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Developing Laboratory Activities to Increase Student Motivation in Earth Science

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DEVELOPING LABORATORY ACTIVITIES TO

INCREASE STUDENT MOTIVATION IN EARTH SCIENCE

by

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A thesis (project), submitted to the Division of Curriculum and Instruction in partial fulfillment of the requirements for the degree of Master of Education

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ABSTRACT

Teachers for generations have struggled with the challenge of motivating students to learn in their classes. Literature suggests that a positive way to increase student motivation and academic achievement in science is with the laboratory experience. With the lack of adequate laboratory space in our schools, teachers are having to "make do" in science classes with limited space and budget. A need exists for 9th grade Earth Science laboratory activities that meet county course objectives and yet are simple enough to be used in a classroom setting, thereby eliminating the need for extra expenses for the science department. This project has developed a set of laboratory experiences appropriate for 9th grade Earth Science courses in Duval County.

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CHAPTER 1

INTRODUCTION

Secondary science teachers instruct students of all achievement levels. Because of the recent upgrading of high school graduation requirements, students of many achievement levels are taking science courses. However, students not only need to succeed in science in order to graduate from high school, but also must attain skills in order to compete in the marketplace. Further, in order for college-bound students to be accepted in the postsecondary institution of their choice, they need competetive college entrance examination scores and minimum grade point averages. Such competition promotes student concern for academic success in high school science courses.

Most teachers would agree that there is a difference in the learning of "motivated" and "unmotivated" pupils. If motivation is present, it can be a source of great joy for a teacher; yet, if it is absent, discouragement for the teacher as well as the student often results.

Teachers for generations have struggled with the challenge of motivating students to learn. Parents of unmotivated students also can experience helplessness in their efforts to interest their child in school subjects, including science. This problem can become especially evident with students in average or below average science classes since these students are not likely to be already interested in science content.

Both theory and professional experience in science teaching indicate that an increase in student motivation and academic achievement may occur with laboratory experiences. This increase in motivation is especially true when hands-on activities are included in classroom instruction, as opposed to students' observing only teacher demonstrations. In addition, by emphasizing student involvement with laboratories, the lecture and discussion portions of instruction may come to life in concrete experiences for the average science student.

Since teachers deal with students on a daily basis, they may be able to assist students in achieving their maximum academic potential in science as well as in other content areas. However, there is often a lack of available science laboratory equipment such as classroom sinks and workspace. As a result, there is a definite need for a lab curriculum that would meet both the needs of the pupil and minimum competency requirements and yet still be suitable in the typical classroom setting.

The curriculum presented in this project includes materials which most schools normally possess, thereby eliminating the need for science departments to acquire additional equipment. With a curriculum such as this in operation, students' learning experiences would be enhanced in such a way as to motivate them and thereby to increase their achievement in science.

The purpose of this project is to develop such a curriculum. The laboratory activities are constructed for 9th grade Earth/Space Science students and are applicable to the already established Duval County (Florida) course objectives. These activities will be simple enough to be applied within the typical classroom setting; yet, by their application, they should increase student motivation within the science classroom.

CHAPTER 2

REVIEW OF RELATED LITERATURE

This chapter is divided into five areas of study: 1) attitudes toward science, 2) the meaning of the term motivation in a school setting, 3) strategies which can be used to motivate learning in the science classroom, 4) learning by inquiry and its use in laboratory activities, and 5) criticisms of the lab-centered curriculum.

Attitudes Toward Science

In 1977 the Third Assessment of Science was conducted as part of an on-going National Assessment of Educational Progress (Yager & Penick, 1986). Relevent survey items were designed to determine students' feelings toward science, science teachers, and science courses. The original battery was administered to a total of 2500 persons representing four age levels. The four levels used were 9, 13, 17-year-olds, as well as a group of young adults.

In 1984 Vargus-Gomez reported on a sample of teachers from the National Science Teachers Association who used their students for gathering additional data in a further N.A.E.P. test. A random sample of approximately 1000 participants was used in this assessment.

The questions in both assessments were divided into three catagories: those which related to science classes, those which related to science teachers, and those which related to the value of science study. Specific questions from each category included:

A. Science Classes

1. Is your science class fun?
2. Is your science class interesting?
3. Is your science class exciting?
4. Does your science class make you feel curious?

B. Science Teachers

1. Does your teacher really like science?
2. Does your teacher make studying science exciting?
3. Does your teacher know a lot about science?

C. Value of Science Study

1. Do you feel that your study of science will be useful if you study more science?
2. Do you feel that knowing a lot about science will help you in the future? (Vargus-Gomez, 1984)

According to data collected from the first set of questions, 9-year-olds found science classes the most fun, with the number of positive responses falling as the age increased. The younger students felt that science classes were interesting with 84% giving a positive response. When asked whether science classes aroused curiosity, less than 50% of the 9-year-old responses were positive, and the numbers decreased with the older age groups.

In the second set of questions, about one third of the elementary students felt that they were being taught by science teachers who enjoyed their work. In contrast, the percentages rapidly increased to 75% and 80% when comparing junior and senior-high students, respectively.

The data from the third set of questions suggest that elementary teachers do a better job of making science exciting to students than the junior and senior-high teachers. A conclusion from this third set of questions is that the longer students are enrolled in a science course the less likely they are to enjoy it. Yeager and Penick (1986) suggest that perhaps we need to teach differently. They further imply that the eagerness and enthusiasum of seemingly competent teachers may be overwhelming to the junior and senior-high students. Or perhaps teachers in the upper grade levels are so eager to tell others what they know that they foget about the basic needs of their students.

Teaching science is more than simply telling facts and figures and expecting the student to absorb it. Teaching is an act that includes communicating information in such a way as to make it interesting, yet being able to point out significant information for future use in the scientific field.

Research by Talton and Simpson (1986) suggests that the family can have a strong influnce on students' attitudes toward science. Perhaps the family can exert a positive influence on students and encourage further science study. Their research also indicates that having parents who are interested in their child's homework and actively involved in the home learning environment positively influences attitudes toward science.

Student attitudes toward science can be improved if teachers will follow the guidelines set down by Yeager and Penick (1986) : When we begin to teach science dynamically, as it exists in the real world, and not as a static subject in texts, we may see different perceptions by students. We must offer real world science, useful now and in the future. As we begin concentrating on meeting the needs of our students we will see increased enrollments, more positive viewpoints, and enhanced science literacy. (p.362)

What Is Motivation In School

Biechler and Snowman (1986), writers of a general textbook on educational psychology, conclude that motivated learners are those who are responsible, curious, and inquiring. All of these are qualities that teachers attempt to bring forth. They acknowledge that if teachers can arouse the student's interest in a subject so that the student wants to attend class because learning is fun, then teachers have succeeded in motivating students.

Biechler and Snowman summarize the two types of motivation with which schools are concerned. Extrinsic motivation is demonstrated by students who must receive some type of praise in order to continue to study. Extrinsic motivation includes such behaviors as praise, a pat on the back, a high grade on a test, or some type of monetary or physical reward for a job well done.

Under ideal conditions we would prefer our students to demonstrate intrinsic motivation. This is evidenced by students who study a subject for its own sake. Some of the more advanced students do show intrinsic motivation, but by far the majority of students, especially those of average to below average academic standing, can be classified as those requiring extrinsic motivational techniques.

Research conducted by Glasser (1986) suggests that the only way teachers can be successful motivators of students is to ensure that the school satisfies the basic psychological needs of its pupils. It is fairly simple for college students to understand that in order for them to become more financially secure they will need a college degree. On the other hand, it is hard to convince junior-high students that they will not have a roof over their heads or food on the table if they do not perform well academically. Glasser (1986) suggests that "to motivate students, schools must concern themselves less with security and survival and more with the everpressing psychological needs for freedom, friendship, fun, and power" (p.37).

Sava (1987) indicates that it is easier to convince students in elementary schools to attend classes than it is to convince students in the junior and senior-high schools. Grade-schoolers take pleasure in being at school for several reasons. First of all, school for a young child is an adventure each day he or she arrives in the classroom. It is a change from the routine previously experienced in staying home on a daily basis. For secondary students, by now attending school for 180 days a year for the past eight or nine years, school has become routine. To them the routine becomes boring rather quickly, especially for those students who have not encountered a great deal of success at school. For these students, attending school daily has become a tedious and unpleasant routine.

Secondly, Sava points out that most teenagers are at the point in their lives where adult authority is not readily accepted; students of that age will have an initial negative attitude toward their teachers for that reason alone. Younger children, on the other hand, often respect the authority of an older person and therefore will submit to adult wishes much more easily than the adolescent.

The third point Sava emphasizes is the notion that peer pressure among elementary-age students does not exert as negative an influence as it does on older students. Peer pressure alone can destroy an honor-roll student at the middle-school level because he or she has a higher priority to be accepted than to maintain high academic standing. Once students have determined the difficult lesson that self-discipline and determination can lead to positive progress, they will have learned from that point on that they themselves can shape their own fututes; they also learn that if they fail, they have no one else to blame but themselves.

Motivational Stratagies

McDaniel (1985) suggests the following list of "ten commandments" for teachers to follow as a means of promoting success through motivation.

1 "Thou Shalt Build an Interesting Curriculum" (p.19). Teachers are to correlate fascinating topics with the course objectives.

2 "Thou Shalt Set Clear Goals" (p.20). Students will move toward goals when they have been clearly established.

3 "Thou Shalt Communicate High Expectations" (p.20). Teachers should state goals in a positive manner and in such a way that the students can attain them and succeed.

4 "Thou Shalt Employ Positive Reinforcement" (p.20). Teachers should acknowledge those students who comply with the objectives and praise them for success.

5 "Thou Shalt Invite Success" (p.21). Teachers must have a positive attitude toward their students which can be demonstrated by increasing the frequency of asking open-ended questions.

6 "Thou Shalt Teach Cooperation" (p.21). By using small-group learning strategies and by involving students as role models for others, supportive reltionships can be established.

7 "Thou Shalt Demonstrate Enthusiasm" (p.21). A teacher who brings "spice" into the classroom will hold the attention of the students.

8 "Thou Shalt Personalize Instruction" (p. 22). This is possible through personal examples in classroom discussions and illustrations.

9 "Thou Shalt Induce Readiness to Learn" (p.22). This can be accomplished by asking thought-provoking questions.

10 "Thou Shalt Encourage Student Responses" (p.22). When teachers ask questions, they need to provide adequate wait time.

In summary, McDaniel argues that a competent teacher who abides by these ten commandments can turn a boring classroon into one filled with excitement and student success. These techniques can also help the teacher to be the best he or she can be.

The following four techniques described below have been suggested to teachers by Webb and Baird (1980) as a means to increase motivation in the science classroom.

Normsetting

This activity is a cooperative effort between the teacher and students to create positive learning conditions in the classroom. According to Webb and Baird, this technique should be used early in the school year as the teacher discusses goals, expectations, behaviors, and commitments of both the teacher and the students. After these are understood by teacher and students, a formal agreement should be made to include procedures for carrying out the goals, the limitations involved, and the consequences identified for both the teacher and the students. The teacher and the students must follow through for the entire year with a commitment to accomplish established goals and to accept the consequences when goals are not met. Normsetting will enhance success by allowing students to catch a glimpse of the positive view of what they are capable of doing. By adopting mutually agreed-upon goals, students understand how they are to behave in order to achieve those goals. The teacher and student have come to a mutual agreement about the consequences of off-task behaviors.

Curiosity Through Paradox

Arnstine (1966) remarks that "curiosity is an event that occurs when certain conditions are met and it is up to the teacher to ptovide those conditions" (p.601). Webb and Baird define paradox as "the appearance of contradiction within a phenomenon" (p.27); it is used to provoke student questions. An example of this idea within the science classroom is to confront students with society's knowledge about the harmful effects of substances such as tobacco or alcohol along with evidence of society's behavior with respect to these substances. The inconsistency between these two contrasting phenomena would tend to raise questions in the minds of students.

