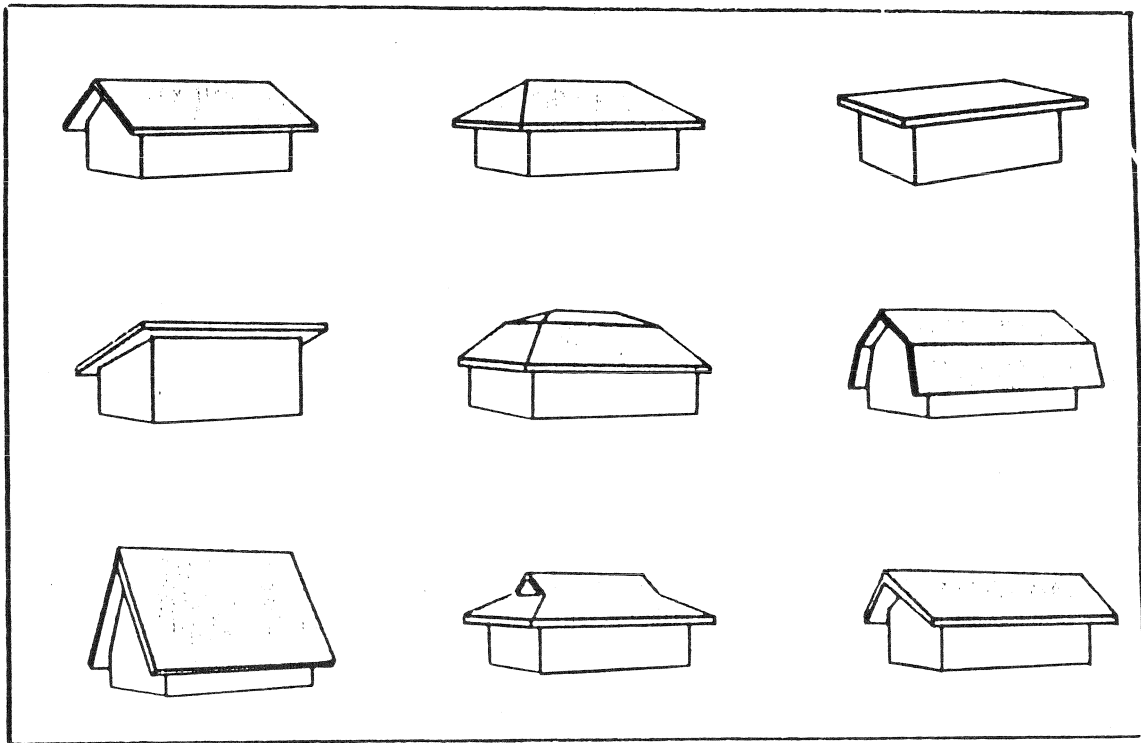


# CONSTRUCTION

## ROOF DESIGN TECHNOLOGY



NAME: \_\_\_\_\_

PERIOD: \_\_\_\_\_



# GRADE SHEET

## CONSTRUCTION AND DESIGN

CRITERIA	POSSIBLE	EARNED
CHECK POINT#1 (2 designs)		
<u>Instructor</u> <u>Date</u>	5	_____
CHECK POINT #2 (Flat sheets)		
<u>Instructor</u> <u>Date</u>	3	_____
CHECK POINT #3 (Arch)		
<u>Instructor</u> <u>Date</u>	3	_____
CHECK POINT #4 (Pleats)		
<u>Instructor</u> <u>Date</u>	3	_____
CHECK POINT #5 (Sandwich)		
<u>Instructor</u> <u>Date</u>	6	_____
CHECK POINT #6 (Your model)		
<u>Instructor</u> <u>Date</u>	20	_____
CHECK POINT #7 (Efficiency)		
<u>Instructor</u> <u>Date</u>	10	_____
TOTAL	50	_____

### GRADE BREAKDOWN

A-42 to 50

B-33 to 41

C-24 to 32

D-15 to 23



## INTRODUCTION

### CONSTRUCTION AND DESIGN

Designers spend many hours to develop new ideas. Many times these are not the best idea or the most practical and cost efficient; therefore, the designer also works closely with the engineers in building models of the structure. The models are then tested for such things as ease of construction, cost, component failure, total failure, and many other possible defects.

New designs are brainstormed, sorted, hacked apart and redone many times before a model is built and tested; still there are many failures. Each failure brings about more design changes and more models.

In this Learning Activity Packet we are going to delve into your mind to design a structure cover, or roof, that will be the most efficient for the materials used. You will be using paper as your building material.

