TRANSPORTATION

Designing Parachutes

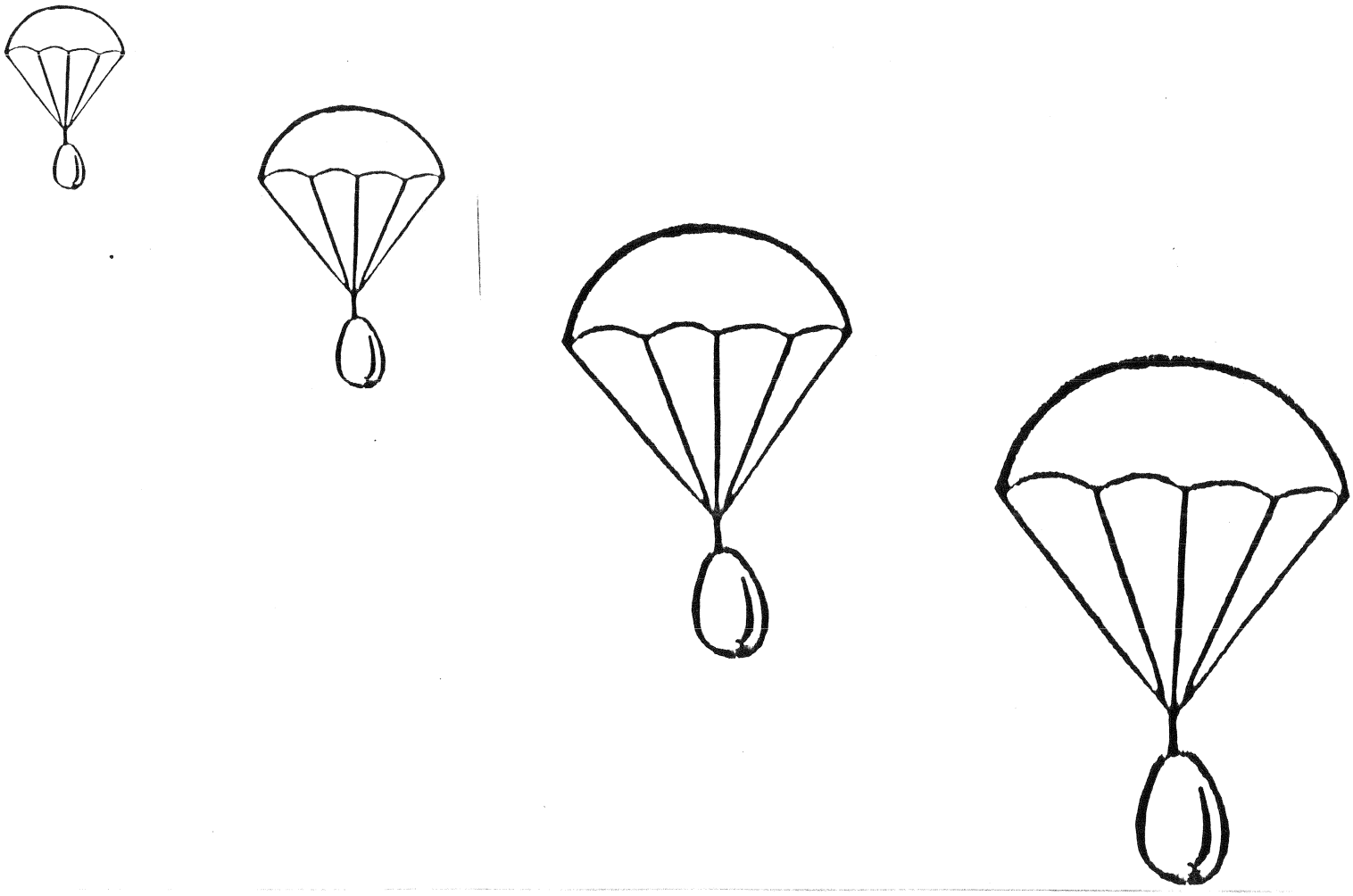
NAME _____ PERIOD _____

Introduction

Designing Parachutes

Parachutes are devices used to add resistance to an object moving through the air. We primarily associate parachutes with skydiving for sport or military purposes, but parachutes are used for a variety of other transportation purposes. Racing cars use parachutes to insure safe stops; military combat aircraft have special parachutes in their tail sections which aid the pilot in recovering from a spin; safe space capsule recovery is insured with parachutes; and smoke jumpers, parachuting firefighters, use parachutes to travel quickly to remote forest fires.