Inquiry Through Student Questions

The third motivational strategy suggested by Webb and Baird calls for the learner's framing of questions about content. The questions are raised by the pupil because of the style in which the material is presented by the teacher.

Clark and Webb (1980) acknowledge that teachers cannot give an answer to someone who has not first asked the question. In order for maximum learning to take place, it is important that the question be initiated by the student. The teacher can assist in raising the question if necessary, but he or she must make sure the student has adopted it before it is answered. This can be called interrogation of the subject matter.

An example of how students can be assisted to ask questions about the subject matter is the use of laboratory experiences in science. Surveys by Gould (1978) showed that in recent years, the laboratory is being used as a tool in arousing interest and in training students in problem -solving by having them question why a particular activity turned out the way it did. Osborne (1976) found that first-year undergraduates regarded laboratory studies as the most effective learning environment for creating interest in physics and for developing critical-thinking skills.

Learning By Inquiry - The Laboratory Way

According to Perez (1982), the 1980-1981 Board of Directors of the National Science Teachers Association unanimously adopted the following statement regarding the place of the laboratory in science education: "The National Science Teachers Association endorses the necessity of laboratory experiences for teaching and learning in science instruction. Adequate support for materials, equipment, and teacher time must be available for the schools to maintain quality science instruction. Such a quality program is critical in today's age of science and technology" (p.20).

Other science-education groups agree with this position. According to Tafel (1982) professors of science argue that the most effective method of teaching science is by using the hands-on approach. He says that national tests show increased achievement scores due to the increased use of the laboratory as a means of motivation.

Perez (1982) states that the laboratory serves as a place where students can do science rather than as a place to learn about it because the students are actively involved with the learning taking place. She believes teachers eliminate a student's learning potential when they eliminate laboratories.

Bybee (1982) argues that the use of laboratories in teaching is "basic" in science education. It is basic because it develops critical-thinking skills.

Bates (1982) suggests that the interpretation of research on the effects of laboratory use can become confusing due to the many different types of laboratories available. He suggests 5 different types of laboratory experiences. The 5 types are: 1) exploration, in which phenomena are observed by the student; 2) operation, in which students use accepted procedures to gather data; 3) deductive verification, in which students infer a measurement; 4) inquiry, in which students explain some novel phenomena according to the concepts being studied; and 5) process, in which students are responsible for designing and evaluating an experiment. He further asserts that hands-on laboratory experiences are essential to the learning process, especially for secondary science students who have yet to master abstract reasoning patterns.

According to Nagalski (1980), twenty years ago the science curriculum was revitalized using the inquiry method of learning and teaching which encourages youngsters to ask the questions that will lead them to the answers they seek. By using the inquiry method of teaching, students are encouraged to put the scientific method into practice. Herron (1971) suggests that students can use the inquiry method to help them recognize and state problems and thereby pursue answers that will serve as the final product and the starting point for further study. Clearly, the secondary school laboratory is a natural place for inquiry-oriented lessons.

Through inquiry, students are conditioned to think critically and creatively and to generate their conclusions based on observations they themselves collect. In effect, they are becoming scientists.

A discouraging point was made as a result of studies by DeRosa, Lockard, and Paldy (1979). They noted that today's science curricula are becoming more textbook-dominated and less lab-oriented which would tend to decrease the application and use of the inquiry mehtod of teaching.

Criticisms of the Lab-Centered Science Curriculum

Dyrli (1981) begins his discussion of criticisms by considering the economics of textbook-centered learning versus the laboratory method. When textbooks are the center of the curriculum, only the first year requires heavy expenditures as the new book is presented in the classroom; since the book will continue to be used fo approximately the next 5 years, subsequent years will require little expenditure. In a lab-centered program additional money from the budget is needed each year for the purpose of buying laboratory materials which cannot be recycled.

Dyrli's second criticism concerns the lack of support by teachers. It seems that this lack of support is leading to a decreased use of the lab-centered science classroom. Teaching science from textbooks is easier for teachers to manage since they do not have to coordinate and organize laboratory activities that correlate with textbook concepts. Until recently, money was appropriated by the National Science Foundation to train teachers in how to use the inquiry-based science method. But according to Dyrli, recent tightening of budgets has eliminated this money. Therfore, new teachers of science do not know how to use the materials provided for them. By comparison, the apparent simplicity of using the textbook approach makes it most appropriate for the beginning teacher.

Dyrli argues that before lab-centered programs were developed, science was mostly a reading program with an occasional laboratory activity used as a teacher demonstration. Since the developement of lab-centered programs teachers are helping students learn by engaging them in inquiry-based studies. Dyrli summarizes by saying that if teachers first would have a positive attitude toward the use of laboratories and, secondly, would apply careful budgeting of items and sharing of kits and materials, they could adapt the lab-centered approach to science education and be successful at it.

According to Dyrli, "the activities provide children with the experience they need to understand both the substance and the significance of what they are reading; to omit them brings us back to science as trivial information and predetermined conclusions, and ignores all that we know about how children learn" (p.39).

CHAPTER 3

PROCEDURES

The review of related literature in Chapter 2 suggests that students involved with "hands-on" laboratory activities tend to perform at a higher academic level than those students without a laboratory-oriented background in science. The literature also indicates that students who are actively part of the laboratory situation will be motivated to a greater degree than students who simply witness a teacher demonstration as the laboratory activity. Also, laboratory instruction incorporates principles about how students actually learn.

The objectives used in the development of this curriculum are those which have been adopted within the Duval County (Florida). These established objectives have been written to ensure broad knowledge of the Earth/Space Science areas in the 9th grade standard curriculum. Upon completion of the course, students should have a better understanding of earth forces, composition, weathering and erosion, atmosphere, the oceans and space, as well as other related topics in the earth science field.

The content included addresses some of those concepts mentioned in the county-adopted Earth Science curriculum guide. The content will be presented using the laboratory to promote inquiry by the student; such presentation will likely serve as a motivation technique in order to increase student interest in the science classes. The content developed in the laboratory will proceed in the same order and with the same organization as inplied in the established objectives.

The content included was designed after circulating a letter to four other teachers in the Earth Science field. (See letter in Appendix) These teachers were asked to indicate those areas in Earth Science where they felt additional laboratory materials and activities were needed to supplement the materials already available from the county adopted textbook and resource materials. The teachers were also asked to indicate those objectives that lacked any laboratory materials at all so that activities could be compiled to ensure better student understanding through participation in the "hands-on" learning process. Furthermore, those laboratory activities which are already recommended but require excessive amounts of preparation time or extra science department expense were simplified so procedures can be followed while still maintaining the same academic focus as the original activities.

The curriculum is categorized by the county course objective being covered. Also included are individual activity objectives. A list of materials needed, procedures, and an evaluation are part of each laboratory activity. Evaluation of the laboratory curriculum materials was done by several Earth Science teachers currently teaching the subject matter in Duval County (Florida) public schools. Because these teachers are teaching the Earth Science curriculum they are familiar with the already available materials and the short comings of the county adopted resources. These teachers can therefore make an accurate and constructive evaluation of the laboratory curriculum as it is presented and predict its effect on student learning of ninth-grade earth science.

Some of the curriculum from Chapter 4 was adapted from Duval County suggested lab activities. Other material came from resource materials compiled during my teaching career or loaned to me by other Earth Science teachers. Workshops I have attended have also provided some of the ideas used in the curriculum, as well as various textbooks suggesting ideas which I have incorporated into parts of the laboratory curriculum.

CHAPTER 4

EARTH SCIENCE LABORATORY CURRICULUM

The following 12 activities are arranged using the following format: County Objective, Objective, and Activity. An answer key for teachers is provided after each exercise.

IDENTIFYING COMMON MINERALS

County Objective: 1.2(4) Identify an unknown mineral by applying identification properties of luster, color, streak, hardness, or cleavage.

Objective: Determine how the physical properties of minerals can be used to identify them.

Materials: Set of common mineral samples

Magnet

Piece of dull tile

Copper penny

A steel nail

A piece of glass

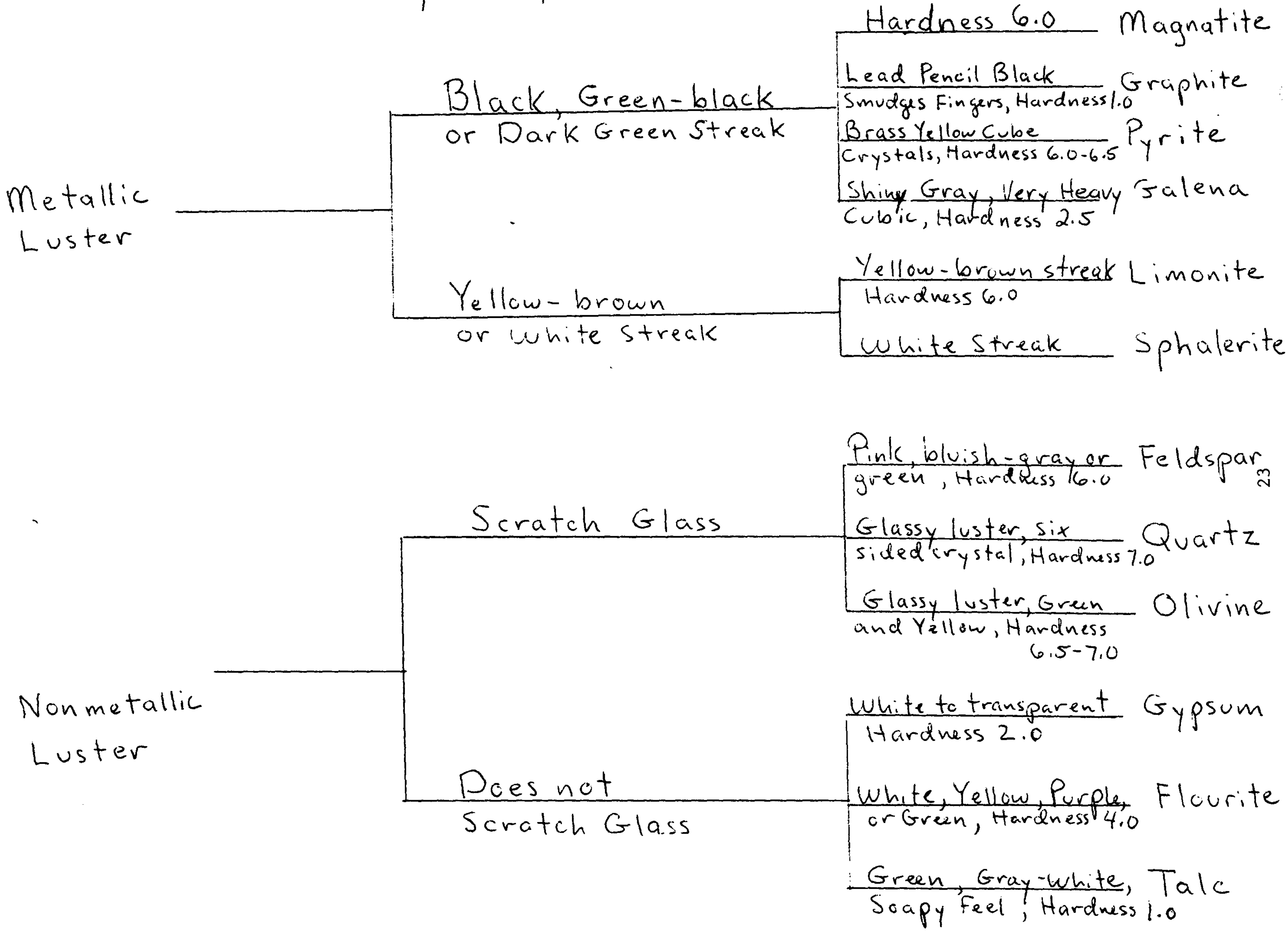
Procedure: Carefully test and observe each of the mineral samples to determine its physical characteristics. Use the Summary of Physical Properties as your guide. Enter your observations in the appropriate column in the Data Table.