## OBJECTIVES

### PROBLEM SOLVING

#### THROUGH COOPERATIVE BRAINSTORMING

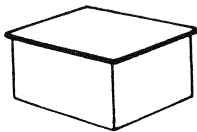
Upon completion of this packet the student will be able to:

1. Use problem solving and testing techniques to reach a conclusion.
2. Design an overhead enclosure without trusses or inside support.
3. Understand forces applied to structure sides by overhead enclosures.
4. Understand how materials are used often determines what material is used.

## INFORMATION SHEET #1

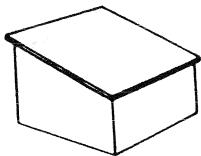
### STRUCTURE TYPES

The introduction told you there are many attempts and much thought involved in a design before success is attained. Some of the successful designs are illustrated below.



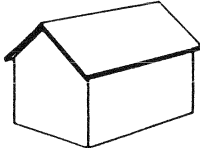
FLAT ROOF

The Flat roof has level rafters that also serve as ceiling joists.



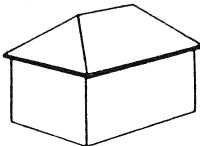
SHED OR LEAN-TO ROOF

The Shed roof is similar to the flat roof but has a slope in one direction only.



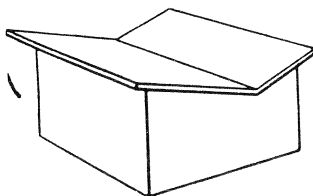
GABLE ROOF

The Gable roof is the most common. It has two slopes that meet at the top to form a ridge and leaves a gable at each end.



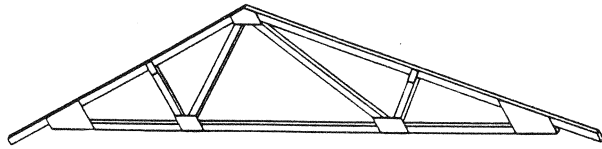
HIP ROOF

The Hip roof slopes at the ends as well as both sides. It gives even overhang all around and makes a low roof appearance.



BUTTERFLY ROOF

The Butterfly is an inverted Gable, usually used when run-off is a special problem.



**trussed rafters.**

The Trussed rafter spans large distances because of its design, but it also limits useable space below the roof.

Most conventional covers have internal units such as walls, posts or trusses to aid in supporting them.

In this Learning Activity Packet we are going to design a "roof," without internal trusses or supports, to cover a predetermined distance or span.

You will be divided into groups to design, test and select the type structure you feel will best do the job.

#### RESOURCES

You may use any of the books, magazines, pamphlets and pictures assembled on the resource bench, as well as the library and other sources outside of class time.

#### TIME ALLOTTED TO COMPLETE THIS PACKET

We will allow five (5) class periods to complete the activities. If, for a GOOD REASON you fall behind, you may check in extra periods with advanced approval only.

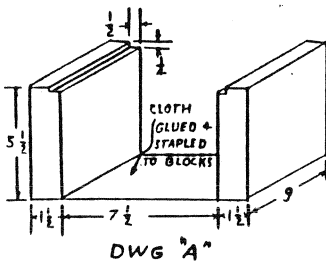
BE SURE TO BRING YOUR GRADE SHEET AND WORKSHEET TO YOUR INSTRUCTOR WHEN YOU REACH EACH CHECK POINT.



## MATERIAL AND EQUIPMENT LIST

Below is a list of materials and equipment to be used in the testing of "roof" designs.

After Check Point #1 you may get the materials and equipment needed. BE SURE TO WATCH FOR EACH CHECK POINT.



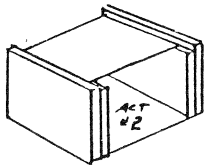
- 1 Test Stand (DWG. "A")
- 1 Postage or Balance Scale
- 7 Flat Paper
- 12 Weights of various size (IN BOX)
- Glue

## ACTIVITY #1

After you have been divided into groups, brainstorm ideas and bring your instructor two (2) of your best designs.

CHECK POINT #1

## ACTIVITY #2



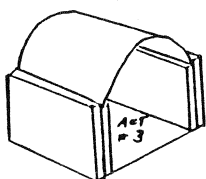
1. Set up test stand.
2. Lay a flat paper across the supports. (Paper will have to be cut to fit.)
3. Add weights until failure.

4. Use scale to weigh load last supported.

Record on recording form. (Last page of packet)

5. Weigh and record the structure (roof).
6. Repeat the test with two (2) then three (3) thicknesses of paper. Record results of each.

