DOCUMENT RESUME

ED 352 272 SE 053 418

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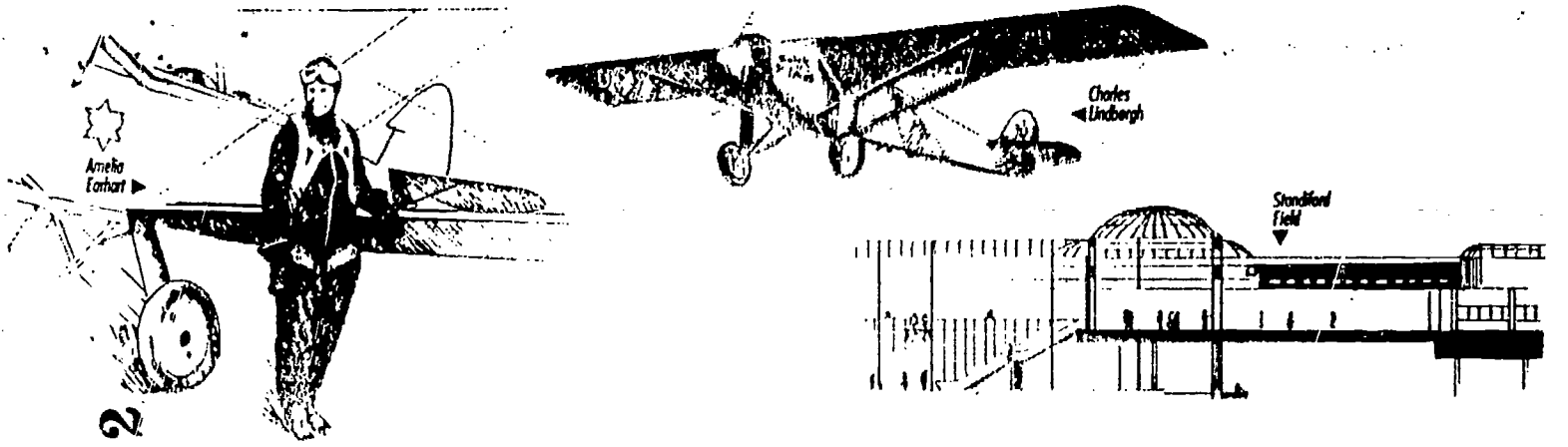
TITLE Curriculum Package: Junior High - Middle School Science Lessons. [A Visit to the Louisville, Kentucky Airports: Standiford and Bowman Fields.]
INSTITUTION Regional Airport Authority of Louisville and Jefferson County, KY.
PUB DATE Jun 92
NOTE 30p.; For Elementary Science Lessons, see SE 053 419. For additional related documents, see SO 022 821-823.
AVAILABLE FROM Regional Airport Authority, P.O. Box 9129 Louisville, KY 40209 (free).
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Aerospace Education; Air Transportation; *Aviation Education; Earth Science; Elementary School Science; Graphs; Intermediate Grades; Junior High Schools; Mathematics Education; Middle Schools; Physics; *Science Activities; *Science Curriculum; *Science Education; Secondary School Science; Wind (Meteorology)
IDENTIFIERS Airplane Flights; Kites; Rockets; Science Process Skills

ABSTRACT

This science curriculum was written for teachers of children in junior high or middle school. It contains science activities for the following lessons: (1) Anemometers and Wind Speed; (2) Up! Up! and Away; (3) Jet Lag--Time Zones; (4) Inventors; (5) Model Rocketry; (6) Geometry and Kites; and (7) Super Savers. In lesson one, students construct an anemometer from paper cups and use it to measure wind speed. In lesson two, students construct tissue paper hot air balloons. The objectives of lesson three are to have students understand why there are time zones and to calculate differences between time zones. Two worksheets on time zones are provided. The objectives of lesson four are to have students understand the developments in man's attempt to fly. In lesson five students launch model rockets and measure the distance from the launch site to where the rockets landed, the altitude reached, and the time of descent. In lesson six, students apply the principles of geometry to construct a box kite. The objectives of lesson seven are for students to gain experience in finding percentages and solving problems concerning airline fares. (PR)



CURRICULUM PACKAGE

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JUNIOR HIGH - MIDDLE SCHOOL SCIENCE LESSONS

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June 1992

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SCIENCE LESSONS FOR JUNIOR HIGH & MIDDLE SCHOOL

LESSON TITLE: **ANEMOMETERS AND WIND SPEED**

GRADE LEVEL: 5, 6, 7, 8

SKILLS:

Goal 2 Concepts and Principles
Science
No. 17 Using Scientific Skills
No. 19 Describing Systems and Interactions
No. 20 Using Models
Mathematics
No. 24 Mathematical Procedures
No. 29 Understanding Data

PERFORMANCE OBJECTIVES:

- The student will learn how to construct an anemometer and measure wind speed.

MATERIALS:

Each group of students will need the following:

Worksheet
4 paper cups - 3 ounce size
1 coat hanger
1 glass medicine dropper
2 thin wooden or plastic slats
1" X 18" (rulers can be used)
1 Wooden support
Scissors or razor blades
Small nails or brads
Wire cutters
Red paint or red marker
Knife or drill

PROCEDURE:

1. Have students construct the anemometer as directed on the worksheet.

2. Take the anemometers outside to a suitable place for mounting where the wind can hit them.

3. Count the revolutions per minute by observing how many times the red marked cup passes in front of you.

4. Divide the number of revolutions per minute by 10 to get the approximate miles per hour or wind speed.

5. Have the students make a graph of their recorded wind speed over several hours or days. They will

need lots of practice if the wind speed gets very high.

6. Have the students collect the weather page from the newspaper and have them pay particular attention to the map symbols that indicate wind speed. The Beaufort Wind Scale is included in many books about eather and is also included in this lesson.

WHAT CAUSES WIND:

Wind is caused by differences in temperature of air masses (warm air expands and moves up; cold air drops); differences in the air pressure within air masses; and the rotation of the earth.