Evaluation: Each student will correctly identify the six unknown mineral samples.

TABLE OF HARDNESS OF COMMON ITEMS

ITEM	APPROXIMATE HARDNESS
Fingernail	2.5
Copper penny	3.5
Steel nail	5.5
Glass	6.0

Summary of Physical Properties



Data Table

Mineral Number	Color	Streak Color	Luster		Magnetic		Hardness			Mineral Name
			Metallic	Nonmetallic	Yes	No	Less than 2.5	2.5-6.0	More than 6.0	

Data Table

Mineral Number	Color	Streak Color	Luster: Metallic	Luster: Nonmetallic	Magnetic: Yes	Magnetic: No	Hardness: Less than 2.5	Hardness: 2.5-6.0	Hardness: More than 6.0	Mineral Name
1	gold	greenish black	✓			✓			✓	pyrite
2	pink	none		✓		✓			✓	feldspar
3	colorless	none		✓ glassy		✓			✓	quartz
4	silver	black gray	✓			✓		✓		galena
5	black	black	✓		Extreme ✓				✓	magnetite
6	gray	gray		✓	✓		✓			talc

Longitude and Latitude Worksheet 1

County Objective: 3.1(2) Explain how locations and directions are determined.

Objective: To study some of the basic features of longitude and latitude.

Activity: Study the attached map to answer the following questions.

Definitions: Longitude - parallel lines running north and south that measure distances east or west of the Prime Meridian.
Latitude - parallel lines running east and west that measure distances north or south of the equator.

Materials: United States map or globe

1. What is the longitude and latitude of the city in which you live?________________

2. How many of the states are intersected by the 30 degree latitude line?________________

3. What is the longitude and latitude of point A?______________

4. What is the approximate latitude of the Florida Keys?________________

5. What is the approximate latitude and longtitude of point B?______________

6. What is the exact longitude of point C?______________

7. What is the difference in longitude between points C and A?________________

8. What is the exact longitude and latitude of point D?_________________

9. In what state would you find longitude 120 degrees and latitude 37 degrees?_____________

10. In what state would you find longitude 76 degrees and latitude 43 degrees?_______________

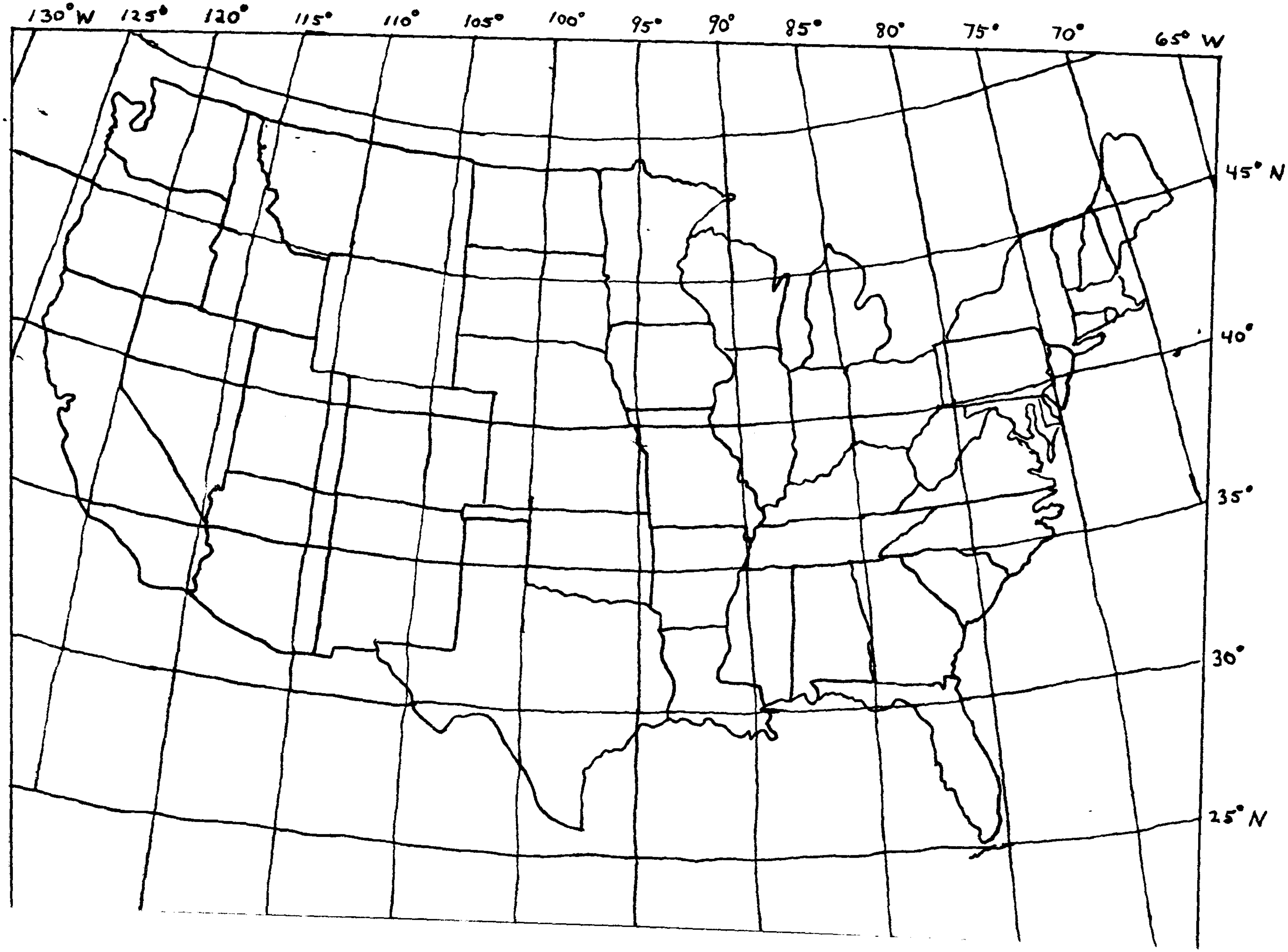
11. Place a point "E" at longitude 102 degrees and latitude 42 degrees.

12. Place a point "F" at longitude 107 degrees and latitude 46 degrees.

13. In what state would you find longitude 93 degrees and latitude 32 degrees?__________________

14. Place a point "G" at longitude 105 degrees and latitude 35 degrees.

15. In what state would you find longitude 84 degrees and latitude 33 degrees?_____________


130°W
125°
120°
115°
110°
105°
100°
95°
90°
85°
80°
75°
70°
65° W
45° N
40°
35°
30°
25° N

Longitude and Latitude Wokksheet 1

Answer Key

1. 31 N, 82 W

2. 3

3. 110 W, 40 N

4. 25 N

5. 97 W, 32N

6. 85 W

7. 25

8. 95 W, 45 N

9. California

10. New York

13. Louisiana

15. Georgia

Longitude and Latitude Worksheet 2

County Objective: 3.1(2) Explain how locations and directions are determined.

Objective : To locate places on a map using longitude and latitude.

Activity : Study the attached map to answer the following questions.

1. At what longitude and latitude do you live?

2. At about what longitude and latitude is Alaska?

3. The center of Australia is located at approximatly what longitude and latitude?

4. The equator is located at what latitude?

5. Name the one continent that latitude 47 S passes through.

6. Name the continents that are found on longitude line 0.

7. What country is found at 45 W and 77 N?

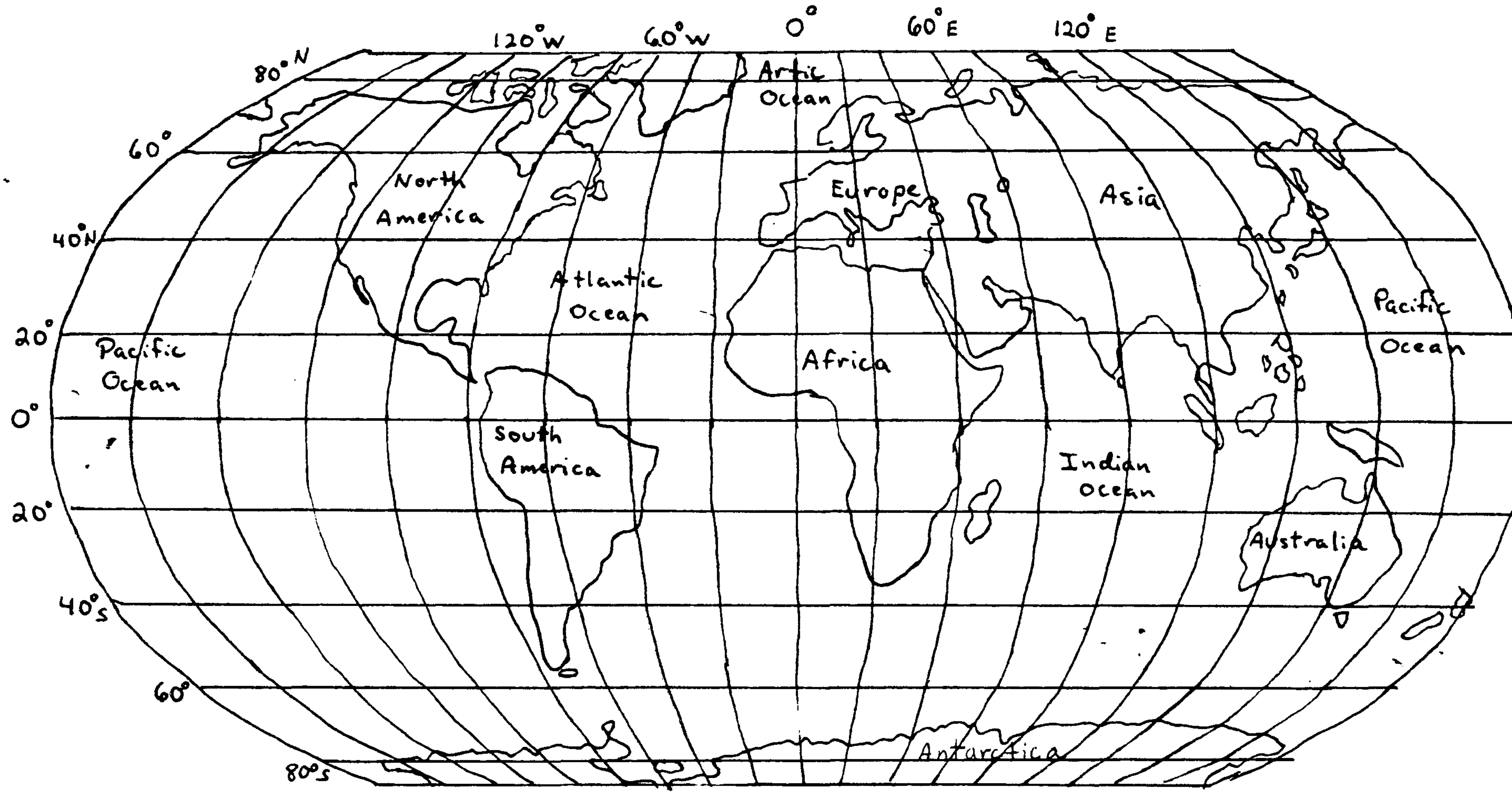
8. What body of water is located at 77 N and 45 E?

9. What continent is located at 18 S and 135 E?

10. How many different continents does latitude 60 S pass through?

11. What continent is located at 22 N and 80 E?

12. What body of water is located at 30 N and 160 E?



80°N
120°W
60°W
0°
60°E
120°E
Artic Ocean
60°
North America
Europe
Asia
40°N
Atlantic Ocean
Pacific Ocean
20°
Pacific Ocean
Africa
0°
South America
Indian Ocean
20°
Australia
40°S
60°
Antarctica
80°S

Longitude and Latitude Worksheet 2

Answer Key

1. 30 N, 80 W
2. 70 N, 160 W
3. 30 S, 130 E
4. 0
5. South America
6. Europe, Africa, Antarctica
7. Greenland
8. Artic Ocean
9. Australia
10. 0
11. Asia
12. Pacific Ocean

Making A Topographic Map

County Objective 3.3(1) Explain how contour lines are drawn.

