Greenhouses: Types and Construction

1. What is the basic function of a greenhouse?

2. What five (5) environmental factors are ideally controlled in a greenhouse?

<table>
<thead>
<tr>
<th>Description</th>
<th>Sketch</th>
<th>Advantages</th>
<th>Disadvantages</th>
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<td>Even Span</td>
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<td>Lean - to</td>
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<td>Quonset</td>
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<td>Curvilinear &amp; Curved Eave</td>
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<td>Lath House</td>
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<td>Cold Frame</td>
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<td>Gothic Arch</td>
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Greenhouse Design

Now that you have designed your greenhouse...

It is time to think about the equipment it will have.

The next step in the greenhouse project is that you will form a team of 3-4 people. Between the group, you must decide which greenhouse design you are going to use. Make sure the design includes the critical components of a greenhouse you previously identified on the “Parts of Greenhouse” worksheet. For example:

* Way to water plants
* Heating and cooling

REMEMBER

You are an AGRICULTURAL ENGINEER!
Your job is to design a state-of-the-art greenhouse for MCPS with the following specifications:
* Minimum size (20’ x 40’)
* Maximum size (30’ x 60’)
* Wide aisles allowing 20 students at a time
* Tables allowing easy clean up & drainage
* A non-slick floor material
* A sink

Awards for most creative greenhouse meeting these specifications & for the most “green” greenhouse (environmentally friendly & energy conservative)
After identifying all of the necessary equipment for your design, you will use the internet to “shop” online for the items you will recommend in your presentation. For each recommended item, you must include:

- A picture of the item
- The company selling the item
- The company website
- The item number
- The price
- A description of the item/material
- Total quantity needed IN YOUR GREENHOUSE

All of your information should be put into either a professional document or PowerPoint file.

The document should then be printed and your team will need to create a display board or poster to use during your presentation.

If you choose to create a PowerPoint, you will not need to print the pictures. Simply use the PowerPoint during your presentation.

AN EXAMPLE...

Description: This plastic greenhouse table measures 96” x 36” x 18” and is available from All American Associates, Inc.
Web address: http://www.aaagreenhouse.com
(Item # BMS9619801S3)
$126.00

Additional legs are available at this website. I suggest the 36” leg (Item #BMLEG36) for $6.99 each.

My design calls for 10 tables and 60 legs for a total cost of $1679.40.
You have your greenhouse and your equipment list…

Now it is time to build a model

Your group will now build a model of your greenhouse design. It is important your model is built to scale; however your team will establish the scale and write it on the base of your model. For example, you may decide that every ½ inch of your model is equal to 1 foot of your greenhouse.

You may use an assortment of materials in building your model, but you must include a key as to what real material each item corresponds to. (Example: popsicle sticks = wood)

Example of items which can be used:

- Craft sticks/popsicle sticks
- Plastic wrap
- Wax paper
- Packing foam
- Bird seed
- Cardboard

Please see Mrs. Whitlow for a “board” to build your model on. There are some materials available here for you to use, but you are also welcome to bring in items from home. You are only limited by your imagination.

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**PARTS OF A GREENHOUSE**

**I. Prior Knowledge**

Based on your knowledge of what plants need for survival, what equipment would a grower need to have in a greenhouse in order to successfully grow a crop of plants? (List everything that you can think of!)

**II. Did you think of everything?**

Now that you have reflected on plant needs and greenhouse equipment, go to the CMS greenhouse and walk around. Complete the chart below as you walk around. Note, you may not use every line of the chart.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PURPOSE</th>
<th>Building or Plant related?</th>
<th>Is this item ABSOLUTELY NECESSARY or is it a LUXURY item?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprinkler / Misting System</td>
<td>Plant</td>
<td></td>
<td></td>
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<tr>
<td>Door</td>
<td>Building</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
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<td>Building or Plant related?</td>
<td>Is this item ABSOLUTELY NECESSARY or is it a LUXURY item?</td>
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</table>

### III. “Dream” List

Before we go to the next step, what kinds of items would you like to see in a greenhouse if money were no option? For example, Mrs. Whitlow would love to have a sink for hand washing, a P.A. system and a small area for a cash register and check out of shoppers. What can you envision?
SCALE DRAWINGS

Architects regularly use scale drawings when they design houses and buildings. A scale is a ratio that compares the measurements used in the drawing to the actual measurements. Scale drawings or models are similar to the actual drawing or figure, and therefore the sides are proportional. The ratio you should use when working with scale drawings or models is:

\[
\text{Scale measurement} \quad \text{Actual measurement}
\]

This is called scale ratio. For example, if a model car measures 2 cm for every 1 ft of the actual car, the scale ratio is 2cm/1 ft. Knowing this ratio allows you to set up a proportion to figure out how long the actual car would be if the scale model was 36 cm:

\[
\frac{2 \text{ cm}}{1 \text{ ft}} = \frac{36 \text{ cm}}{x \text{ ft}}
\]

By solving the proportion, you can determine that the actual car length is 18 ft.