In this transportation activity, you are going to design a parachute and payload basket system that will protect a raw egg from breaking or cracking when dropped from a predetermined height.



Objectives
Designing Parachutes

Upon completetion of this package, the student will be able to:

1. Define parachute.

2. Describe the three phase of parachute operation.

3. Identify several applications of parachutes.

4. Design and make a parachute for a specified purpose.

5. Calculate parachute rate of descent.

6. Describe terminal velocity and explain its importance to appropriate parachute design.

7. Design a payload basket system that will protect an object when dropped from a predetermined height.

Grade Sheet
Designing Parachutes
Transportation

Time Frame : Total time required to complete Technology Learning Activity - 4 peroids.

CRITERIA	POSSIBLE	EARNED
Activity 1		
Check Point 1 (Parachute Design)	2	_____
_____ _____ Instructor Date		
Check Point 2 (Assembled Parachute)	2	_____
_____ _____ Instructor Date		
Check Point 3 (Calculations-Worksheet 1)	2	_____
_____ _____ Instructor Date		
Check Point 4 (Calculations-Worksheet 2)	2	_____
_____ _____ Instructor Date		

Activity 2

Check Point 1 (Basket Design)		2	_____
_____ Instructor	_____ Date		
Check Point 2 (Success of drop)		10	_____
_____ Instructor	_____ Date		
Evaluation Sheet		12	_____
	TOTAL	32	_____

GRADE BREAKDOWN

A - 29 - 32

B - 25 - 28

C - 21 - 24

D - 17 - 20

Information Sheet 1
Parachute Concepts

The operation of a parachute involves only a few simple concepts, and includes three basic phases: deployment of canopy and lines; inflation of the canopy; and descent. After deployment, air rushes into the canopy and forms a ball of air in the top or crown, which spreads out to the bottom or skirt of the parachute until the entire canopy is inflated. Stabilized descent is achieved when a certain velocity is reached and the canopy drag equals the weight of the payload. This stabilized descent is called the terminal velocity.

Concepts (terms and definitions)

Drag: something that retards motion or action.