3.3(2) Determine the coutour interval when given a map.

3.3(4) Determine the elevation of specific points when given a map.

Objective

Make a topographic map using cutout contour shapes.

Materials

scissors, ruler, paper, glue, colored pencils or markers

Procedure

A. Trace the contour shapes of Sea Gull Island on a sheet of paper and cut them out. Trace the dashes too. The outline of the largest shape represents 0 feet of elevation. Each smaller shape represents 20 feet more of elevation.

B. Glue the largest shape on another sheet of paper.

C. Place the next-largest shape on top of the largest one. Glue this smaller one one top of the larger shape, lining up the dashes on both pieces.

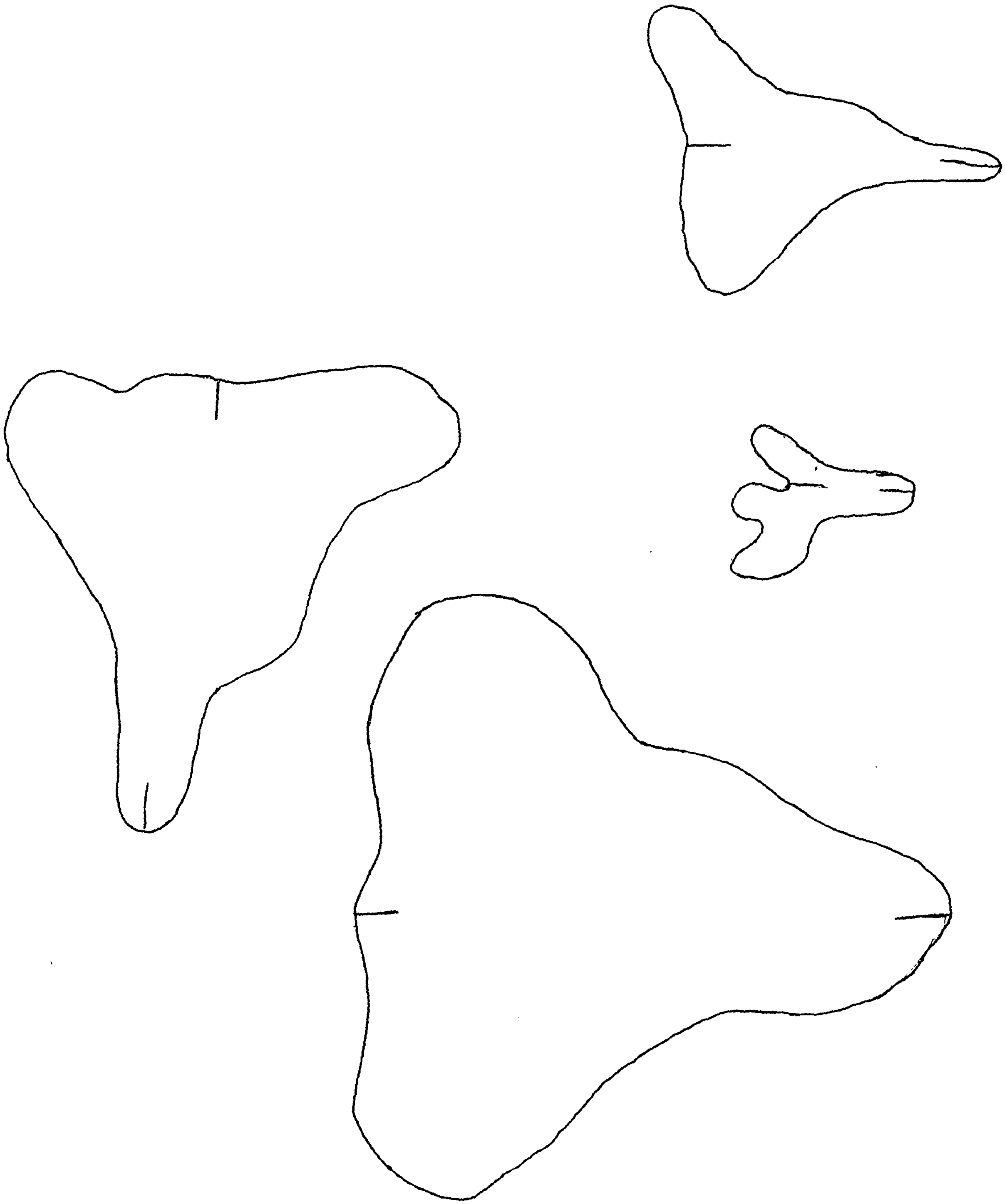
D. Repeat Step C until all the shapes have been glued down.

E. Draw each contour line by tracing around each shape with a colored pencil or marker. Label each contour line, starting with 0 feet.

F. Draw a scale at the lower right side of your contour map sheet to show that 1 cm is equal to 150 feet.

QUESTIONS

1. What is another term for 0 ft?
2. Which shape represents the highest elevation?
3. About how long is Sea Gull Island?
4. What is the highest elevation represented on your map?
5. What is the contour interval of your map?
6. What part of your map has the most gentle slope?
7. What do the contour lines on a topographic map show?
8. How would the contour lines appear for an area that has a steep slope?
9. List several features found on a topographic map.
10. Why doesn't the highest point on a hill have a contour line?



Making A Topographic Map

Answer Key

1. sea level
2. the smallest shape
3. 1650 feet
4. 60 feet
5. 20 feet
6. where the contour lines are fartherest apart
7. points of equal elevation
8. close together
9. mountains, valleys, bodies of water, elevation, swamps railroad tracks
10. Only one point is highest. Contour lines connect two or more points that have the same elevation.

Topographic Worksheet 1

County Objective: 3.1(2) Explain how directions and location determined

3.2(3) Explain how a scale is determined.

Objective: To study some of the basic features of a contour map.

Activity: Study the attached contour map to find the answers to the questions which follow.

1. What is the contour interval of this map?__________

2. How many square miles are represented by this map?_________

3. The correct scale for this map is:_________

4. What is the elevation of Forest Lake?_____________

5. What is the maximum elevation of point A?_________

6. What is the elevation of point C?____________

7. Is John's River an inlet or an outlet of Forest Lake?_________

8. Does Red River flow into or out of Forest Lake?________

9. What is the gradient per mile between points D and E?_____________

10. To the nearest half-mile, determine the length of the portion of Lonesome Trail that is shown on this map.__________

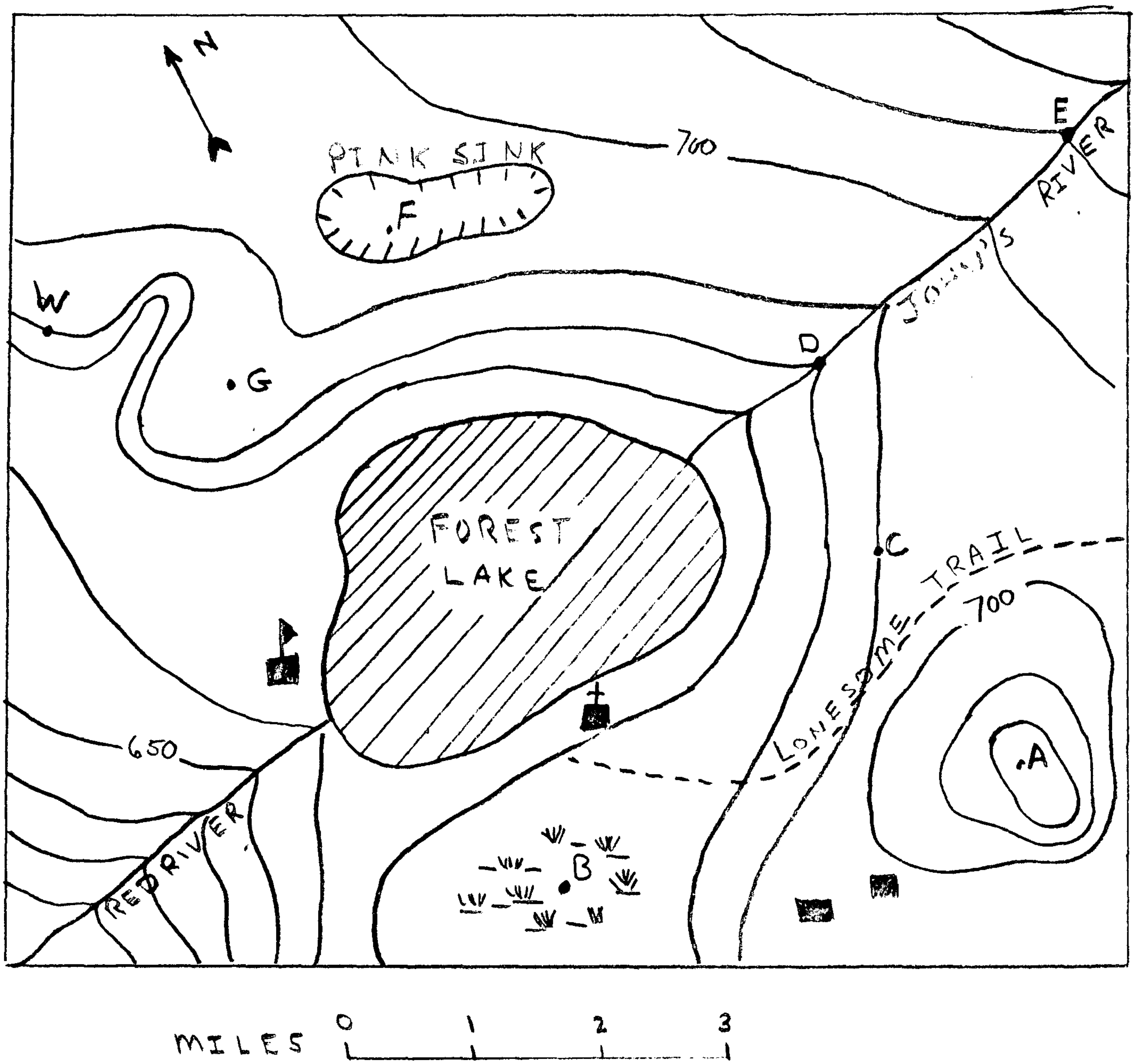
11. What is located on the south shore of Forest Lake?_________

12. What feature is located at Pink Sink?________

13. What direction does Red River flow?_________

14. What feature is located at point B?__________

15. What is the elevation of the school?_________


N
PINK SINK
700
F
W
G
E
D
JOHN'S RIVER
FOREST LAKE
C
LONESOME TRAIL
700
A
650
RED RIVER
B
MILES
0
1
2
3

Topographic Worksheet #1

Answer Key

1. 100
2. 52.5 square miles
3. 2611
4. 2838
5. 2450
6. depression
7. school
8. southeast
9. 3 miles
10. inlet
11. out of
12. southeast
13. 2400

Topographic Worksheet 2

County Objective: 3.1(2) Explain how directions and locations are determined.

3.2(3) Explain how a scale is determined

Objective: To study some of the basic features of a contour map.

Activity: Study the attached contour map to find the answers to the questions which follow.