EXAMPLE: In my Google SketchUp Greenhouse, the greenhouse plan measures 20 ft x 40 ft. If I have already begun my model, and the width is 12 inches. What is my ratio?

\[
\frac{12 \text{ inches}}{20 \text{ feet}} = \frac{1}{x}
\]

\[
(1) \times (20) = (12) \times (x)
\]

\[
20 = 12x
\]

\[
20 / 12 = x
\]

\[
x = 1.67
\]

OR, 1 inch of my model is equal to 1.67 ft on my actual greenhouse

So how long should my length be on my model greenhouse?
Another example: If I chose a greenhouse table measuring 5’ long by 3’ wide by 3 ½ ’ tall, and my scale is ½ inch = 1 ft, how big should the table be in my model?

Directions: Complete the following based upon YOUR model as you continue to work today.

1. What are the dimensions of your greenhouse, based on your drawing in Google Sketchup?

2. If you have already begun your model, what are the dimensions of your model?

Thus, what is your scale?

3. If you have not begun your model, what scale do you plan to use?

4. Complete the following table based on the scale you just determined and the shopping list you have been working on.

<table>
<thead>
<tr>
<th>MY GREENHOUSE COMPONENTS &amp; EQUIPMENT:</th>
<th>Dimensions of product on “Shopping List”</th>
<th>The model should be this size:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table</td>
<td></td>
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<tr>
<td>Fan</td>
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</table>
GRADE SHEET – STEM Project PART I & II

PART I:

Google Sketch Up – Greenhouse Design
Plan shows a greenhouse with basic components of a building:

- Walls .................................................................................................................. 5
- Roof ................................................................................................................... 5
- Door ................................................................................................................... 5

Practical materials for a greenhouse shown (i.e. walls & ceiling) ................. 20
Greenhouse meets size specified (check dimensions) ..................................... 10
Basic equipment is shown (i.e. fans, water pipes, tables) minimum 5 items ..... 15
“Extras” were included ....................................................................................... 15

TOTAL POINTS POSSIBLE........................................................................ 75

PART II:

Greenhouse Equipment
EVERY piece of equipment is identified ......................................................... 20
(i.e. water lines, something to hang baskets on, fans, cooler, heater, tables, etc.)

- Picture included for each piece of equipment ........................................... 20
- Company selling and web address for each item ..................................... 20
- Item number .................................................................................................. 10
- Price ................................................................................................................. 10
- Description of each item or material ......................................................... 20
- Quantity needed for your greenhouse ....................................................... 10

Total price for ALL equipment is given ....................................................... 20
Math is accurate

Information is PROFESSIONALLY presented in either a PowerPoint document
or on a poster. Students use complete sentences, proper grammar, correct spelling,
& document is professional in appearance .................................................... 20

TOTAL POINTS POSSIBLE........................................................................ 150
PART III:
Greenhouse Model

Model and all components are built to scale.............................................. 75
Key is given showing the following:
   Scale........................................................................................................ 10
   Model materials are defined...................................................................... 15
   Model resembles the drawing in Google Sketch Up............................... 50
   Neatness of project.................................................................................. 50

TOTAL POINTS POSSIBLE......................................................... 200

PART IV:
Scale Drawings Worksheet – Math problems and chart are completed........... 50

PART V:
The presentation of your engineering firm
Your firm and all group members are introduced........................................... 10
Your Google Sketch Up Greenhouse is shown and discussed......................... 10
Your model is shown, highlights given.......................................................... 20
Equipment presentation - all equipment AND associated costs...................... 20
All group members participate........................................................................ 10
Presentation is professional............................................................................ 30
   • Speakers are clear
   • Seriousness
   • Appropriate use of language and presentation, etc... (not sitting on tables)
   • Clear introduction, presentation and closure

REMEMBER – you are trying to win a contract from the MCPS school division!

TOTAL POINTS POSSIBLE......................................................... 100