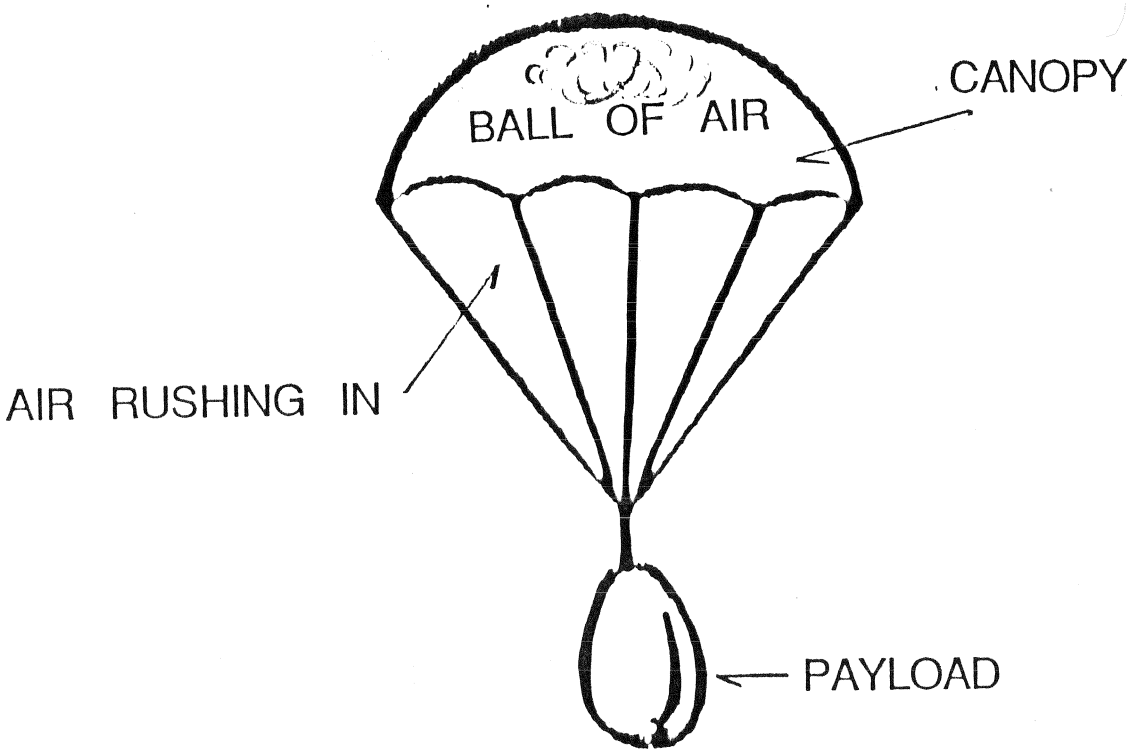
Payload: the weight of such a load.

Canopy: the lifting or supporting surface of a parachute.

Rate of descent: drop distance in feet divided by average descent time in seconds.

Parachute: a folding umbrella - shaped device of light fabric used especially for making a safe descent.

DRAG



PARACHUTE

Information Sheet 2
Math Concepts

Calculate the "Average Descent Time" for three drops.

Formula: Descent Time (DT)

$$\text{Average (DT)} = \frac{\text{DT 1} + \text{DT 2} + \text{DT 3}}{3}$$

Example: DT 1 = 3 seconds
DT 2 = 4 second
DT 3 = 5 seconds

$$\text{Avg. DT} = \frac{3 + 4 + 5}{3} = \frac{12}{3} = 4$$

Avg. DT = 4 seconds

Calculate " Rate of Descent".

Formula:

$$\text{Avg. DT} = \frac{\text{Drop Distance (in feet)}}{\text{Avg. Descent Time (in seconds)}}$$

Example: $\frac{\text{Drop Distance} = 20 \text{ feet}}{\text{Avg. Descent Time} = 4 \text{ seconds}}$