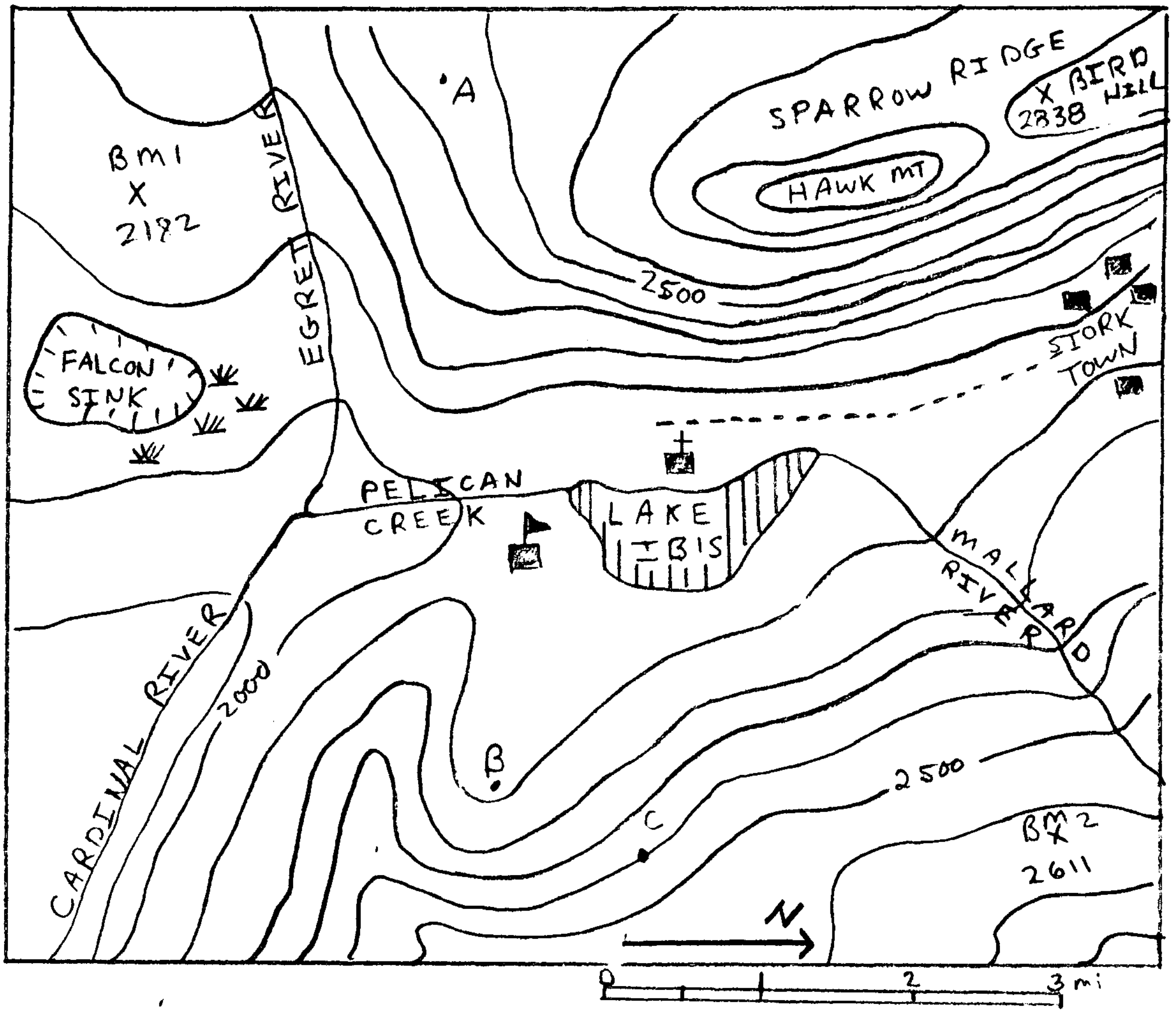
1. The contour interval on this map is ? __________
2. How many square miles are represented by this map?__________
3. What is the elevation of BM2?__________
4. What is the elevation of Bird Hill?__________
5. What is the maximum elevation of point A?__________
6. What is the feature located at Falcon Sink?__________
7. What is located on the south side of Lake Ibis?__________
8. What direction does Cardinal River flow?__________
9. To the nearest half-mile, what is the distance by trail from the church to Stork Town?__________

10. Is Mallard River an outlet or inlet of Lake Ibis?_________

11. Does Pelican Creek flow into or out of Lake Ibis?_________

12. What direction would you go to travel from Sparrow Ridge to the school?_________

13. What is the elevation of point C?_________



SPARROW RIDGE
X BIRD HILL
2838
HAWK MT
A
BM1
X
2182
EGRET RIVER
2500
FALCON SINK
STORK TOWN
PELICAN CREEK
LAKE IBIS
MALLARD RIVER
CARDINAL RIVER
2000
B
2500
C
BM X 2
2611
N
0
1
2
3 mi

Topographic Worksheet #2

Answer Key

1. 10
2. 67.5
3. 2611
4. 2838
5. 2499
6. depression
7. school
8. southeast
9. 4 miles
10. inlet
11. out of
12. east
13. 2400

Topographic Worksheet #3

County Objective: 3.1(2) Explain how directions and locations are determined.

3.2(3) Explain how a scale is determined.

Objective: To study some of the basic features of a contour map.

Activity: Study the attached contour map to find the answers to the questions which follow.

1. What is the contour interval on this map?____________

2. What is the approximate elevation of the church?____________

3. What is the maximum elevation of the school?____________

4. What feature is located at Blue Sink?____________

5. To the nearest half-mile what is the widest distance across Brown Bay?____________

6. What is the elevation of Green Beach?____________

7. Does Yellow River flow into or out of Silver Sea?____________

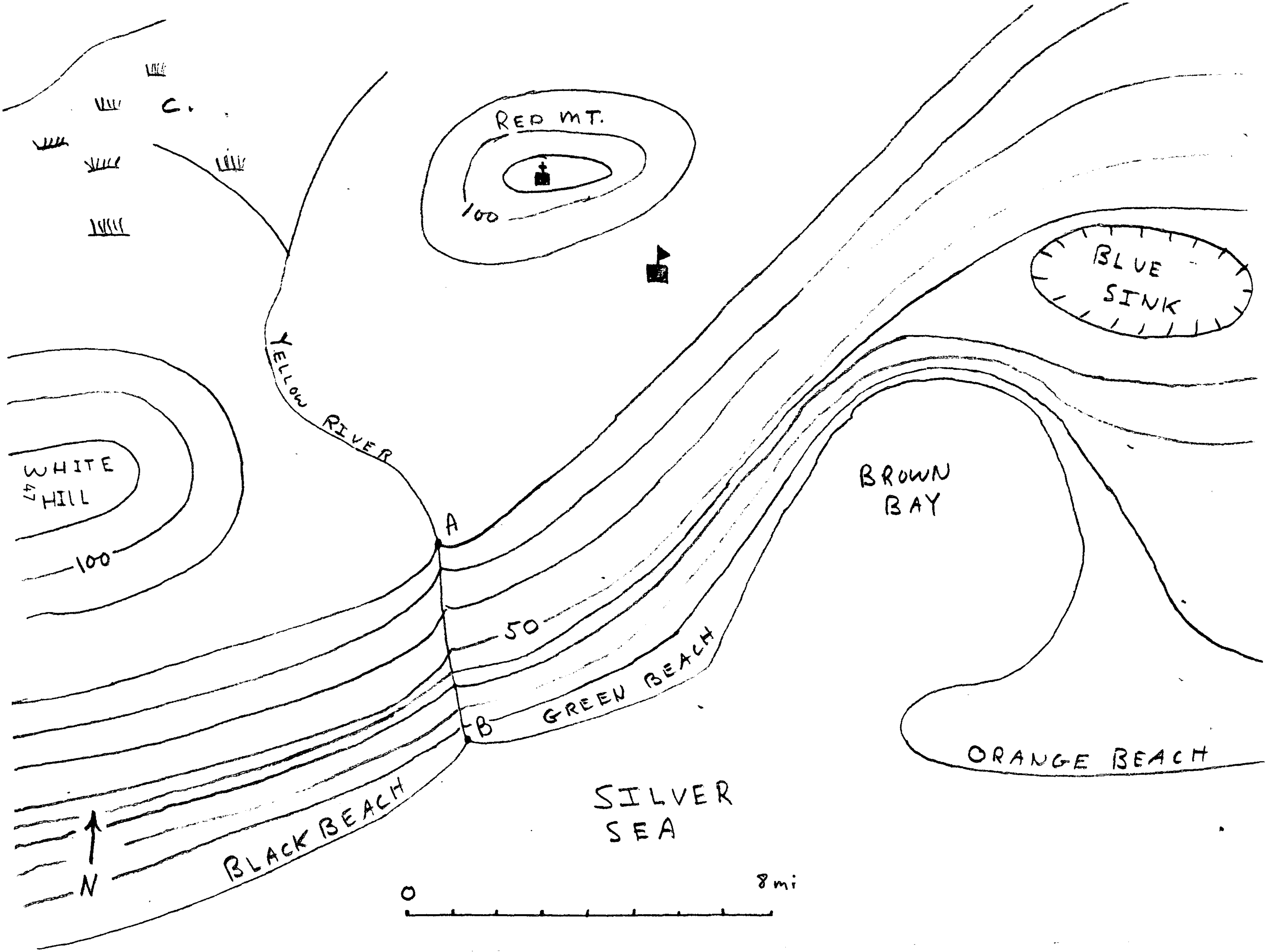
8. What direction would you travel to get from Black Beach to Orange Beach?____________

9. What is the maximum elevation at White Hill?____________

10. What is the gradient per mile between points A and B?________

11. What is the correct scale for this map?__________

12. What feature is located at point C?__________



C.
RED MT.
100
BLUE SINK
WHITE HILL
47
100
YELLOW RIVER
A
50
B
BROWN BAY
GREEN BEACH
ORANGE BEACH
BLACK BEACH
SILVER SEA
N
0
8 mi

Topographic Worksheet #3

Answer Key

1. 10

2. 110

3. 89

4. depression

5. 6.5 miles

6. 0

7. into

8. east

9. 119

10. 80/4.4 mile (20/mile)

11. 1 cm = 1 mile

12. swamp

Topographic Worksheet 4

County Objective: 3.1(2) Explain how directions and locations are determined

3.2(3) Explain how a scale is determined

Objective: To study some of the basic features of a contour map.

Activity: Study the attached contour map to find the answers to the questions which follow.