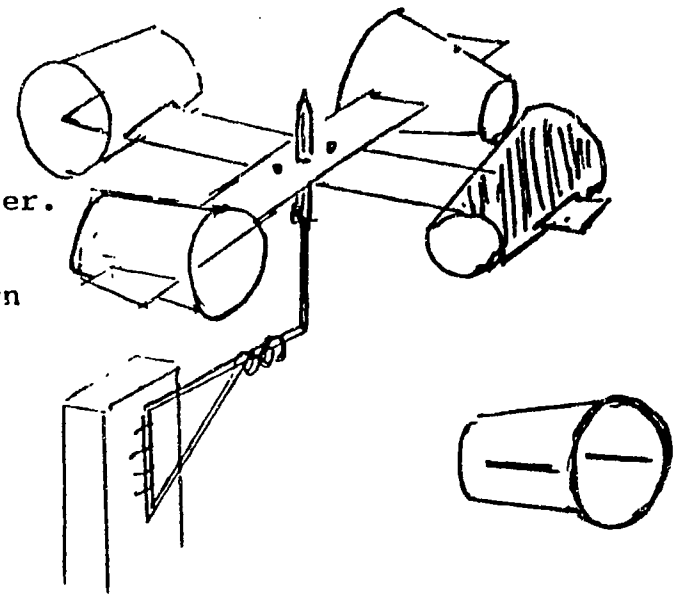
QUESTIONS TO THINK ABOUT:

1. Does it make any difference which way the wind is blowing in determining wind speed with your anemometer?

2. What occupations are most concerned with wind speed?

3. Why are weather forecasters concerned with wind speed?

ANEMOMETER CONSTRUCTION



1. Nail slats together making a cross.
2. Cut a hole for the eye dropper. (the glass part)
3. Bend the coat hanger as shown to make a bracket.
4. Cut slits in the paper cups to fit the slats.
5. Color one cup red.
6. Mount the coat hanger on a fence post or porch railing.
7. Slide the cups onto the slats.
8. Place the glass eye dropper on the end of the coat hanger.
9. Place the slats with the cups on the eye dropper.

BEAUFORT WIND SCALE

Number	Map Symbol	Descriptive Word	Velocity Miles Per Hour
1			1 to 3
2		Light	4 to 7
3		Gentle	8 to 12
4		Moderate	13 to 18
5		Fresh	19 to 24
6			25 to 31
7		Strong	32 to 38
8			39 to 46
9		Gale	47 to 54
10			55 to 63
11		Whole Gale	64 to 75
12		Hurricane	above 75

LESSON TITLE: UP! UP! AND AWAY!

GRADE LEVEL: 5, 6, 7, 8

SKILLS:

Goal 2 Concepts and Principles
Science
No. 17 Using Scientific Skills
No.20 Using Models
Mathematics
No. 25 Space and Dimensionality
No. 26 Measurement

PERFORMANCE OBJECTIVES:

. The student will be able to build a tissue paper balloon.

MATERIALS:

For each balloon

One dozen sheets of tissue paper (any color or combination of colors)
Paper clips or snap clothespins
Brown wrapping paper (for pattern)
Glue sticks
Felt marker
Telephone wire or other fine wire
Hair-dryer or air-popper (heat source)

PROCEDURE:

1 Have the students make a pattern for the balloon using brown wrapping paper or newspaper, following the diagram included with this lesson. This is a very large balloon and needs to be to hold enough air to float. Three or four students should work together to cut out and assemble the balloon successfully.

2. Have each group of students choose the colors of tissue paper they want. They will need twelve sheets of tissue paper. Have the students glue two sheets of tissue together at the narrower ends. You want to make it long enough for the pattern. Make six of these long sheets for the balloon. (Use glue sticks - you will find that other types of glue and paste are too wet to use with tissue paper.)

3. Next have the students fold

long sheets of tissue paper length wise and stack them up with the folded edge together. Place the pattern on the whole stack of folded tissue papers and clip them together with wooden clothespins.

4. The straight edge of the pattern should line up with the folded edges of the tissue. Cut out all six layers of tissue at the same time, making sure that the open ends are being cut off and discarded.

5. Next the pieces are glued together, very much like putting together a dress pattern. Keep all the patterns stacked up and pinned together as you glue. The first is lying against the table. Glue the top of the first sheet to the bottom of the second sheet. Then glue the top to the second sheet to the bottom of the third sheet. Continue gluing until you get to the top of the stack - 3rd to the 4th, 4th to the 5th, and 5th to the 6th. There will be one loose end at the top of the stack. Fold the top edge of the 6th sheet around and glue it to the bottom of the first sheet. All the seams are on the outside of the balloon.

6. Make a cuff at the bottom opening of the balloon and insert a wire hoop. Measure enough wire to fit the opening plus a little more. Twist the wire together to form a circle that fits the bottom of the balloon; then glue the cuff closed. Light wire, like telephone wire, is adequate. It holds the bottom of the balloon opened.

7. Now you are ready to test the balloon to see if it will hold air. Use a hot air popcorn popper or a hand held hair-dryer to fill the balloon with hot air. One student should stand on a chair or table to suspend the balloon over the heat source while it is filling with hot

air. If there are any unsealed seams, they can be glued while the balloon is inflated; likewise any holes can be patched with pieces of tissue. Patches will not effect the flying ability of the balloon.

CONCEPTS:

Hot air expands. When you heat the air in the balloon you will see the effects of the hot air expanding. It will expand the balloon. The balloon will also float upward once there is enough hot air to make the balloon rise. As the air cools, it contracts so the balloon will float back to earth. The tissue paper is very fragile and will easily tear, so watch where and how it lands. Strings can be attached to the bottom of the balloon to hold onto it. The balloon will not go very far before the air cools and it starts to fall to earth. The wind may pick up the balloons if you take them outdoors. You will need your heat source to keep the balloons inflated.