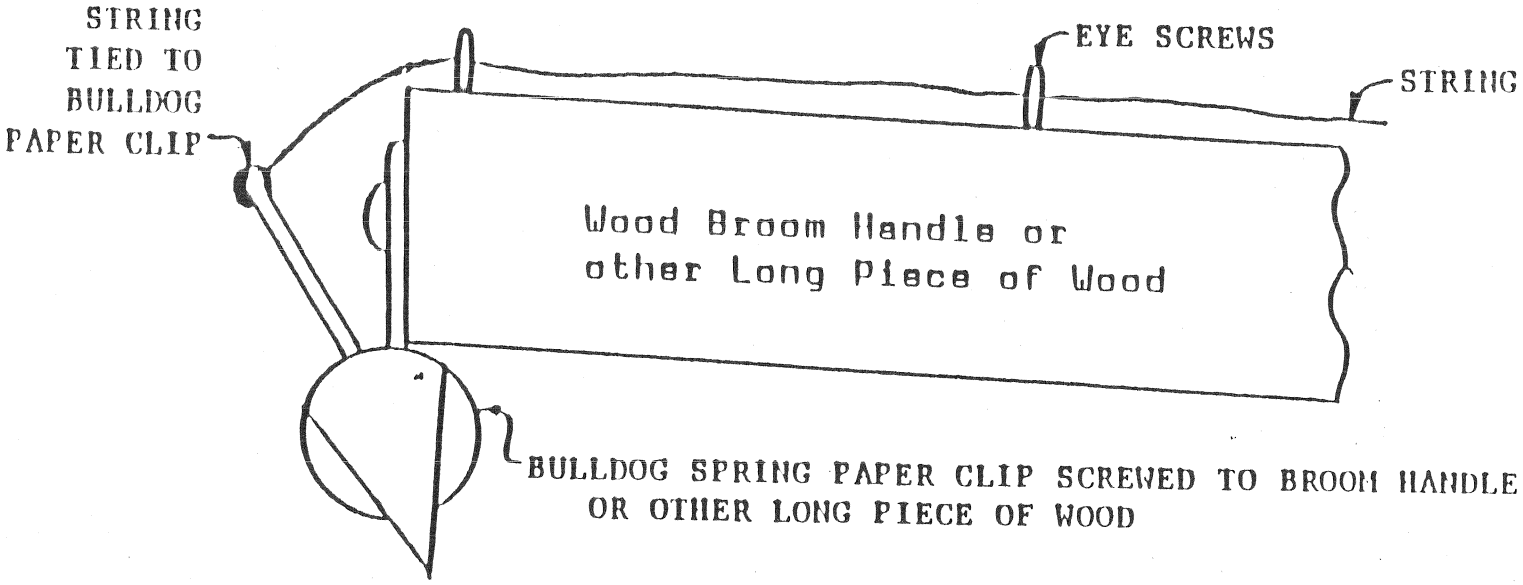
$$\frac{\text{Avg. DT} = 20 \text{ feet}}{4 \text{ seconds}} = 5 \text{ ft./sec.}$$

You will complete problems similar to these on worksheet 1 and 2. If you don't understand it, go over the problems again. See your instructor if you still have problems.

Information Sheet 3
Parachute Launcher

This device insures consistent parachute drops every time.

TO USE; Pull string to open paper clip; put center of parachute canopy in clip; let clip close. Hold launcher at the predetermined height and pull the string -- the parachute is launched. This device insures consistent parachute drops every time.



Activity 1

Design And Construct a Parachute

Introduction

The design, shape, and material used to make a parachute varies dependent upon several factors including; intended use, payload weight, payload characteristics, and the desired opening rate and terminal velocity. Canopies are often made of geometric shapes such as: squares, rectangles, triangles, circles, pentagons, hexagons, and octagons. Materials vary according to their weight and porosity.

In this activity, you will design and construct a parachute using a material, canopy shape, and line length of your choice. The parachute will be tested for: 1. Rate of descent.
2. Payload weight vs rate of descent.

Material List

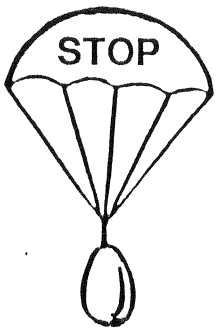
Below is a list of materials that may be used in the construction and testing of your parachute:

drafting paper
drafting tools
scissors/ razor knives
duct tape
fishing snap swivel
payload (large washers or nuts)
stop watch
plastic sheets
garbage bags
dry cleaning bags
cloth
tissue paper
nylon
fishing line
nylon sewing thread

Procedure

1. Design the parachute.

CHECK POINT 1



2. Select desired material for parachute.

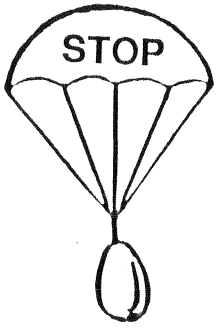
3. Trace design on material and cut out design.