1. The contour interval on this map is ____________.

2. What is the elevation at point A?____________

3. What is the elevation at point F?____________

4. The elevation at point E is ______________.

5. What is located at point A?_____________

6. What is the maximum elevation of April Ridge?_____________

7. Does Abe's River flow into or out of Lake Jim?_________

8. Does the elevation rise or fall as you move from point B to point C?______________

9. What is located on the east shore of Doug Lake?_________

10. What is the distance by road from Doug Lake to Lake Jim?_____________

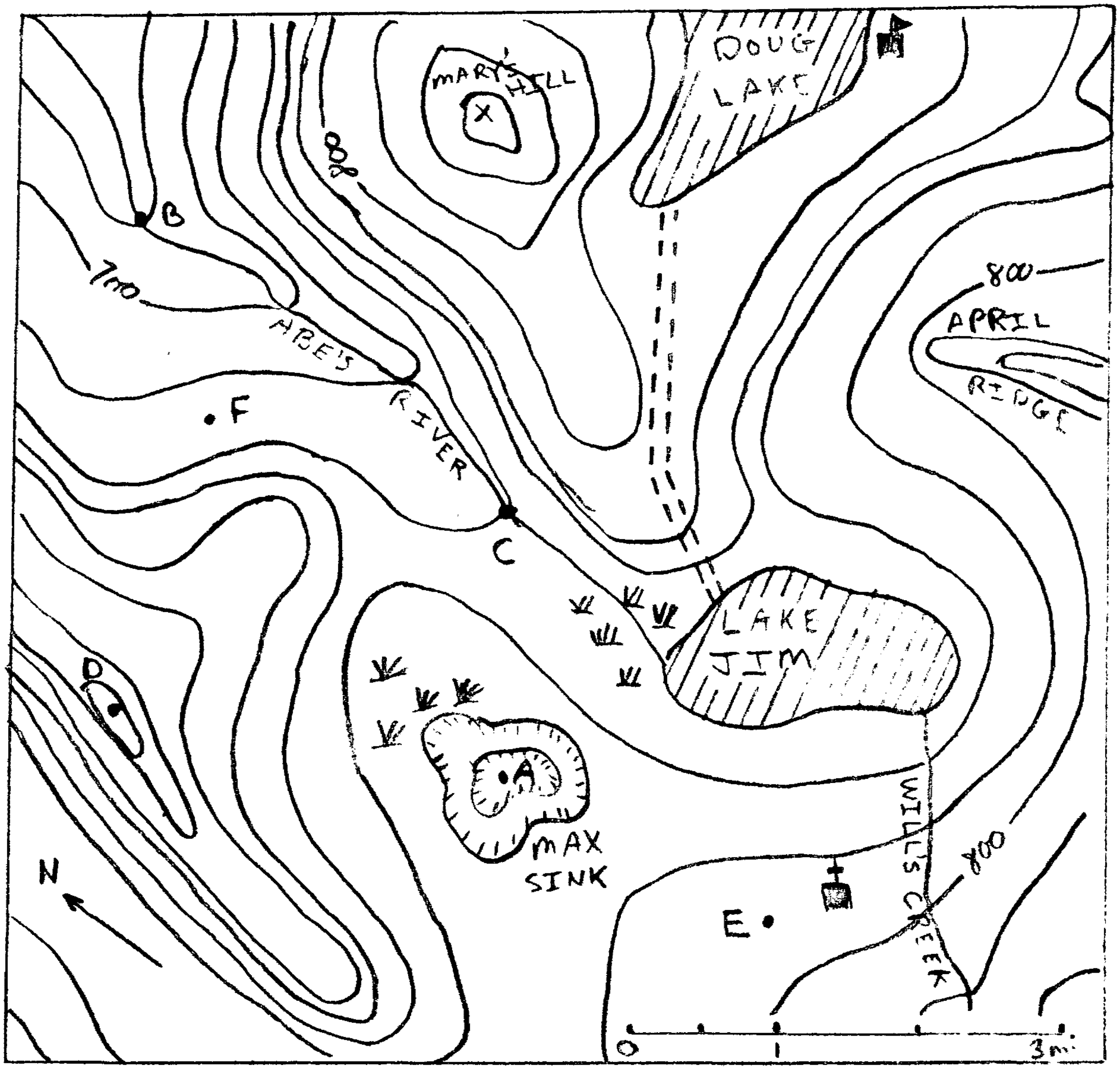
11. What is the maximum elevation of Mary's Hill?_____________

12. What is located on the north shore of Max Sink?___________

13. Does Will's Creek flow into or out of Lake Jim?_______________

14. What direction would you travel to go from April Ridge to Max Sink?______________

15. How many miles is it from Lake Jim to the church?_____________


MARY'S HILL
X
DOUG LAKE
B
700
ABE'S RIVER
F
C
800
APRIL RIDGE
LAKE JIM
D
MAX SINK
N
E
WILL'S CREEK
800
0
1
3 mi

Topographic Worksheet #4

Answer Key

1. 20
2. 740
3. 730
4. 790
5. Max Sink, depression
6. 840+
7. out of
8. rises
9. school
10. 3 miles
11. 879
12. swamp or marsh
13. into
14. west
15. 1.5 miles

Weather Fronts
Investigation

County Objective: 5.3(6) Describe the formation, movement, and interrelationship of air masses.

Objective: Locate the probable position of the clouds and approaching front.

Activity: Study the attached map and weather data to determine cloud position, wind direction, and locations of air masses.

The attached diagram shows a part of the Florida peninsula. Weather data have been included on the map.

Procedure:

1. The 29.60 inch isobar has already been drawn. Notice that the isobar does not pass through any of the listed stations. Draw the 29.50 and the 29.70 isobars. Each may, or may not, pass through a station.

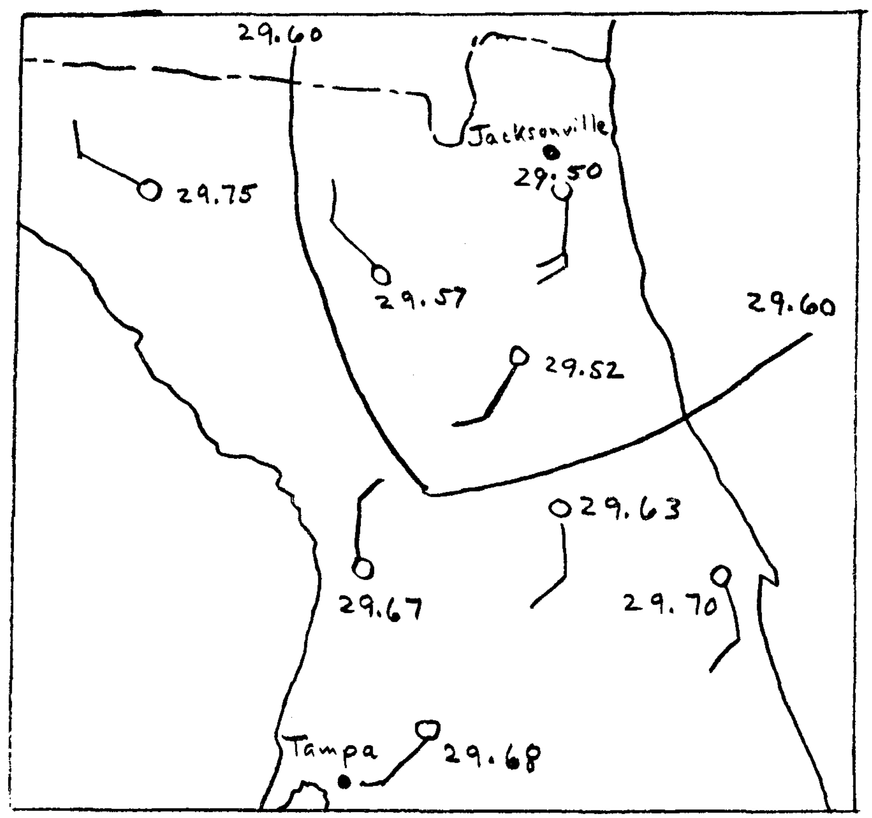
2. Draw a dotted line where you think there should be clouds. Lightly shade in the area a small distance on either side of the dotted line.

a. What are the conditions necessary for cloud formation?

b. Where can clouds be expected to form and why?

3. Form a hypothesis about the type of weather front and its position.

4. Make a prediction about the type of weather that will occur in the next several hours in Jacksonville and in Tampa.


29.60
Jacksonville
29.50
29.75
29.57
29.60
29.52
29.63
29.67
29.70
Tampa
29.68

Weather Fronts

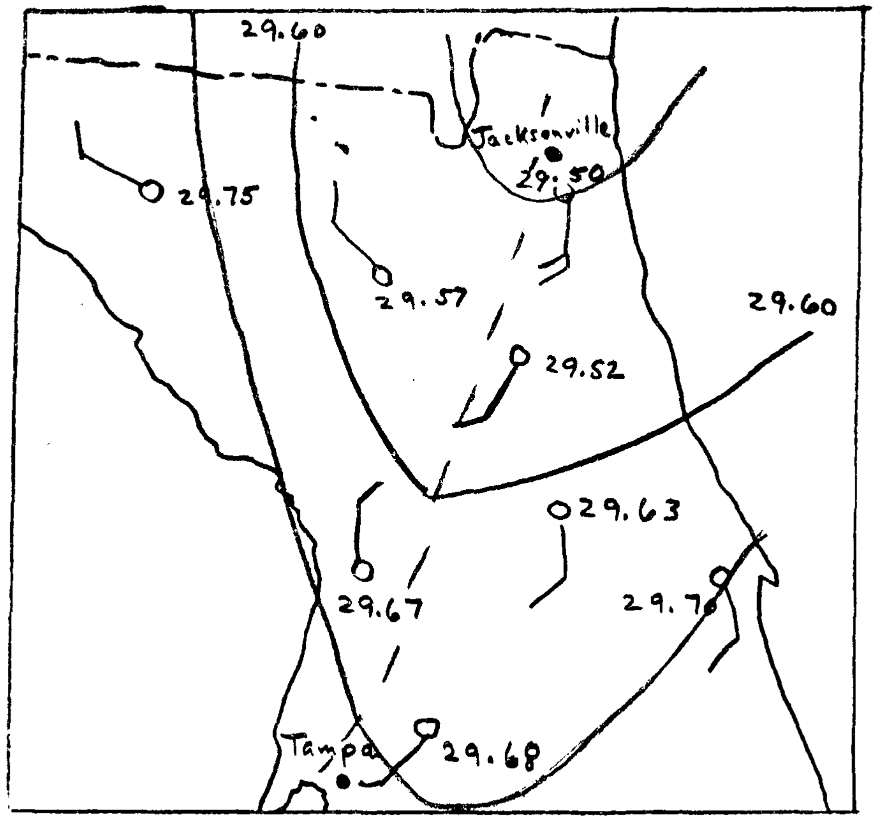
Answer Key

2.a. A low pressure area, and rising air

2.b. There is cold front stretching from west Jacksonville to Tampa. Clouds would form on the front line.

3. There is a cold front moving from west to east from Jacksonville to Tampa.

4. Rain followed by clearing skies and colder temperatures.


29.60
Jacksonville
29.50
29.75
29.57
29.60
29.52
29.63
29.67
29.70
Tampa
29.68

Isobar Worksheet 1

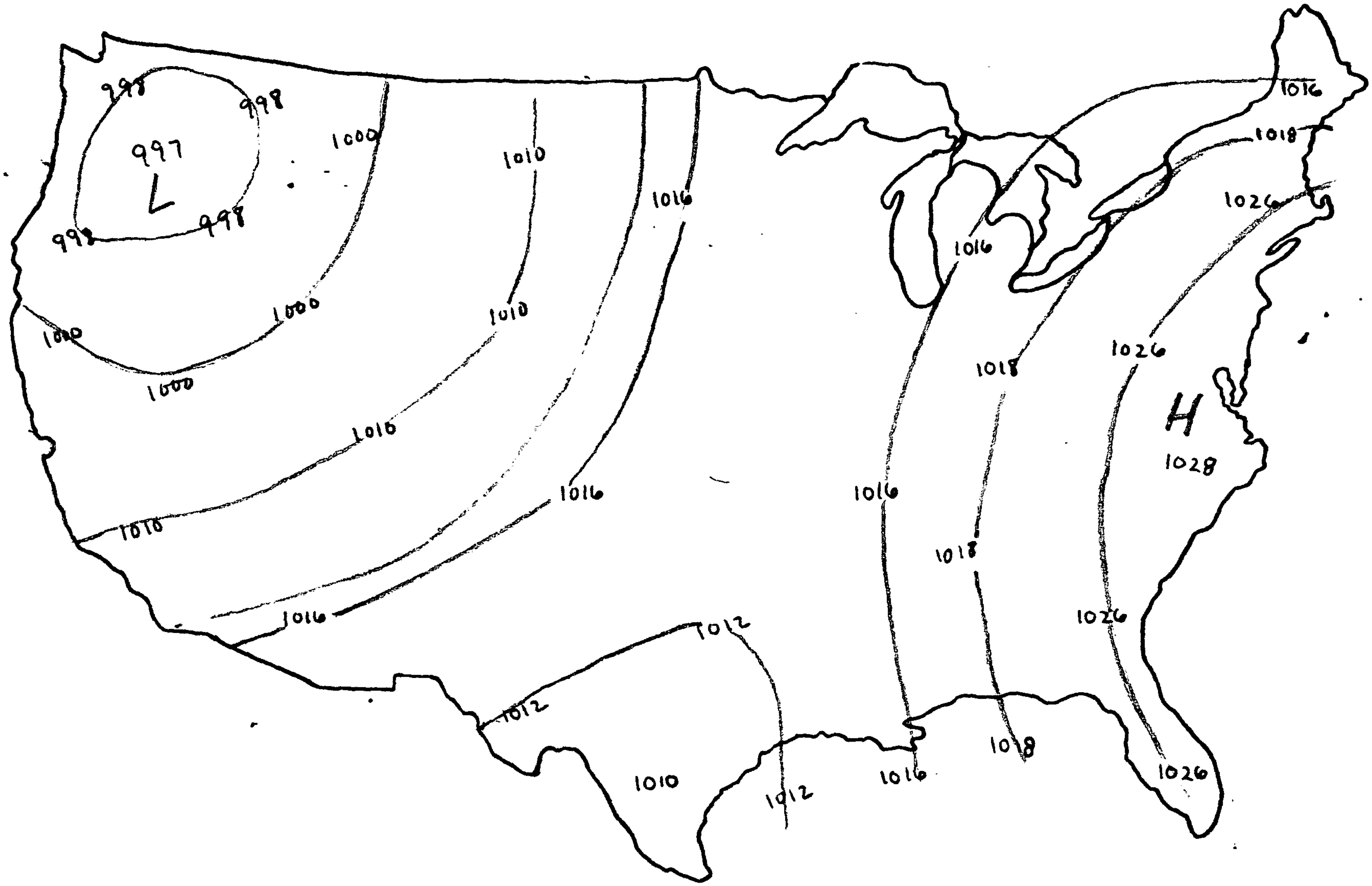
County Objective: 5.3(16) Predict weather through the observation and analysis of weather instruments or weather maps.