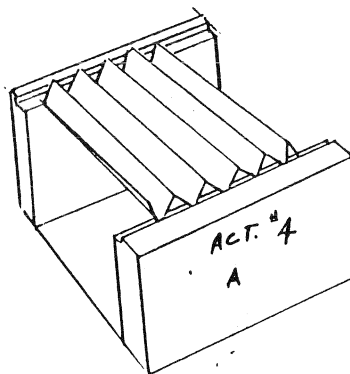
#### CHECK POINT #2



#### ACTIVITY #3

1. Form an arch with the paper between the ridges on the test stand. (Do not cut paper)
2. Add weights until failure.
3. Repeat steps 4-5-6 from above.

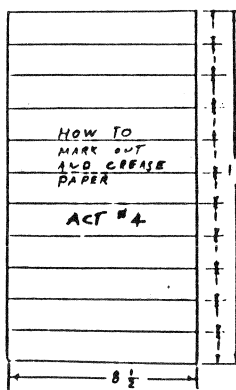
#### CHECK POINT #3



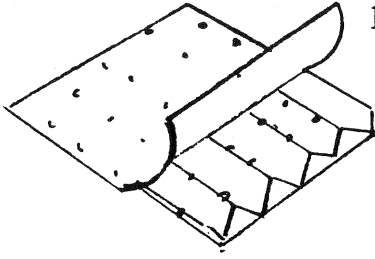
#### ACTIVITY #4

1. Crease paper to form pleats as shown on diagram. (Activity #4-A)
2. Place on test stand as shown.
3. Add weights until failure.
4. Use scale to weigh load last supported. Record on recording form.
5. Weigh and record the structure. (roof)

#### CHECK POINT #4



### ACTIVITY #5



1. Spot glue (about 1" apart) a sheet of paper to each high ridge on both sides of the pleated paper (used in Activity #4) to form a sandwich.

LET DRY

2. Place the unit on the test stand.
3. Repeat steps 3-4-5 in Activity #4.

CHECK POINT #5

### ACTIVITY #6

1. Build your structure. REMEMBER YOUR MATERIAL IS PAPER ONLY ! You may use glue at the contact points of members only.  
(LET DRY)
2. Place your structure on the test stand.
3. Repeat steps 3-4-5 in Activity #4

CHECK POINT #6

### ACTIVITY #7

Under the box on your recording form is the formula for calculating the efficiency of each of your tests. The higher the percent of each structure, the more efficient it is in the use of materials and strength. Calculate the Efficiency percent of each of your tests and record the results on the Recording Form.

CHECK POINT #6

You have now experienced some of the processes used in construction design. You have used the same materials in different ways and learned they react to stress (load) in different ways. This is why a design that looks good is not necessarily good design.



# RECORDING FORM

ACTIVITY	SHEETS	WEIGHTS		EFFICIENCY
		LOAD	STRUCTURE	
2	1			
	2			
	3			
3	1			
	2			
	3			
4	1			
5	1			
6	Model			

Formula to find efficiency

$$\frac{\text{Weight Supported} \times 100}{\text{Weight of Structure}} = \text{Efficiency \%}$$



TECHNOLOGY EDUCATION

CONSTRUCTION

Name \_\_\_\_\_

DATE \_\_\_\_\_

1. Name four of the five roof styles shown in the information sheets.

\_\_\_\_\_

2. What is the advantage of trussed rafters?

3. What is a disadvantage of the trussed rafter?

4. Which of the five roof styles shown is the most common in residential construction?

5. Which structure that you tested was the most efficient?

6. What would happen to the strength if you were to glue papers together to get 1" thick?

7. What would happen to efficiency?

8. Name a type of structure that would need a wide span self-supporting roof.





## PACKAGE RATING SHEET

Circle the answer to each question that best describes how you felt about using this Learning Activity Packet.

1. Was the reading level of the packet in your range?

Too easy                  no problem                  to hard

2. Did the Introduction let you know about what to expect?

No                  Sort of                  Yes

3. Did the objectives explain what you were to learn?

No                  Sort of                  Yes

4. Did the pictures help to explain what you were to do?

No                  Not really                  Yes

5. How was it to understand the written instructions?

Hard                  Not bad                  Easy

6. Did you learn form this activity?

No                  Not much                  Yes

7. Did you enjoy this activity?

No                  Not much                  Sort of                  Yes

8. Do you feel what you learned in this activity will be of value in some of the things you may do in the future?

No                  Not much                  Maybe                  Yes