QUESTIONS:

1. How does your balloon compare to the ones that people ride?

2. What material are those balloons made of?

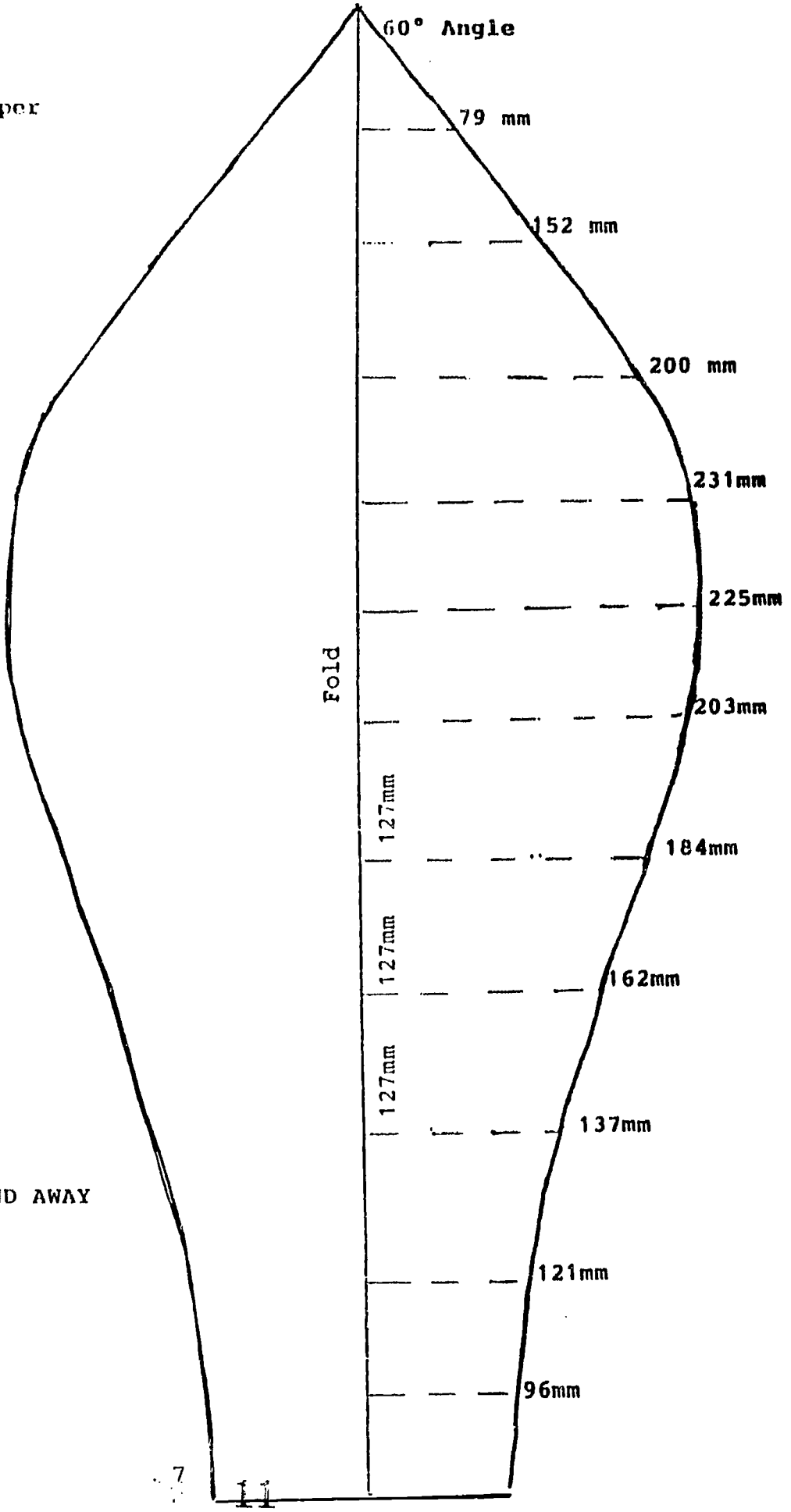
3. How do they heat the air in them? Would this work for your tissue paper balloon? Why or why not?

4. How does a balloon move around while up in the air?

5. Is balloon travel efficient? How does it compare to flying in an airplane?

BALLOON PATTERN

1. Brown paper or newspaper 139 cm in length.
2. Mark spaces along the edge 127mm apart.
3. Measure in from the edge the millimeter widths as indicated on the pattern.
4. Start at the top, making a 60° angle and draw a line to connect the dots.
5. Cut out the pattern. It will be half the width of one panel.
6. Place the pattern on the folded tissue.
7. Cut six panels



WORK SHEET FOR UP UP AND AWAY

LESSON TITLE: JET LAG - TIME ZONES

GRADE LEVEL: 5, 6, 7, 8

SKILLS:

Goal 2 Concepts and Principles
Science
No. 18 Patterns
No. 24 Mathematical Procedures
No. 26 Measurement of Time

PERFORMANCE OBJECTIVES:

. The student will understand why there are time zones and how many there are.

. The student will be able to calculate differences between time zones.

MATERIALS:

Globe
American Airlines map with It's Time lesson
Time Zone Problem Worksheet
Pencils and paper

PROCEDURE:

1. Direct students' attention to the globe. Ask students how long it takes the earth to rotate on its axis? (one day) How many hours is that? (24) That is exactly how many time zones there are around the Earth.

2. Ask students to find the first time zone. (Greenwich, England) Start counting the time zones with Greenwich. The observatory is on Prime Meridian and standard time is counted from there going east e.g.: when it is noon in Greenwich it is 1:00 p.m. in the next time zone in Eastern Europe. The time zones are one hour later in the day for the next ten time zones. The twelfth one, where it is midnight, is called the International Date Line and is located in the middle of the Pacific Ocean exactly opposite the Prime Meridian.

3. Find this on your globe. When the time is midnight at the International Date Line, the next time zone is 1:00 a.m. and each zone is an hour later in the morning as you move toward the United States on your globe.

