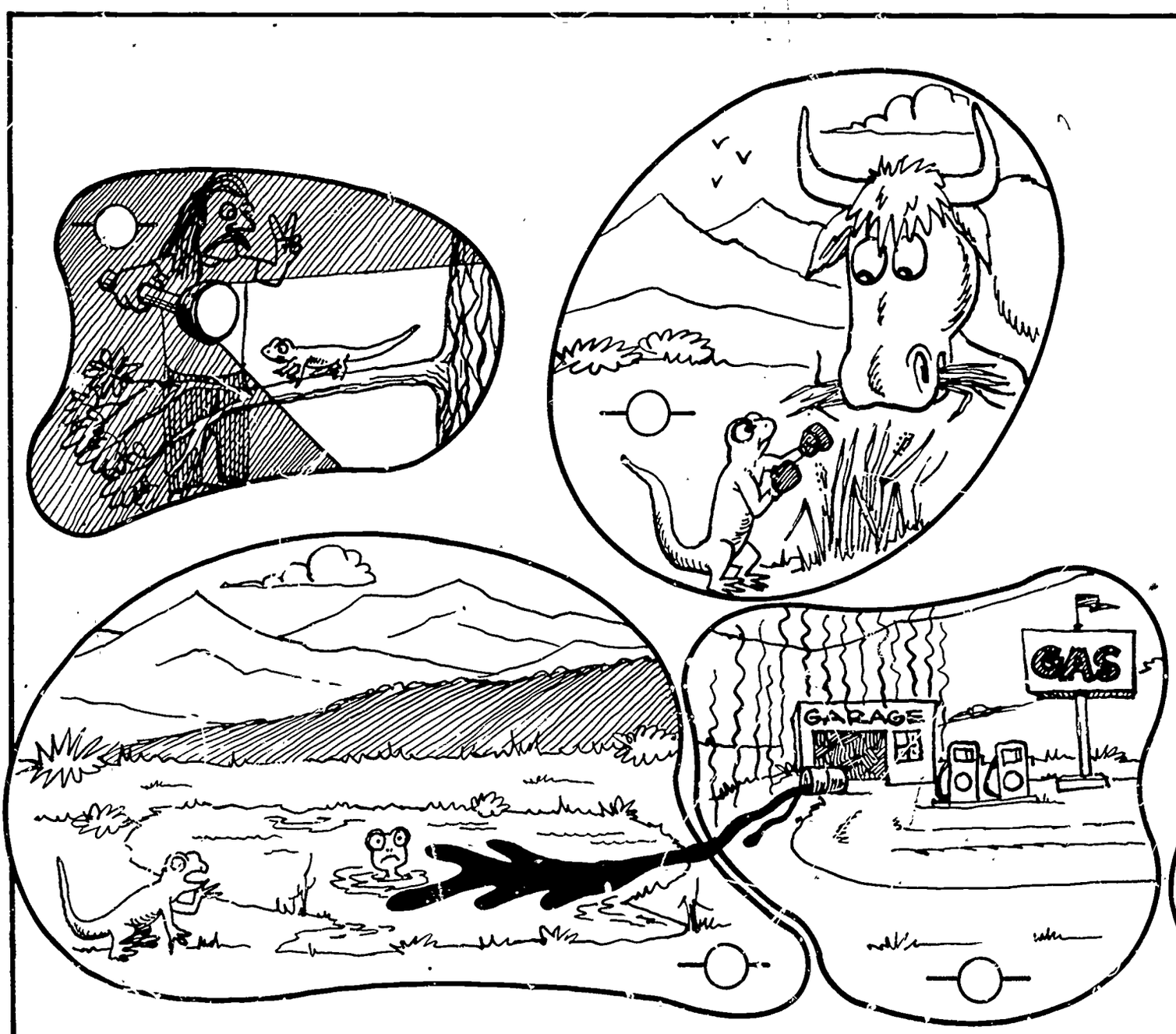
Because life matters. _____

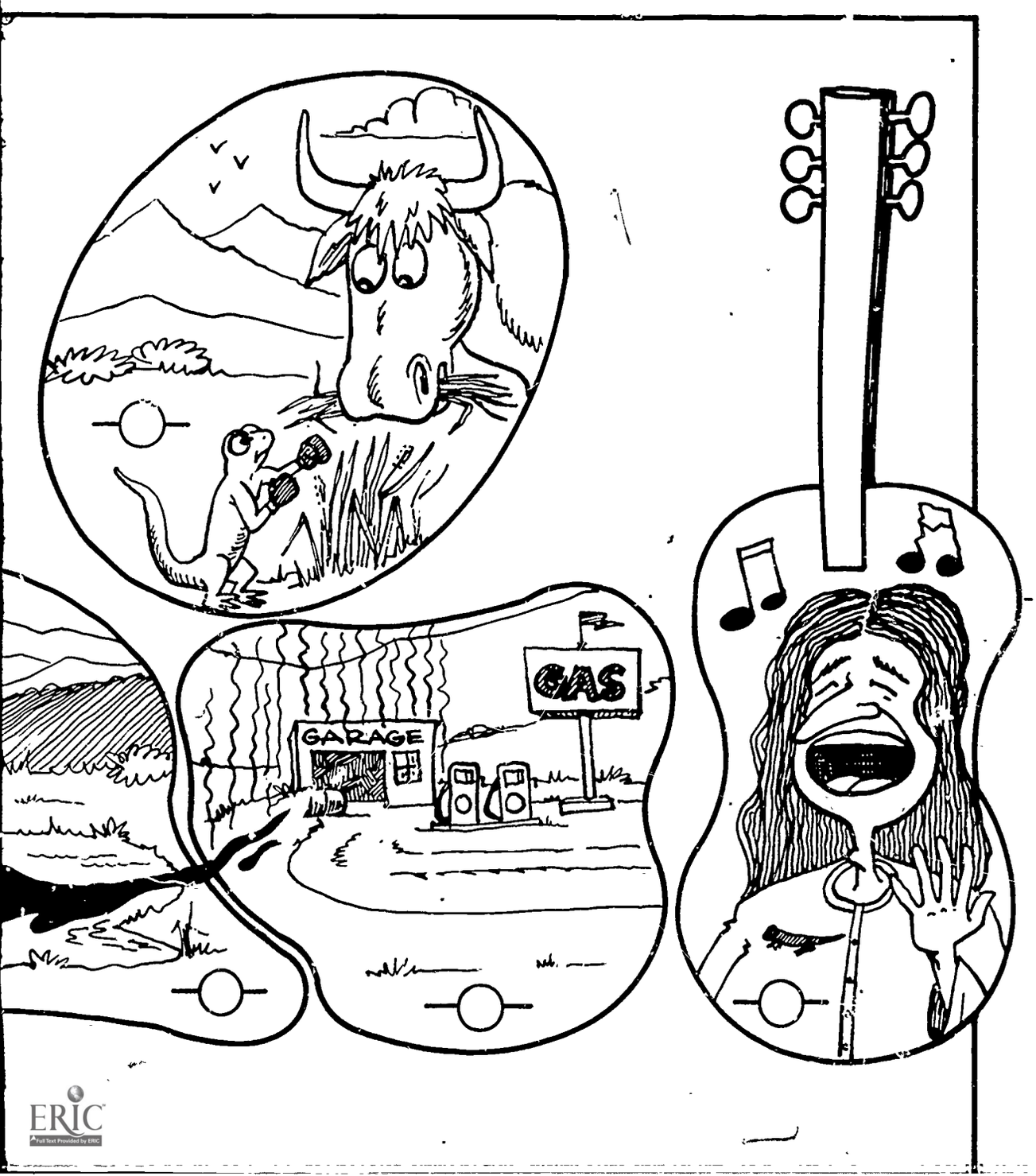

SALAMANDER MAP
TRAILER PARK
COMING SOON!


SALAMANDER MAP
TRAILER PARK
COMING SOON!


DON'T SAVE THEM!
SAVE THE SALAMANDERS
EAT THE SALAMANDERS
HOW!


EAT THE SALAMANDERS
HOW!
RANGER


GAS
GARAGE


GAS
GARAGE

Instructional Activity

Sunshine School
Santa Cruz County Office of Education

Designed by: Michael Chester

Subject: Reading and Discovery

Activity Name: The Zen-Deity-Science Quiz

Participation: Five to six students

Time: one - three days

Theme

This quiz game is similar to the television quiz show "To Tell the Truth." Three students assume the roles of guests on a quiz show. All three claim to be a certain person--but only one is telling the truth. In this activity, there is a difference in emphasis from that on the television show. The questions asked by panelists are designed solely to discern differences in attitude among the three guests who claim the same identity. For example, in the first cycle of play, the three guests claim to be Zen master Roshi Ishiguro. All three use the same data sheet to answer any factual questions about Zen. But each has a different pattern of responses regarding his attitudes and feelings. The two or three students who are "panelists" try to decide which attitude seems the most Zen-like. Both "panelists" and "guests" consult written guides as they frame their questions and answers. These guides provide general lines of inquiry and response for the students to follow.

After the "real" guest has been identified in each round of play, all participants have a chance to debate the implications of the roles and argue as to what the attitudes of (for example) an actual Zen master might be.

Instructional Objectives

Each student is to carry out his part of the quiz show dialogue in a way that reflects his reading of both the data sheet and the question (or response) guide.

Schedule

This activity can fill from one to three days (depending on how much discussion is generated in the activity) and no precise calendar is needed. However, it is probably advisable to carry out the three rounds of the quiz in this order: Zen master, Greek deity, scientist. Since the Zen sequence is probably the most vivid of the three and the scientist sequence the least vivid, that order of events