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A Language Arts Project Involving the Construction of a Solar Greenhouse by Navajo Children

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This project is accepted in its present form.

Principal Advisor Raymond C. Clark

Date June 27, 1978

Reader Michael Grald

Date June 27, 1978

The Borrego Pass School greenhouse never would have happened without the administrative support of Don Creamer, Director of Special Projects, at Borrego Pass School. Without the guidance, help, and understanding of individuals at the New Mexico Solar Energy Association, we'd still be hammering away, building a greenhouse not nearly as efficient as the structure we built. Their energy played an integral role in the success of our project.

This paper, in three parts, explains why and how fifth and sixth grade students at a Navajo bilingual elementary school in New Mexico built a solar greenhouse as a language arts project. The first part catalogues the English speaking, reading, and writing needs of the children. It details the rationale behind building a greenhouse to address these needs. The second part is the greenhouse project itself. It contains English lessons which the students used as guidelines for planning and building the greenhouse structure. The third part, found in the Appendix, contains one of the students' workbooks.

I hope this serves someone in good stead. The project could never be literally duplicated, because it was closely tied up with the particular requirements of the students, the school, the place, and the available resources. But it may facilitate other teachers in developing their own answers. That's what I'm hoping for.

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Background and rationale behind building a greenhouse as a Language Arts Project

I really had no idea what I was getting myself into. A person there had told me over the phone to come on out, that I'd have to interview before a group of Navajo school board members. I told him the 2500 mile journey from Vermont to the Navajo Reservation in New Mexico was a long way to go for something as indefinite as what this particular teaching opportunity seemed to be. He assured me, off the record, that on the basis of what he'd seen and heard, I'd be hired. I went to the local library, picked out an atlas, and looked for Borrego Pass. When I couldn't find that, I looked for Crownpoint. There it was, sixty miles northeast of Gallup, 110 miles northwest of Albuquerque. The road through Crownpoint was dotted as are those which go through national parks and forests. Borrego Pass was situated somewhere twelve miles east of Crownpoint. Must be beautiful, I thought.

As I later found out, Borrego Pass School, a Navajo bilingual elementary school, had been in existence over sixty years. For a long time it had been a one room adobe building run by Mormon missionaries. Navajo children whose parents had converted to the Mormon faith would come from miles around for basic English speaking, reading, writing, math, and religion instruction. Recently, the one room building had been replaced by a larger one. The school had been taken over by the Bureau of Indian Affairs. Additional trailers, hogans (six-sided structures of mud and logs, indigenous to the Navajo), quonset huts, and buildings had been built. With the enforcement of a previously ignored truancy law, the student population had grown considerably. Three buses would leave early in the morning, one down the eastern

slope of the Continental Divide, one straddling the Divide along an extended mesa, and one down the precipitious western edge, to pick up 125 children from isolated camps in a fifteen square mile area. As the buses returned, the silence would be broken and the school would suddenly come to life.

Waiting to go before the school board after I arrived, I was more curious of the school's English language program than of the history of the area. The same person I had spoken with over the phone, who had previously held the English Language Arts Specialist position for which I was applying, told me the school had "no 'ESL' program." He spoke of ESL (English as a Second Language) as one might speak of a dentist appointment. He went on to explain that getting the kids motivated to use oral and written English, the "why" and "why not" of language teaching, was much more important than teaching systemized English structure, ESL as he saw it, the "what" of language instruction as I heard it all.

The interview went well. Six Navajo men and one Navajo woman listened as I described how I had found out about the job, what my previous teaching experiences had been, under what circumstances I had grown up, what important events and influences had shaped my life, and what values I cherished. I had the job. They asked when I'd begin. I told them immediately.

Officially, I was the English Language Arts Specialist, funded federally under Title I of a 1967 Education Act, which stipulated that any child unable to speak, read, and write English at normal grade levels was entitled to remedial instruction. My first duty was to administer a standardized test of three parts--reading recognition, reading comprehension, and spelling--to determine which students would qualify for remedial help. All but one of the thirty-four fifth and sixth graders I tested qualified, demonstrating that they were at least 1.1 grade equilivent years behind "normal"

kids. From these thirty-four I had to pick the twenty children most behind, because it was further stipulated that I could only take a maximum of ten students from each of the two grades.