4. Have the students find the Prime Meridian on the globe and count the time zones around the globe. Between New York and Greenwich, England there will be five time zones. When it is seven a.m. in New York City, it is 12:00 noon in Greenwich, England.

5. There are roughly 1,000 miles between time zones. Ask the students to determine how many time zones there are in the United States. (There are four time zones in the mainland: Alaska and Hawaii have their own, making a total of six time zones.)

6. The earth turns counter clockwise. How can you be sure of this? Because the sun comes up in the east - New York - before it comes up in the west - California. Look at your globe. Designate a spot as the sun; try turning the globe both ways.

7. Go back to the International Date Line on your globe. What is the date on either side of the line? If you are coming from California to Japan do you gain a day or lose one? If you are coming from China to Alaska do you gain a day or lose one? (Coming from east to west, you add 24 hours so you lose a day. Going from west to east, subtract 24 hours and gain a day.) How can you prove this?

QUESTIONS:

How does the change in time effect people who are flying long distances?
(Jet lag - your body is on a different time schedule than the place you are visiting. It may be time for you to go to bed at home but it is morning at the place you are visiting.)

Which way would jet lag be worse, flying six time zones east or west? Why? Do you have jet lag going both ways of your journey?

TIME PROBLEMS FOR TRAVELERS

The following travelers do not change the setting of their watches while in flight. What time will each watch read at the time of arrival after traveling between the time zones shown?

	Traveling From	Traveling To	Arrival Time	Watch Time
a.	Los Angeles	Chicago	5:45 p.m.	_____
b.	Los Angeles	New York	7:25 p.m.	_____
c.	Los Angeles	Denver	2:30 a.m.	_____
d.	Denver	Louisville	9:43 a.m.	_____
e.	Denver	Chicago	6:40 a.m.	_____
f.	Chicago	New York	8:53 p.m.	_____
g.	Hawaii	New York	1:10 p.m.	_____
h.	Hawaii	Los Angeles	3:35 p.m.	_____
i.	Hawaii	Chicago	9:05 a.m.	_____
j.	Louisville	New York	6:27 p.m.	_____

Try Some Global Time Differences

k.	Louisville	London	4:40 p.m.	_____
l.	New York	London	2:15 p.m.	_____
m.	Louisville	Budapest	5:45 a.m.	_____
n.	Louisville	Rome	8:28 a.m.	_____
o.	Louisville	Japan	7:25 p.m.	_____
p.	London	Budapest	1:47 a.m.	_____
q.	Sweden	Japan	8:26 a.m.	_____

TIME DIFFERENCE PROBLEMS GOING WEST

Louisville's Standiford Airport is on Eastern Time. If travelers leaving from Louisville do not change their watches what time will each watch read after arriving at their destinations?

	Traveling From	Traveling To	Arrival Time	Watch Time
a.	Louisville	Chicago	2:35 p.m.	_____
b.	New York	Los Angeles	4:27 p.m.	_____
c.	Louisville	Denver	5:54 a.m.	_____
d.	Chicago	Los Angeles	2:20 a.m.	_____
e.	Chicago	Denver	4:36 p.m.	_____
f.	Denver	Los Angeles	6:42 a.m.	_____
g.	Denver	Anchorage	3:25 p.m.	_____
h.	Los Angeles	Hawaii	9:35 a.m.	_____
i.	Los Angeles	Anchorage	9:12 p.m.	_____

Now Some International Times

j.	Hawaii	Japan	1:25 a.m.	_____
k.	Hawaii	Sweden	8:29 p.m.	_____
l.	Japan	Budapest	7:48 a.m.	_____
m.	Budapest	Rome	5:30 p.m.	_____
n.	Sweden	London	3:18 a.m.	_____
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b.	New York	Los Angeles	4:27 p.m.	7:27p.m.
c.	Louisville	Denver	5:54 a.m.	7:54a.m.
d.	Chicago	Los Angeles	2:20 a.m.	12:20a.m.
e.	Chicago	Denver	4:36 p.m.	5:36p.m.
f.	Denver	Los Angeles	6:42 a.m.	7:42a.m.
g.	Denver	Anchorage	3:25 p.m.	5:25p.m.
h.	Los Angeles	Hawaii	9:35 a.m.	11:35a.m.
i.	Los Angeles	Anchorage	9:12 p.m.	10:12p.m.

Now Some International Times

j.	Hawaii	Japan	1:25 a.m.	6:25p.m.
k.	Hawaii	Sweden	8:29 p.m.	7:29a.m.
l.	Japan	Budapest	7:48 a.m.	3:48p.m.
m.	Budapest	Rome	5:30 p.m.	5:30p.m.
n.	Sweden	London	3:18 a.m.	4:18a.m.
o.	Rome	London	2:10 p.m.	3:10p.m.
p.	Hawaii	London	4:40 a.m.	6:40p.m.
q.	London	New York	6:18 p.m.	11:18p.m.

TIME PROBLEMS FOR TRAVELERS

The following travelers do not change the setting of their watches while in flight. What time will each watch read at the time of arrival after traveling between the time zones shown?

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c.	Los Angeles	Denver	2:30 a.m.	1:30a.m.
d.	Denver	Louisville	9:43 a.m.	7:43a.m.
e.	Denver	Chicago	6:40 a.m.	5:40a.m.
f.	Chicago	New York	8:53 p.m.	7:53p.m.
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LESSON TITLE: INVENTORS

GRADE LEVEL: 4, 5, 6, 7, 8

SKILLS:

Goal 1 Basic Communication
No. 2 Reading
No. 11 Writing
No. 12 Speaking

Goal 2 Concepts and Principles
Science
No. 22 Evolution

PERFORMANCE OBJECTIVES:

. The student will understand the evolution and development of man's attempt to fly and be able to describe many of the inventions that were tried.

. The student will know some of the most important inventors of flying machines.