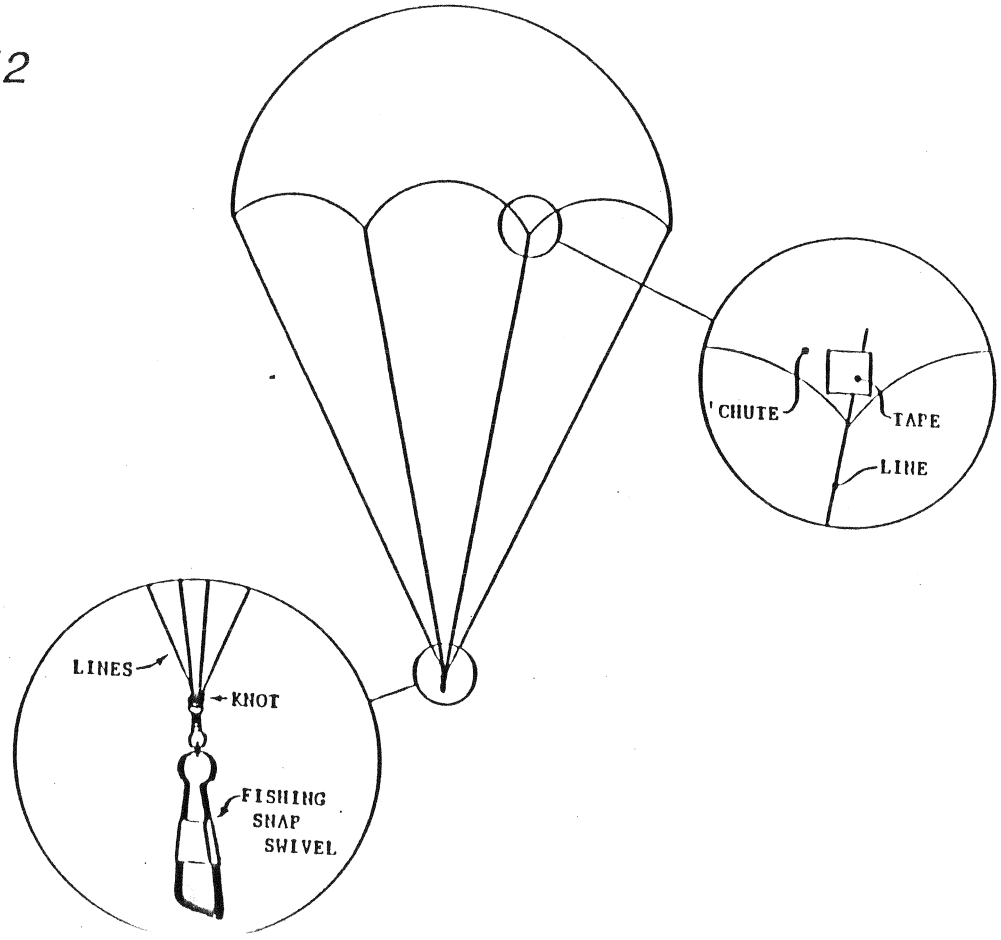
4. Determine string length for lines, measure and cut.

5. Secure lines to parachute with tape.

6. Tie a fishing snap swivel to other end of lines.

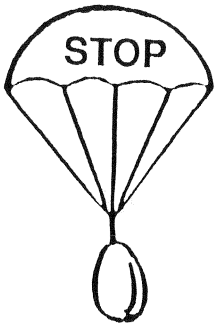
CHECK POINT 2





7. Test: Rate of Descent

a. Attach standard payload weight to snap swivel.
b. Drop payload and parachute using parachute launcher.
c. Record descent time in seconds on worksheet 1 (Data Recording Sheet).
d. Drop parachute three times.
e. Calculate "average descent time".
f. Calculate "rate of descent".