Objective: To study some of the basic features of an isobar map.

Activity: Draw the isobars for the following pressure readings; 1016, 1018, 1020, 1022, 1024, 1028, 1032. After drawing the isobars above, locate the areas of high pressure and label with "H". Locate the low pressure areas and label with "L".

Definition: Isobar - Lines drawn on a weather map connecting points with similiar barometric pressure readings.


998
998
1016
997
1000
1010
1018
1016
1026
998
998
1016
1000
1010
1000
1026
1018
1000
1010
1028
1016
1016
1010
1018
1016
1012
1026
1012
1018
1026
1010
1016
1012


998
998
997
L
998
998
1000
1010
1016
1000
1010
1000
1000
1010
1016
1010
1016
1012
1012
1010
1012
1016
1016
1016
1018
1018
1018
1016
1018
1026
1026
H
1028
1026
1026

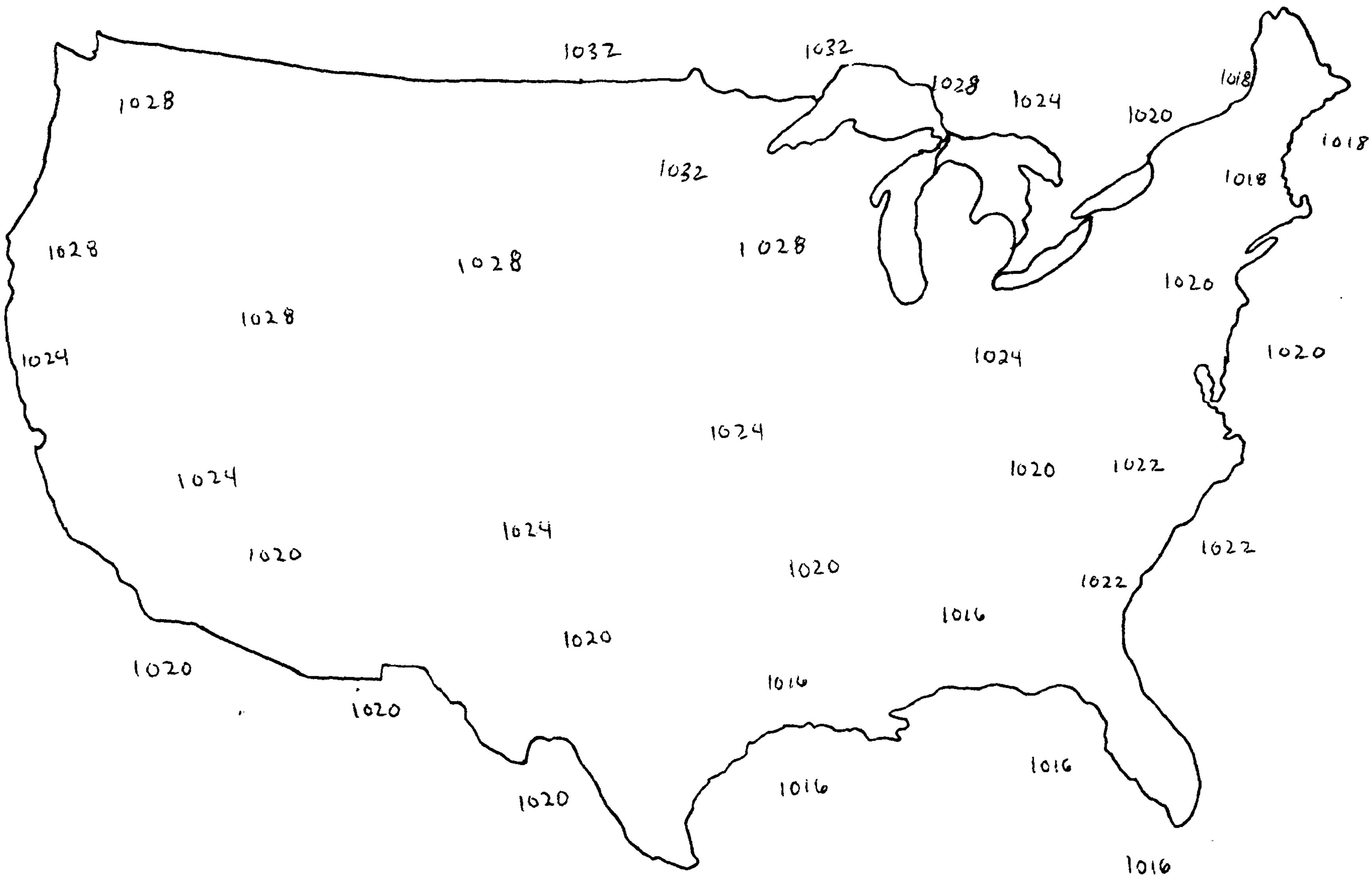
Isobar Worksheet 2

County Objective: 5.3(16) Predict weather through the oberservation and analysis of weather instruments or weather maps.

Objective: To study some of the basic features of an isobar map.

Activity: Draw the isobars for the following pressure readings: 998, 1000, 1010, 1012, 1016, 1018, 1026. After drawing the isobars above, locate the areas of high pressure and label with "H". Locate the low pressure areas and label with "L".

Definition: Isobar - Lines drawn on a weather map connecting points with similiar barometric pressure readings.


1032
1032
1028
1028
1024
1018
1020
1018
1032
1018
1028
1028
1028
1020
1028
1024
1024
1020
1024
1024
1020
1022
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1020
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1020
1022
1016
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1020
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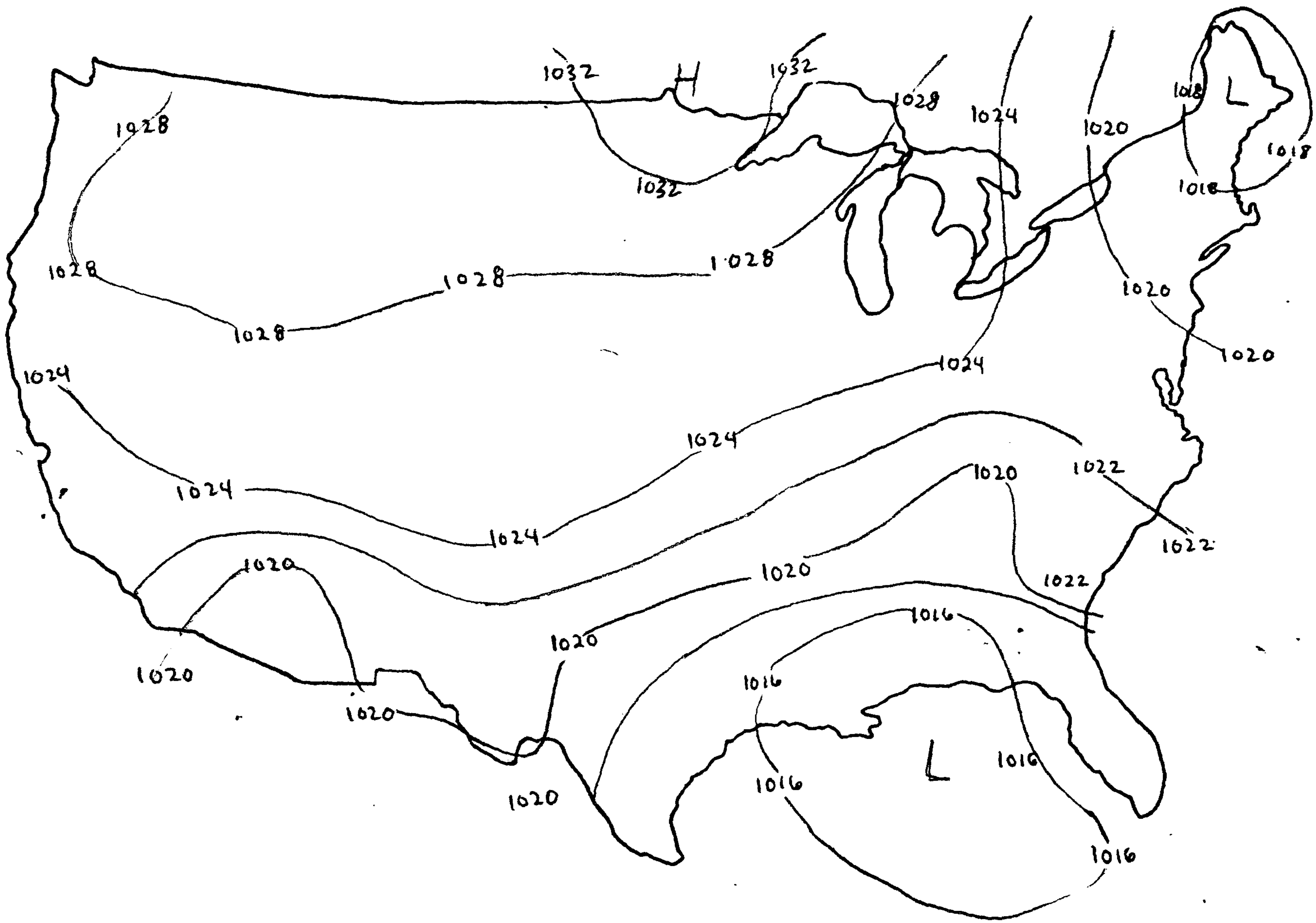
1020
1016
1016
1020
1016


1032
H
1032
1028
1024
1020
1018
L
1028
1018
1018
1032
1028
1028
1028
1028
1020
1020
1024
1024
1024
1024
1024
1022
1020
1022
1020
1022
1020
1020
1016
1020
1016
1016
L
1016
1020
1016
1020