PROCEDURE:

1. Assign students the names of the inventors of flying machines. Some of the names are:

Archimedes	Ctesbius
Dedalus	DaVinci
Wilbur Wright	Orville Wright
McDonnell	Douglas
Leer	Goddard
Henry Farman	Paul Cornu
Montgolfier	Jacques Charles
Bernoulli	George Cayley
Elmer Speery	Andre Garnerin

2. Have students give written and oral reports on the inventors' life and work. Have students include pictures and/or drawings of their inventions.

3. Draw a time line on the chalkboard. Start with the time B.C. and mark intervals of 100 years to the twentieth century; then use intervals of ten years.

4. Have students mark the date of the inventor and his invention at the appropriate time along the time line. Students should give their reports orally to the class.

5. Have students then place their pictures or drawings above or below the date. (This can be turned into a mural.)

6. Students can readily see how the inventions became more efficient, more workable, and more complicated. Discuss the different types of flying machines and whether or not they are still in use today.

QUESTIONS FOR DISCUSSION:

What do you think was the key idea in developing the airplane?

Name some of the inventions that make flying as safe as it is today.

How did the politics of the times accelerate the development of the airplane?

In what ways do you think airplanes can be improved? What do you think the cost would be to make these improvements?

What suggestion do you have for the airlines?

LESSON TITLE: MODEL ROCKETS

GRADE LEVEL: 5, 6, 7, 8

SKILLS:

Goal 2 Concepts and Principles
Science
No. 17 Scientific Processes
No. 19 Systems and Interactions
No. 20 Models and Scales
Mathematics
No. 26 Measurement Procedures
No. 27 Change
No. 29 Data

PERFORMANCE OBJECTIVES:

. The student will begin to understand how rockets work.

. The student will begin to understand how we travel into space beyond the pull of gravity.

MATERIALS:

Model rocket kits
Model rocket engines
Launching pad
Firing mechanism
Three graphs

PROCEDURE:

1. Have students assemble model rockets from kits. (Students may design their own logos and paint the outside.)

2. Review very carefully all the rules for safety in firing the rockets. These are included in every model rocket kit from Estes (manufacturer). (Estes has both posters, videos, and computer programs explaining these rules and a description of how rocket engines work.)

3. Have students choose a spot for firing the rockets and decide on the procedures for measuring the height or ascent of the rockets, timing the descent and recovering the rockets.

Things to remember:

The ascent is very rapid and your measurement will be a very rough estimate in most cases. The descent will be effected by the wind's speed and direction because of the parachute that will open after the initial firing. Have students watch the descent before following the falling rockets.

4. A team of students can be assigned to measure the distance from the launching pad to the landing point. There will be time between firing of rockets to do this.

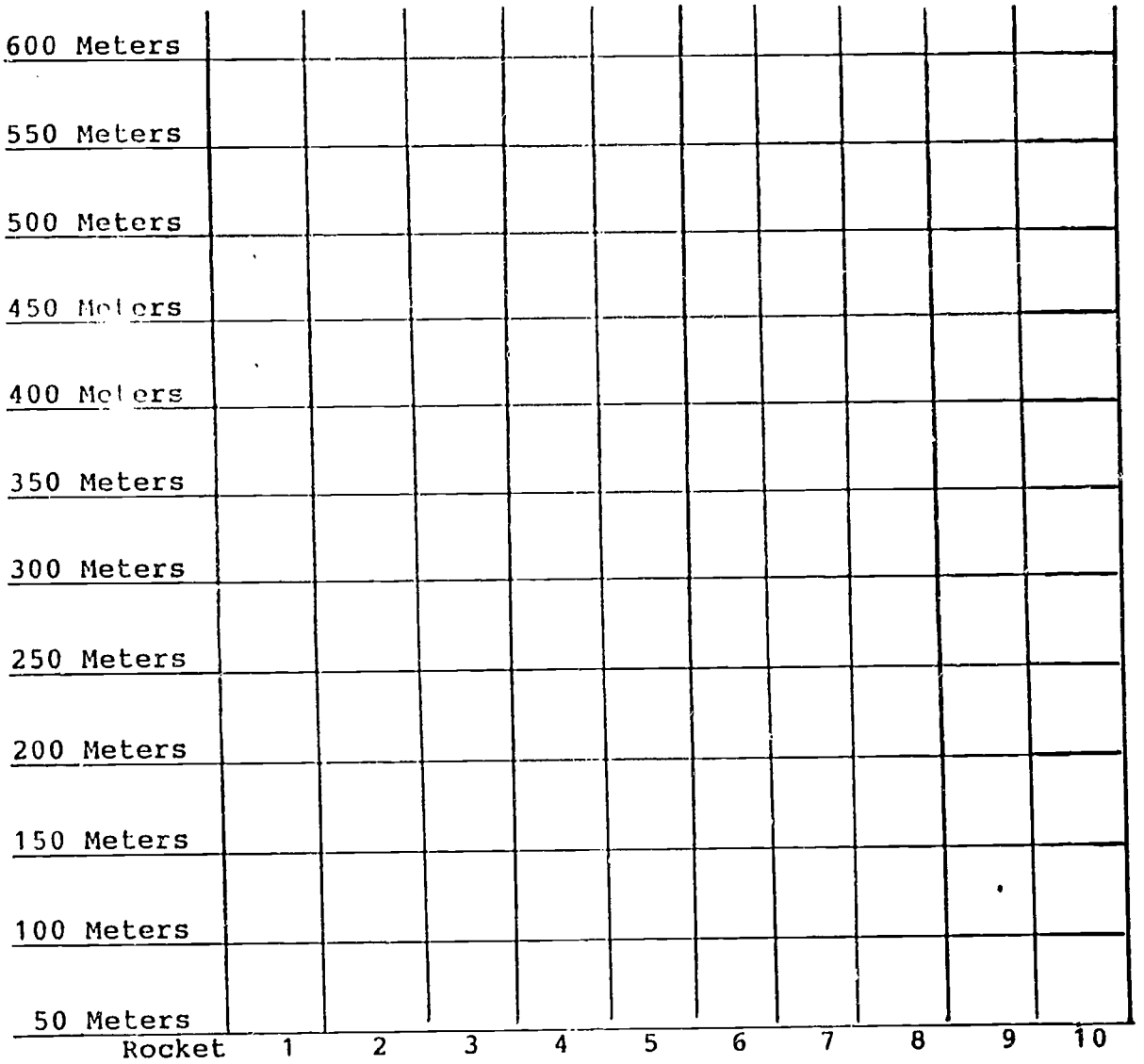
5. Have students display their rockets when they return to class with the statistics collected at the launching site listed beside them.