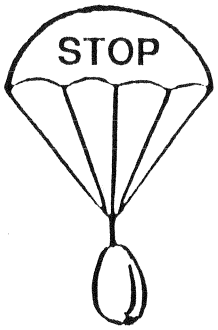


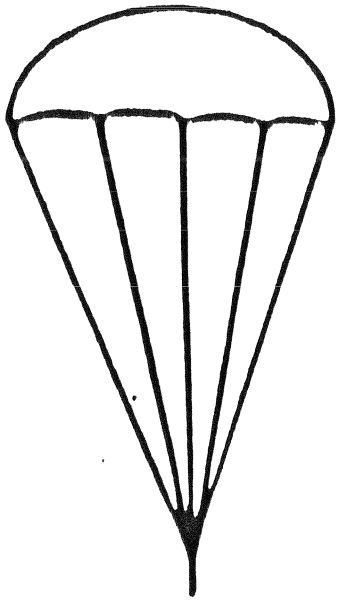
CHECK POINT 3

8. Test: Payload Weight vs Rate of Descent.

a. On the second graph, worksheet 2, record your average "Descent Time" above WT1 (weight #1).
b. Add additional weight specified by your instructor to the standard payload weight to create weight #2 (WT2). Conduct one drop and record the results.
c. Repeat above procedure using the heaviest payload weight (WT3) provided by your instructor. Record results.
d. Compare the results of the three weight test.

CHECK POINT 4





Worksheet 1

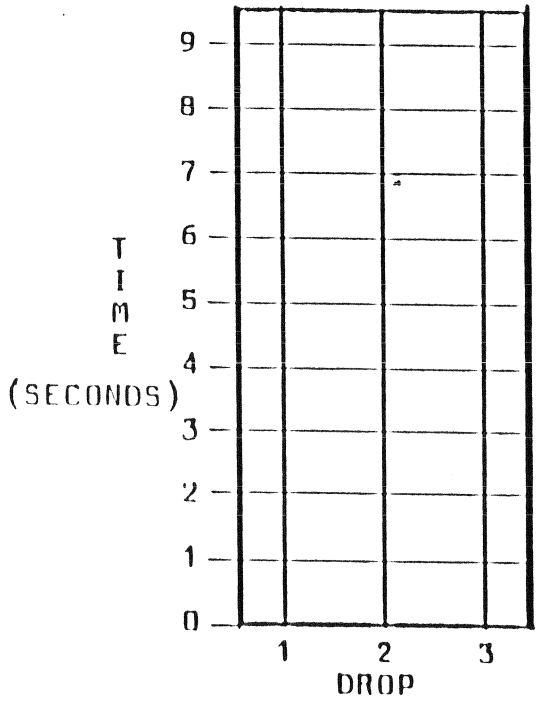
Parachute Experiment: Data Recording Sheet

Parachute Material Used: _____

Parachute Shaped Used: _____.

TEST:

1. RATE OF DESCENT:



AVG. DESCENT TIME= $\frac{DT1+DT2+DT3}{3}$

AVG. DESCENT TIME= $\frac{+\quad +}{3}$

AVG. DESCENT TIME=

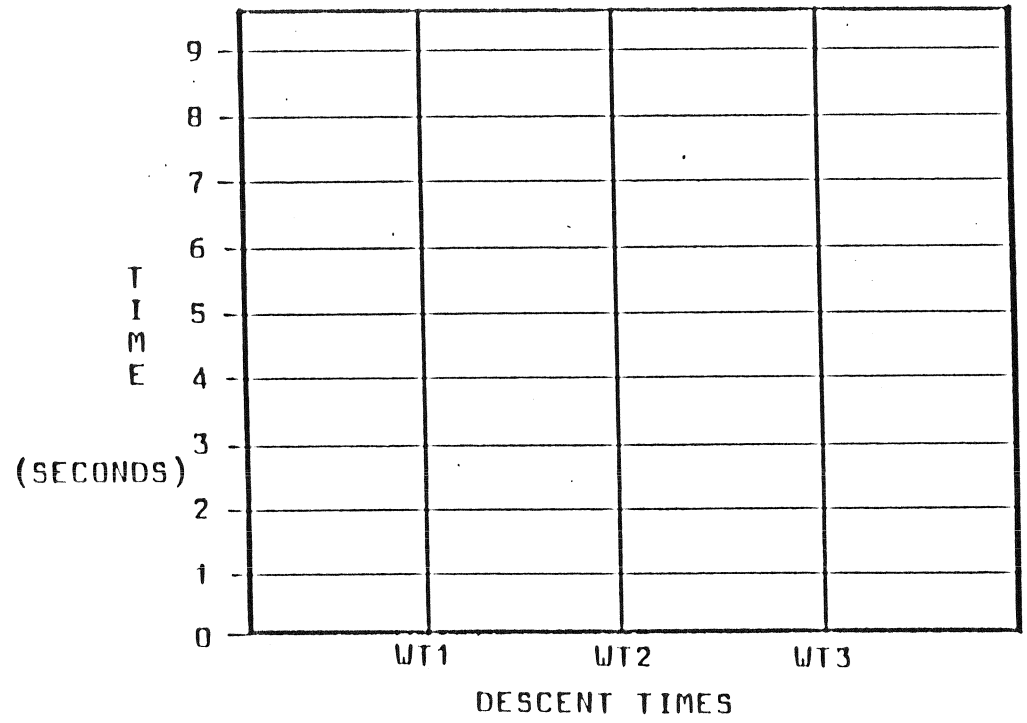
RATE OF DESCENT= $\frac{\text{DROP DISTANCE (FT)}}{\text{AVG. DESCENT TIME}}$

