*Date* _____ *Topic*_____

---Main Ideas, Key Points, Formulas---

---Notes---

Structures, Frame Styles, and Coverings:

---Summary of Main Ideas---

***Main Ideas, Key Points, Formulas***

***Notes***

Greenhouse Site Selection:

Greenhouse Interiors – Layout:

Greenhouse Interiors – Benching:

***Summary of Main Ideas***

***Main Ideas, Key Points, Formulas***

***Notes***

Greenhouse Interiors – Flooring:

Additional Considerations:

Environmental Concerns:

***Summary of Main Ideas***

**Greenhouse Structures, Frames and Coverings**

## Greenhouse Structures

### Freestanding

It's easy to manage the upkeep of freestanding greenhouse structures. Snow removal, temperature regulation, and ventilation are simple because the structure is not connected to any other structure. They also boast the advantage of providing uniform light. However, freestanding structures are more expensive to build, and require more energy and space.

### Connected

Connected greenhouse structures are built together and share a single roof. They are easier to construct, and require fewer building materials. Walls inside the connected structures delineate zones for different kinds of plants. Less energy is expended when heating and cooling the connected structures because of the advantage of the shared walls. However, it is harder to adjust temperatures or apply insecticides in specific zones within the connected structure. It is also difficult to remove snow from the roof and gutters. Connected structures also have more shadows and less light.

### Lean To

The lean-to is a modified connected greenhouse structure. It is built facing east or south, and shares one wall with an existing structure. It is a small structure, generally only 7 to 12 feet wide, with not much room inside. Utilities like heat, water, and electricity come from the connected building. The lean-to does not have good roof support. Growers often use a lean-to for starting seeds.

## Greenhouse Frames

### Gothic Arch

The Gothic Arch frame is a freestanding structure. It is built in a rounded style, with a subtle peak at the top of the roof. This allows for ample room inside for the growing of potted plants and spring annuals.

### Quonset

Quonset frames are freestanding structures, developed during World War II. They are entirely rounded, and simple to build. Their rounded shape takes storage space away from the walls and cuts into the space overhead.

### A-Frame

The A-Frame is a freestanding structure. Each side of the roof runs straight from the ground to the tip of the roof. It is a straightforward design that uses less material than a standard even span. A-frames have ample space along the walls, and boast good air circulation.

**Cold Frames**
Outdoor growing structure with transparent covering; heated only by the sun, top opened during the day, closed at night; used to harden and protect plants from frost, winter storage of bulbs.

**Hotbeds**
Outdoor growing structure with transparent covering; used by steam, hot water, or electricity; used to start seedlings or cuttings.

**Lath Houses**
Outdoor growing structures covered with lath or shade fabric supported by vertical poles; reduces light intensity, used in summer in temperate climates or year-round in warm climates.

**Even Span**
The even span frame has a symmetrically framed roof. It has good air circulation, adequate space, and encourages even temperature maintenance within the greenhouse.

**Uneven Span**
The uneven span frame has a roof with asymmetrical gables. It is often built on shallow hillsides facing south, in order to take advantage of winter light.

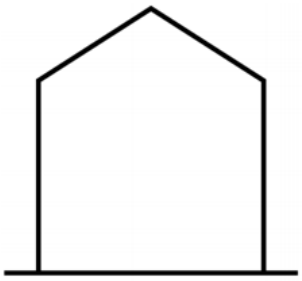
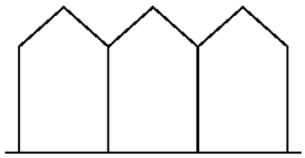
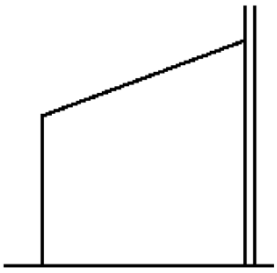
## Greenhouse Coverings