6. Have students make three graphs to summarize the date. One graph will show the heights achieved by the rockets. One graph will show the times of descent and the third will show the distance between launching and landing sites.

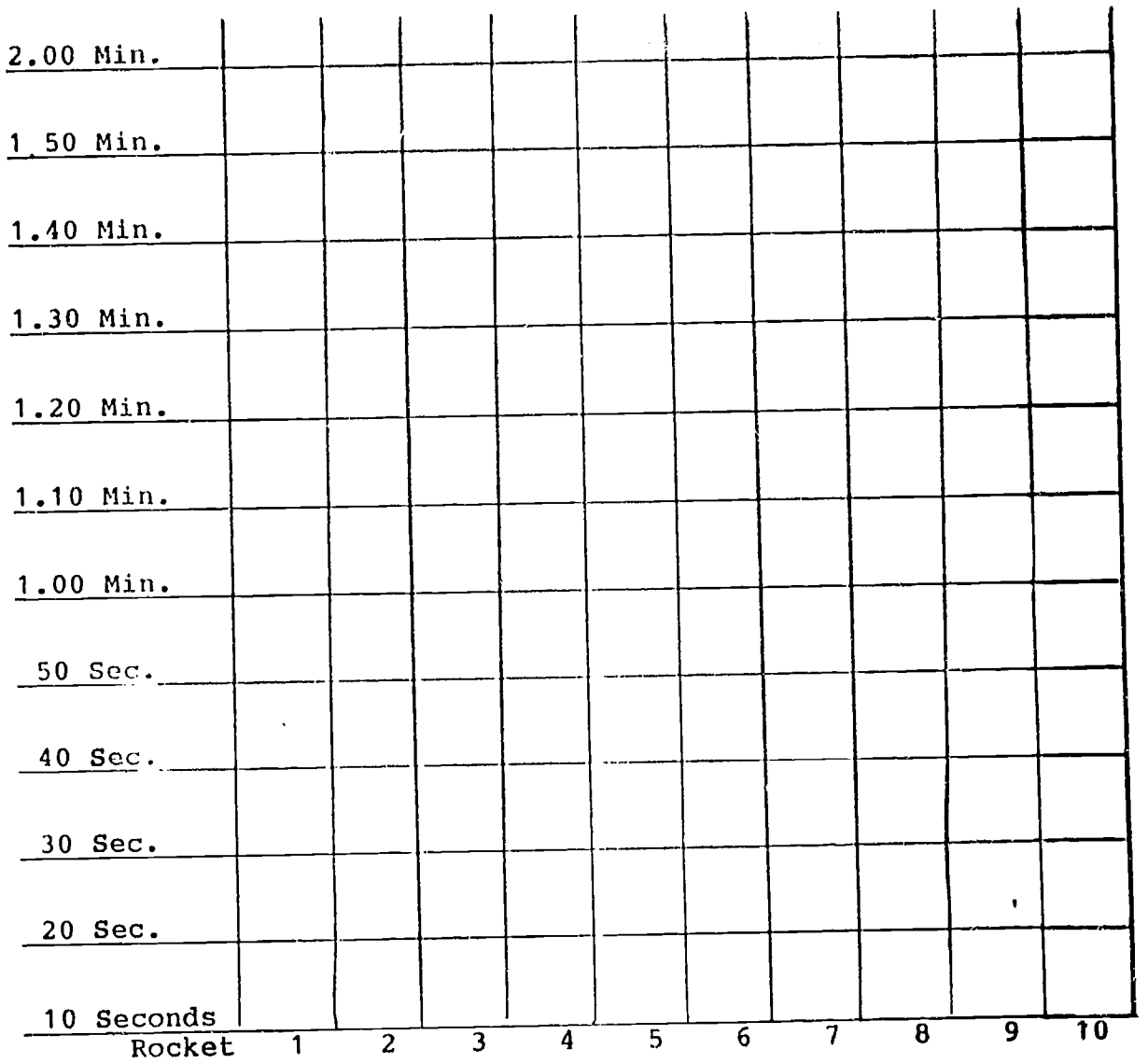
7. Discuss the experience with the students. What were their reactions? What surprising things happened? How could the experience be improved? What were the best things about the experience? What did you learn about rocketry from the experience?

8. You may have the students write creative stories about space travel and illustrate them. Now that they have some background, their imaginations can produce their own "Star Trek" play.