RATE OF DESCENT= _____

RATE OF DESCENT= _____

Worksheet 2

2. PAYLOAD WEIGHT VS. RATE OF DESCENT:



Activity 2

The Ultimate Basket

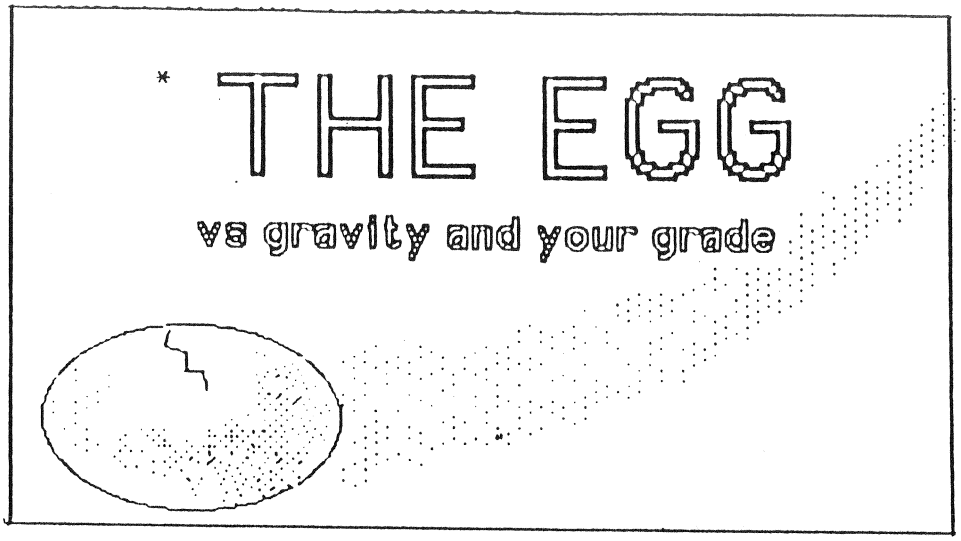
Introduction

Reagans receive $200,000 in foreign gifts.

The official gift list is in - all $200,000 worth of presents given to President and Mrs. Reagan last year. The high roller: His Majesty Fahd Ibn Abd Al-Aziz Al Saud of Saudi Arabia. He gave Nancy Reagan a $20,000 gold evening tote with NR spelled out in diamond chips; the president a $12,500 enameled egg with gold interior. Other gifts: a $15,000 ivory elephant from Thai Queen Sirikit and a $20,000 metal sculpture of a nude women from Colombian President Belisario Betancur.

Your mission should you choose to accept .... and you do, is to design the ultimate basket that will safely protect the president's $12,500 enameled egg when dropped over the white house from a C-141 military combat aircraft.