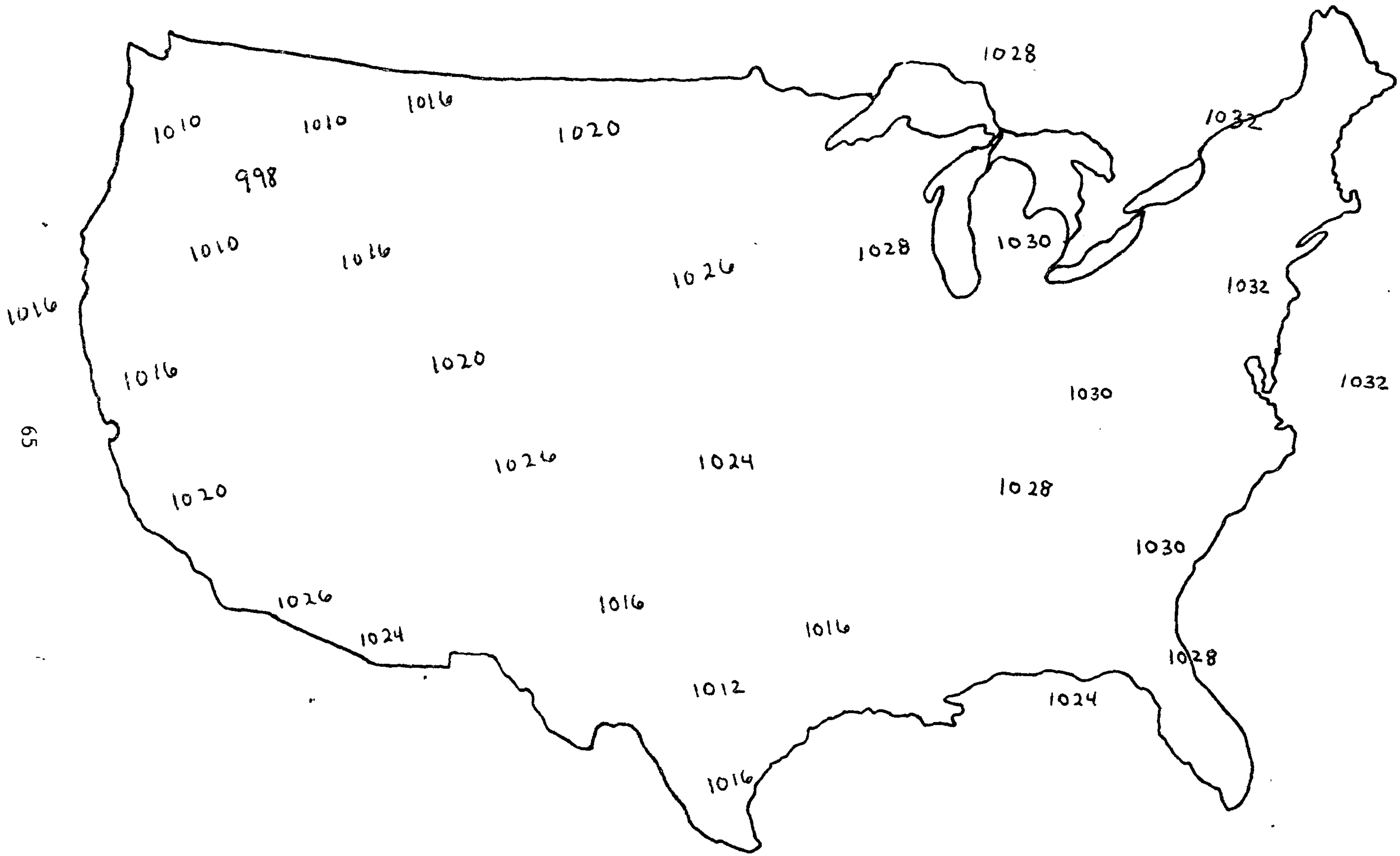
Isobar Worksheet 3

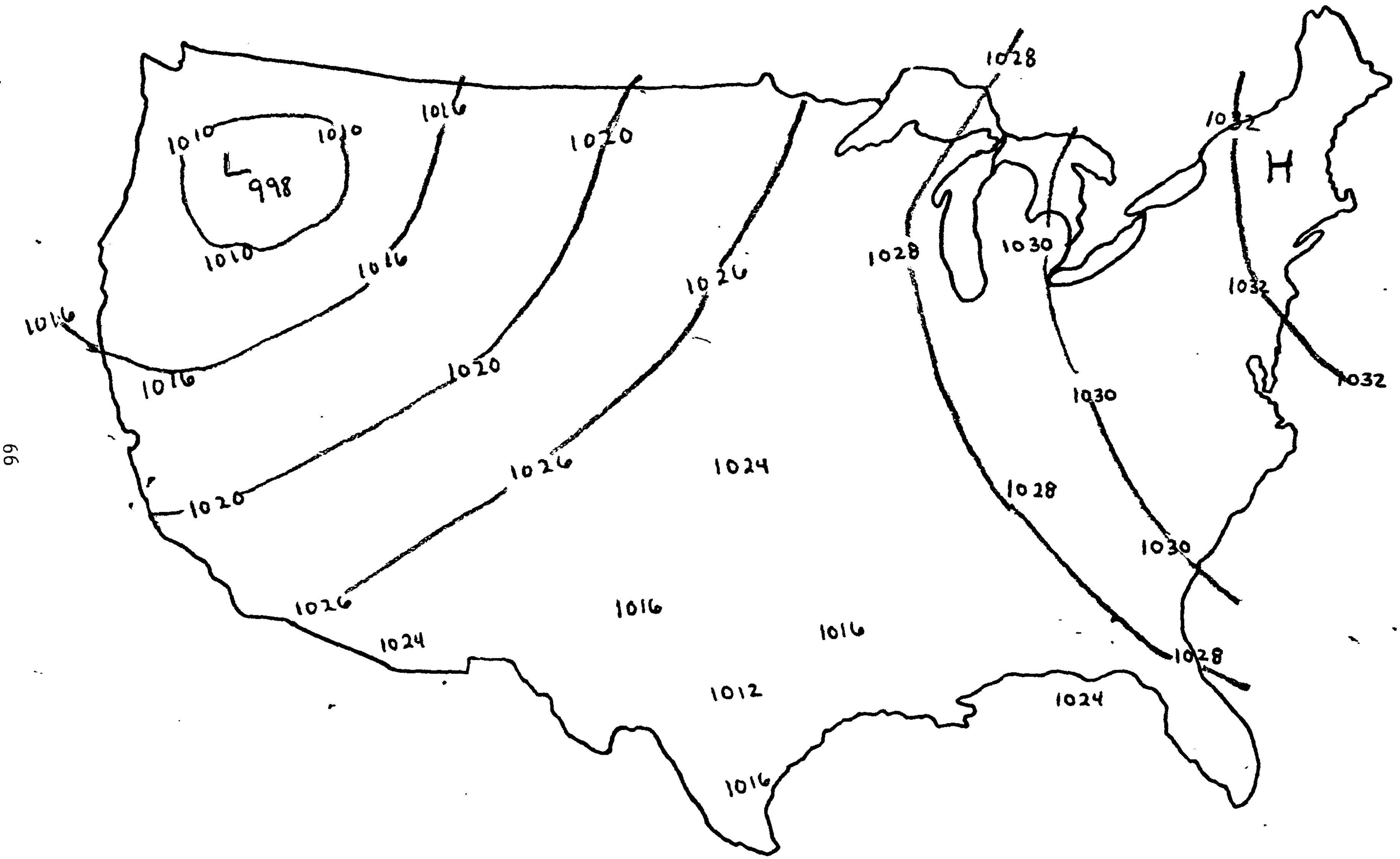
County Objective: 5.3(16) Predict weather through the observation and analysis of weather instruments or weather maps.

Objective: To study some of the basic features of an isobar map.

Activity: Draw the isobars for the following pressure readings; 1010, 1016, 1020, 1024, 1026, 1028, 1030, and 1032. After drawing the isobars above, locate the areas of high pressure and label with "H". Locate the low pressure areas and label with "L".

Definition: Isobar - Lines drawn on a weather map connecting points with similiar barometric pressure readings.


1028
1010
1010
1016
1020
1032
998
1010
1016
1026
1028
1030
1016
1032
1016
1020
1030
1032
1026
1024
1028
1020
1030
1026
1016
1016
1024
1028
1012
1024
1016


L
998
H
1010
1010
1010
1016
1016
1016
1016
1020
1020
1020
1026
1026
1026
1024
1024
1016
1016
1012
1016
1028
1028
1028
1028
1030
1030
1030
1032
1032
1032
1024

CHAPTER 5

RESULTS AND CONCLUSIONS

The same group of four teachers who suggested the content also reviewed the laboratory curriculum presented in this project after completion and made the following recommendations: 1) The numbers of units of materials covered should be increased. 2) Providing additional laboratory materials, for example more maps, would give teachers a choice of the activity most appropriate for their own situation. 3) The curriculum should include at least one laboratory activity for each of the Duval County minimum level skills objectives; the students are already required to pass minimum level skills before successfully passing a course. Participation in "hands-on" laboratory activities would provide additional understanding of concepts taught in class, to ensure that students would have more of an opportunity to pass the Minimum Level Skills Test. Student involvement would also increase, a situation which would provide stimulation, as mentioned in Chapter 2.

Evaluating teachers concluded that the laboratory activities would provide practice for their students and expand concepts presented in the classroom. Practice would also tend to increase student understanding of ideas presented by the textbook.

Suggestions for future work include more testing of the activities presented. When other Earth Science teachers exchange ideas that they use in their classroom additional activities can be developed. A next step could involve input from a group of Earth Science teachers who follow the suggestions which emerged from the total laboratory curriculum evaluation.

REFERENCES

Arnstine, D. (1966). Curiosity. Teachers College Record, 67, 595-602.

Bates, G. C. (1982). The importance of the laboratory in school science: A research perspective. In Klein, S. E., Yager, R. E., & McCurdy, D. W. (eds.), The laboratory is vital in science instruction in the secondary school. The Science Teacher, 49 (2), 20-23.

Biehler, R. F., & Snowman, J. (1986). Psychology applied to teaching (5th ed.) Boston: Houghton Mifflin.

Bybee, R. W. (1982). The science laboratory in secondary schools: Support from the basics. In Klein, S. E., Yager, R. E., & McCurdy, D. W. (Eds.), The laboratory is vital in science instruction in the secondary school. The Science Teacher, 49 (2), 20-23.

Derosa, J., Lockard, J. D., & Paldy, L. (1979). The teacher is the key. The Science Teacher, 46 (4), 31-37.

Dyrli, O. E., (1981). Should we scrap lab-centered science programs? Learning, 9 (7), 34-35, 39.

Glasser, W. (1985). Discipline is not the problem: Control theory in the classroom. The Education Digest, 52 (9), 36-39.

Gould, C. D., (1978). Pratical work in sixth-form biology. Journal of Biological Education, 12, 33-38.

Herron, M. D., (1971). The nature of scientific inquiry. School Review, 79, 171-212.

McDaniel, T. R. (1985). The ten commandments of motivation. Clearing House, 59 (1), 19-23.

Nagalski, J. L. (1980). Why inquiry must hold its ground. The Science Teacher, 47 (4), 26-27.

Osborne, R. J. (1976). Using student attitudes to modify instruction in physics. Journal of Research in Science Teaching, 13, 525-531.

Perez, L. (1982). Laboratory teaching in high school science. In Klein, S. E., Yager, R. E., & McCurdy, D. W. (Eds.), The laboratory is vital in science instruction in the secondary school. The Science Teacher, 49 (2), 20-23.

Sava, S. G. (1987). Holding on to student enthusiasum. The Educational Digest, 52 (7), 28-31.

Tafel, M. (1982). Role of the laboratory for science in the middle/junior high school. In Klein, S. E., Yager, R. E., McCurdy, D. W. (Eds.), The laboratory is vital in science instruction in the secondary school. The Science Teacher, 49 (2), 20-23.

Talton, E. L., & Simpson, R. D. (1986). Relationships of attitudes toward self, family, and school with attitude toward science among adolescents. Science Education, 70, 365-374.

Vargus-Gomez, R. G. (1984). Comparison of science teacher opinions and student attitudes between samples drawn from school with exemplary science programs and randomly selected ones. Ph.D. Thesis. The University of Iowa, Iowa City, IA.

Webb, C. D., & Baird, J. H. (1980). Three strategies for motivating pupils. Clearing House, 54, 27-29.

Yager, R. E. & Penick, J. E. (1986). Perceptions of four age groups toward science classes, teachers, and the value of science. Science Education, 70, 355-363.

Earth Science Teachers

I need the input of all Earth/Science teachers for a project I am working on. I'm interested in finding out from you those content areas that you feel the students have difficulty with. Also include in your list of content areas those parts of the curriculum you feel need additional resources to enhance learning in your students. If you have any questions, please ask.

LIST OF AREAS:

Thank You,

David Holley

VITA

David R. Holley received his B.S. in Animal Science in 1980 from Clemson University, Clemson, South Carolina. After graduation, he worked as a pork producer in Jacksonville Florida. Later he attended the University of North Florida and became a certified science teacher specializing in the areas of biology and earth science. He is currently teaching 9th grade science in Jacksonville, Florida where he has been for the last 7 years.