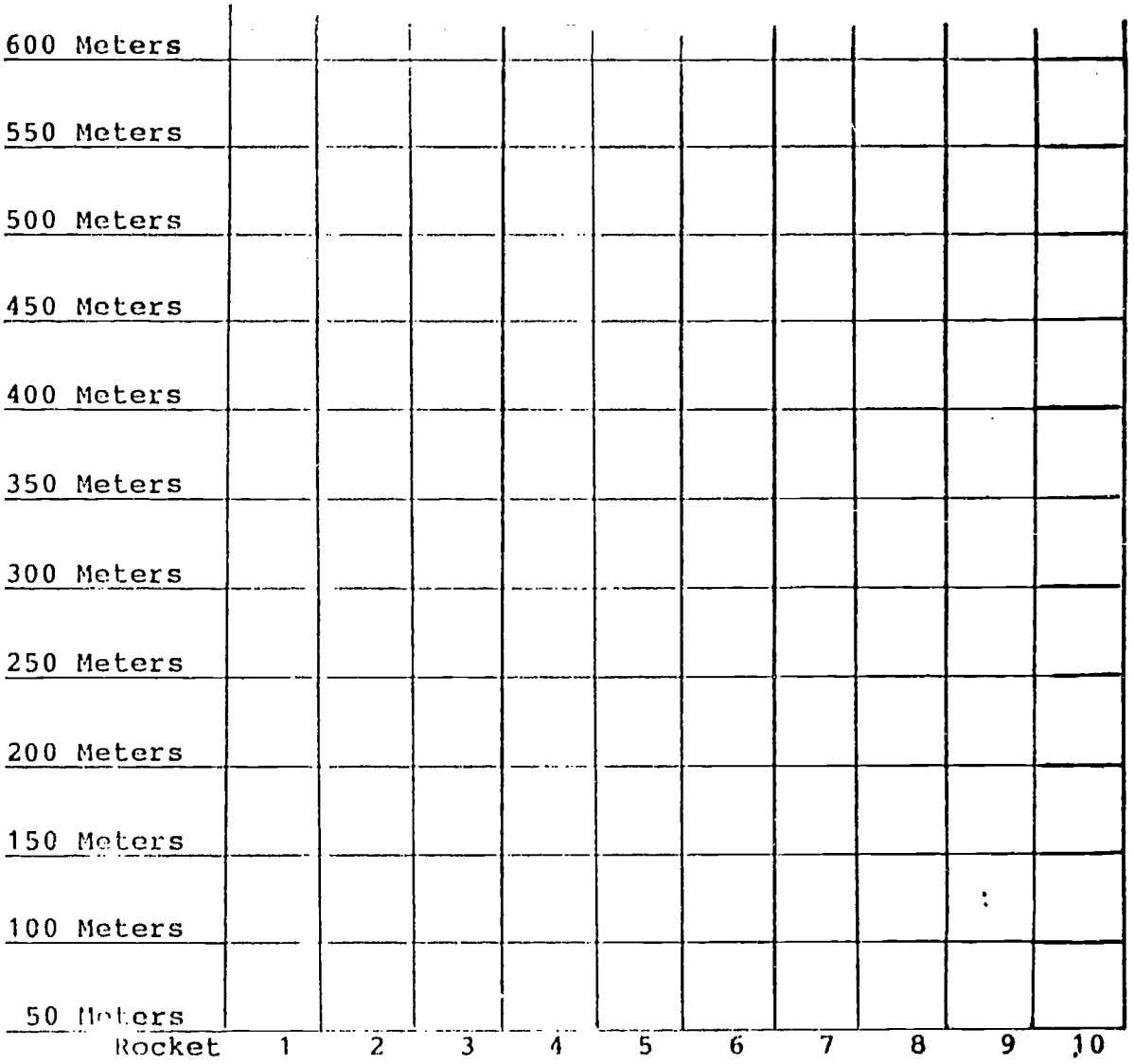
GRAPH OF DISTANCE FROM LAUNCHING PAD



GRAPH OF TIME OF DESCENT



GRAPH OF HEIGHT



LESSON TITLE: GEOMETRY AND KITES

GRADE LEVEL: 5, 6, 7, 8

SKILLS:

Goal 2 Concepts and Principles
Science
No. 18 Patterns
No. 19 Systems and Interactions
Mathematics
No. 25 Space and Dimensionality
No. 26 Measurement
No. 27 Change

PERFORMANCE OBJECTIVES:

. The student will be able to apply the principles of geometry and measurement in constructing a box kite.

. The student will demonstrate his/her creativity in designing his/her own pattern and model for a box kite.

MATERIALS:

Pictures of box kites
Wooden or plastic sticks for the structure or form of the kites
Silk, plastic, material such as mylar
Tissue paper or other material for the surfaces of the kites
Measuring tapes, meter sticks, rulers, pencils, paper, and glue sticks

PROCEDURE:

1. Show students pictures of different types of box kites.

2. Ask students if they can make a tetrahedron fly? How about a triangular prism? A cube? A rhombohedron? Challenge the students to design a large geometric figure that can fly like a kite.

3. Direct students to design their own pattern and draw a scale model.

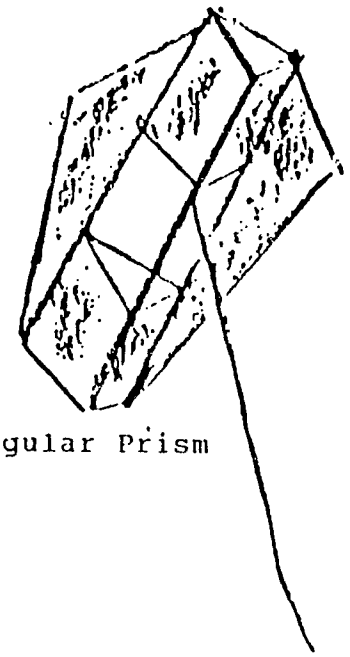
4. Have students work in small groups to transfer the design to the real thing. Allow students to choose their own materials once they have justified their design.

5. In putting the design into three dimensions, make sure that students consider the weight of the materials, the surfaces that will face the wind, the wind resistance factors, the balance, (Will it have a tail? Does it need a tail?) and the control. Remember, the wind is the power, so it must be light enough to float on the air currents. Where will you attach the bridle? This will decide whether it soars or pulls against the line.

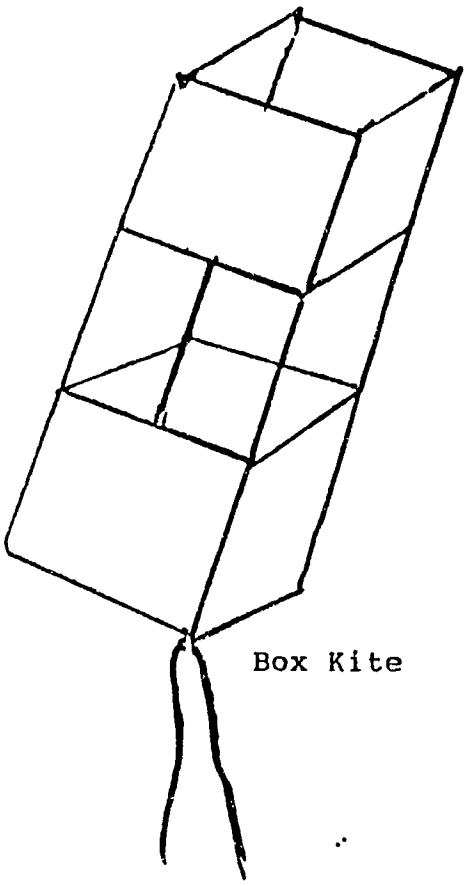
6. Allow students several trial runs and remakes to get their creation air borne. Set a deadline for the finished products to be displayed and flown.