In this activity you will design a payload container that will protect a raw egg from breaking or cracking when dropped from a predetermined height. The major test you will be performing for this mission is to get the egg safely from the school roof to the ground below. The drawback to this is that you must drop the egg to the concrete landing zone below. If you fail this mission, you will not only lose your government job and salary of $53,750 a year, but more importantly, your grade for this assignment will suffer.



Material List

Below is a list of materials that may be used in the designing and construction of the **Ultimate Basket.**

drafting tools
1 - 8"x8" sheet of drafting paper
scrissors/razor knives
raw eggs
string
glue, tape, staples (a limited amount of these fasteners will be available)
washers

Problem Sheet 1

Problem:

Using the materials located on the material list, you are to design the ultimate basket that will protect a raw egg from breaking or cracking when dropped from a predetermined height.

Parameters:

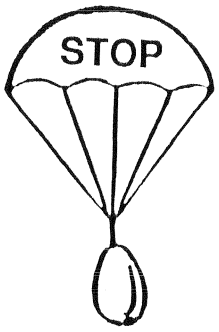
You Must:

1. Use only the material listed on the material list.
2. Use as little Material as possible.
3. Use an ordinary hen's egg.
4. Design the basket so that only one thickness of paper exists between the egg and landing surface.
5. Design the basket with one open side.

You Must Not:

1. Modify the egg.
2. Use foam rubber or other insulating materials.
3. Make a mess.

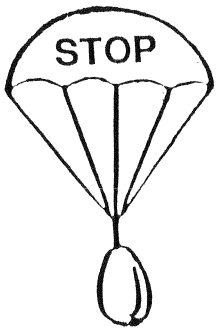
CHECK POINT 1



TEST: You may perform one test drop without an actual egg. You may use washers that equal the egg's weight.

Test drop with raw egg.

CHECK POINT 2



Evaluation Sheet
Designing Parachutes

DIRECTIONS: Read each question carefully and answer each question with a short, but complete answer. No credit will be given for incomplete answers. Print or write your answers legibly.

2 pts. 1. Define parachute.

3 pts. 2. Describe the three phases of parachute operation.
a.

b.

c.

4 pts. 3. List four applications of parachutes.
a.
b.
c.
d.

3 pts. 4. Describe terminal velocity and explain its importance to appropriate parachute design.

_____ Raw Score

12 Total Points

TECHNOLOGY EDUCATION
PACKAGE/ACTIVITY RATING SHEET

Package/Activity Name _____

Date Started ____/____/____

Date Finished ____/____/____

Package Grade _____

****

INSTRUCTIONS: Circle the number on the continuum that best represents your feelings about this package/activity. If you circle a 1 or 2 you ***must*** make a comment in the space provided. If you circle a 3,4 or 5 you ***may*** comment if you wish. Please be honest! Your evaluation will be used to improve this package. Thanks.

****

1. Was the package/activity easy or difficult to understand and follow?

Difficult		Just Right		Easy
1	2	3	4	5

Comment(s):

2. Was the reading level of the package/activity easy or difficult for you?

Difficult		At my level		Easy
1	2	3	4	5

Comment(s):

3. Was the time allowed for completion of this package/activity too long or not enough?

Not enough		Just right		Too much
1	2	3	4	5

Comment(s):

4. *Were the learning objectives as stated in the package/activity very clear and understandable or vague and not easy to understand?*

Vague-Unclear		Understandable		Very Clear
1	2	3	4	5

Comment(s):

5. *Was the evaluation (grading criteria) of this package/activity too easy or too tough?*

Real Tough		Fair		Easy A!
1	2	3	4	5

Comment(s):

6. *Do you feel you learned very little or alot from completing this package/activity?*

Very Little		Learned Something		Alot
1	2	3	4	5

Comment(s):

7. *Overall, how would you rate/rank this package/activity?*

Pure Junk		Not bad		Awesome
1	2	3	4	5

Comment(s):