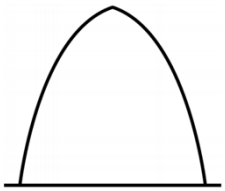
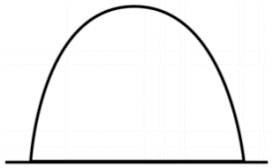
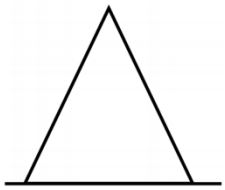
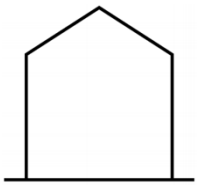
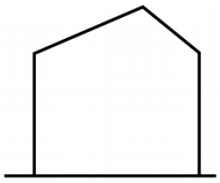
**Glass**
Glass is strong and allows for ample light to enter the greenhouse. It's long-lasting and easy to maintain. However, it's breakable and requires a sturdy frame for support, which can be expensive.

**Polyethylene Film**
This covering is flexible, lightweight, and easy to install. A light frame is adequate to support polyethylene film. The film is also effective in transmitting adequate light. However, it requires frequent maintenance and replacement, and is vulnerable to damage.

**Polycarbonate**
Polycarbonate forms rigid plastic panels with which to cover a greenhouse. It is light and durable, but not as strong as glass. It transmits light well, although not infallibly, and does require regular replacements.

**Structures, Frames, and Coverings**

| | **Name of Structure** | **Pros** | **Cons** |
|---|---|---|---|
|  | Freestanding | | |
|  | Gutter Connected | | |
|  | Lean To | | |

| | **Name of Frame** | **Pros** | **Cons** |
|---|---|---|---|
|  | Gothic Arch | | |
|  | Quonset | | |
|  | A-Frame | | |
|  | Even Span | | |
|  | Uneven Span | | |

| | **Name of Frame** | **Pros** | **Cons** |
|---|---|---|---|
|  | Cold Frames | | |
|  | Hotbeds | | |
|  | Lath Houses | | |
| | **Name of Covering** | **Pros** | **Cons** |
|  | Glass | | |
|  | Polyethylene Film | | |
|  | Polycarbonate | | |

## Greenhouse Building Site

Rate three potential greenhouse sites based on the criteria in the left column of the table below. Enter ratings as numerical values according to the key below.

1 = Does not meet criteria well

2 = Condition of the site is passable

3 = Site meets the criteria perfectly

Once the table is complete, add the values in each column. Whichever site scores the highest should be chosen as the best building site.

| **Criteria** | **Site #1** | **Site #2** | **Site #3** |
|---|---|---|---|
| No obstructions to the East or South | | | |
| 0% - 5% Ground Slope | | | |
| Access to Water | | | |
| Is there enough space for the 100’ ridge to run North to South? | | | |
| **Totals:** | | | |

**Layout, Bench, and Flooring**

| Sketch | Name | About |
|---|---|---|
| | Longitudinal | |
| | Peninsula | |
| | Island | |
| | Stationary | |

| Sketch | Name | About |
|---|---|---|
| | Rolling Top | |
| | No Benches | |
| | Pyramid Frame | |
| | Sectional/Transportable | |

| Sketch | Name | About |
|---|---|---|
| | Benches | |
| | Concrete flooring | |
| | Gravel flooring | |

## Greenhouse Environmental Controls

### Heating

| What do greenhouse owners/designers need to know or understand about heating? | | | |
|---|---|---|---|
| | Explanation | Pros | Cons |
| Wood Burning Furnace | | | |
| Infrared System | | | |
| Solar | | | |
| Gas Powered Heaters | | | |

**Ventilation and Cooling**

| What do greenhouse owners/designers need to know or understand about ventilation and cooling? | | | |
|---|---|---|---|
| | Explanation | Pros | Cons |
| Exhaust Fan and Louver System | | | |
| Horizontal Air Flow Fans | | | |
| Fan & Pad Coolers | | | |
| Retractable Roof and Vent Kits | | | |
| Retractable Side-Walls | | | |

**Irrigation**

| What do greenhouse owners/designers need to know or understand about irrigation? | | | |
|---|---|---|---|
| | Explanation | Pros | Cons |
| Overhead | | | |
| Drip | | | |
| Misting | | | |
| Ebb and Flood Benches and Floors | | | |
| Circulating PVC System | | | |
| Hand Watering | | | |