7. You may want to award prizes for the best/most unusual geometric solid; the most intricate design; the highest flier; the most efficient flier; the most attractive; and any other category you deem appropriate.

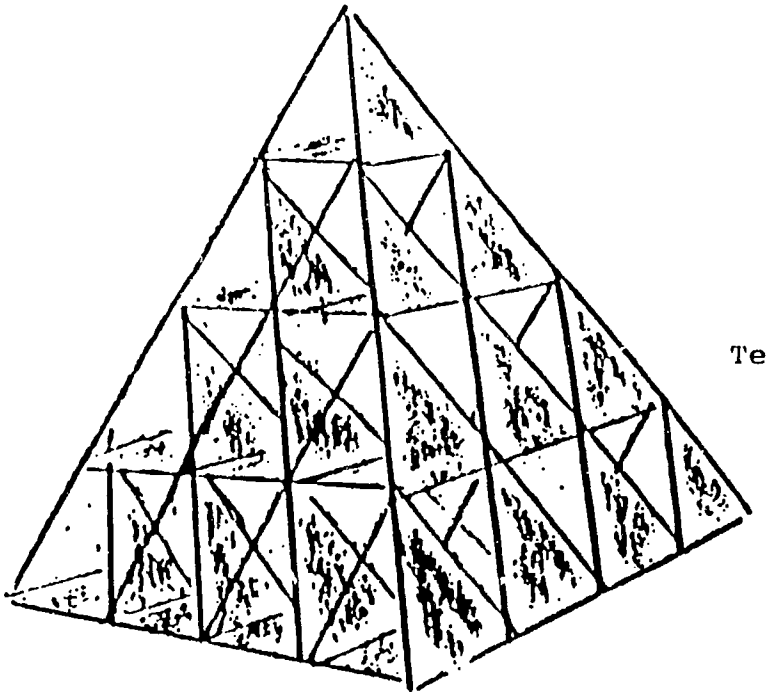
8. Have a discussion about what were the most challenging parts of the assignment; what information they would pass on to the next group of students; and what was the most rewarding or satisfying part of the task. Ask students to relate what rules of geometry that they had used in creating their kites and how they applied them. Ask students to decide which geometric solid was easiest to convert from the tow dimension state to the three dimensional form.



Triangular Prism



Box Kite



Tetrahedron

LESSON TITLE: SUPER SAVERS

GRADE LEVEL: 5, 6, 7, 8

SKILLS: Goal 2 Principles and Concepts
Mathematics
No. 24 Mathematical Procedures
No. 28 Mathematical Structure
No. 29 Data

PERFORMANCE OBJECTIVES: . The students will gain practical experience in finding percentages and solving problems concerning airline fares.

MATERIALS: Worksheet
Timetables
Paper and pencil

PROCEDURE:

1. Explain to students that there are choices about flying that determine the cost of the flight. Distance is of course the number one factor but other things enter into the price of the ticket.

The other available choices are the type of service selected, first class or coach; the time of year, peak season and off peak season; the day of the week of departure; and whether the flight is round trip or one way. Round trip is sometimes double the one way fare.

Airlines have dollar savings plans for each day of the week if you have purchased your ticket 30 days before the flight and stay at least one week before returning.

Saturdays and Sundays	- 35%
Monday or Friday	- 40%
Tuesday, Wednesday or Thursday	- 45%

Decide which days and which season are the best times to fly. Try some of the problems on the worksheet to help you understand how to figure out the cost of tickets and why they are called Super Savers.

Super Saver Worksheet

Normal Cost One Way	Round Trip	Departure Day	Discount Rate	Discount Amount	Cost
$ 150	_____	Monday	_____%	_____	_____
87	_____	Friday	_____%	_____	_____
123	_____	Sunday	_____%	_____	_____
186	_____	Tuesday	_____%	_____	_____
239	_____	Thursday	_____%	_____	_____

The Tour America Plan allows a twenty percent discount for off peak season which is September 15 through May 31. Peak season discount is only 15 percent June 1 through September 14. Find the discounted price for the following trips.

Normal-Coach Round Trip	Departure Date	Discount Rate	Discount Amount	Fare
$120	Feb. 4	_____%	_____	_____
250	July 9	_____%	_____	_____
172	Oct. 16	_____%	_____	_____
348	Jan. 12	_____%	_____	_____
297	Aug. 23	_____%	_____	_____

Super Saver Worksheet

Normal Cost One Way	Round Trip	Departure Day	Discount Rate	Discount Amount	Cost
$ 150	$300	Monday	40 %	$120.00	$180.00
87	174	Friday	40 %	69.60	104.40
123	246	Sunday	35 %	86.10	159.90
186	372	Tuesday	45 %	167.40	204.60
239	478	Thursday	45 %	215.10	262.90

The Tour America Plan allows a twenty percent discount for off peak season which is September 15 through May 31. Peak season discount is only 15 percent June 1 through September 14. Find the discounted price for the following trips.

Normal-Coach Round Trip	Departure Date	Discount Rate	Discount Amount	Fare
$120	Feb. 4	20 %	$ 24.00	$ 96.00
250	July 9	15 %	37.50	212.50
172	Oct. 16	20 %	34.40	137.60
348	Jan. 12	20 %	69.60	278.40
297	Aug. 23	15 %	44.55	252.45