Having figured out who the Title I fifth and sixth graders were, using the Peabody Individual Achievement Test as a measurement instrument, my next step was to diagnose the speaking, reading, and writing deficiencies of each student. The problem areas were numerous. For the majority of the children, oral communicative competency was severely limited. Half of the twenty kids were unable to verbalize basic needs and wants in English. Those who could would do so making frequent errors in subject-verb agreement, morphology, sentence structure, and pronounciation. Most had great difficulty expressing themselves in past tenses. Most were unable to ask a question by inverting the subject and operator of a given sentence. And most were incapable of understanding four or five oral directions when given at once.

The majority of children had great difficulty decoding written English. Some of the fifth graders couldn't read at all, even the most elementary Dolch sight-list words. Reading comprehension was a universal problem area.

One twelve year old sixth grader, Franklyn Woody, typified the problems. His September grade equilivent scores on the Peabody test were indicative not only of problems in the test areas--reading recognition, 2.4; reading comprehension, 2.7; spelling, 2.2--but also of an inability to communicate effectively in English. One morning before school he came up to me and asked, "Dan, you going to town?" I told him no, we had school. "No," he replied, "yesterday are you going to Gallup?" I said yes. I had gone to buy groceries in Gallup. "I see you," he said, smiling, "little red car," with great emphasis on "little." "You going too fast," he said.

I gave Franklyn a puzzled look. He explained with a stick on the ground. "We going this way," he said, pointing, "and you going this way," he added, indicating that we passed each other on the road going in opposite directions. "Really fast." I never would have known he'd seen me from the back of his family's pickup if he hadn't literally drawn a picture.

Although Franklyn's difficulties in English were quite typical, the support he received and the English he was exposed to at home weren't. He came from a very strong family. His father was president of the school board, and he made sure Franklyn came to school. He had brothers and sisters at the high school in Crownpoint. The family had a television. They were well-fed, well-clothed, and important members of the local community.

Many of Franklyn's classmates were from less fortunate circumstances. Divorce, alcoholism, and violence defined the worlds of some. In several homes, education was seen to have little value. Parents had not gone beyond third grade, and were still alive and well, so why should their kids? For many children there simply wasn't any exposure to English outside of school. Some students had to stay home to herd sheep. For these reasons, just getting the children to school was a challenge, much less teaching them English.

A great deal of the difficulty the children were having in English could be traced to the absence of a coherent, consistent, and comprehensive English language program. From what I gathered, the school was only beginning to tackle the problem of systemizing English instruction. Many different tacks--modeling language, audio-visual approach, packaged ESL kits--had been tried in the past by a variety of teachers in apparent random fashion. The fundamental notions behind the school's recently inaugurated bilingual, bicultural educational program seemed sound enough. From kindergarton through second grade, Navajo was the medium of instruction. Children were taught to read Navajo in the first grade. Anglo teacher aides "modeled"

English through the K-2 years. Third grade marked the transition into English, when it became the instructional language. Reading in English commenced. There was a great deal of translation by a Navajo bilingual aide. English remained the instructional language in the fourth, fifth, and sixth grades. Translation was provided by a Navajo aide. Theoretically, by the sixth grade, children would be able to read, write, and converse fluently in both languages. But this was not happening for several reasons. Only two years before, there had been no blueprint for a bilingual, bicultural educational program. Navajo reading had not been part of the children's education. Neither had organized ESL. Teachers were left to their own devices regarding language instruction. Duplication and ommision of English skill areas characterized teachers' efforts. There were no guidelines or sequences, because it was felt that children learned a second language as they learned the first. Children would "pick it up." Drills, sequence, and structure had failed in the past because it was dry, dull, and artificial. I quickly dropped the acronym "ESL" from my vocabulary. By this, the administration referred to everything static, structured, and sequenced in English language instruction. I was encouraged to adopt their educational philosophy that structure wasn't as important as meaning. I adopted it in some ways. In other ways, I didn't.

I made a list of my students' needs as I perceived them. We would have to work on oral communication. Following oral directions, expressing needs and wants, relating self-descriptive information, describing an event in the past, and describing a future event were all basic behavioral objectives. We would have to tackle the problem of reading recognition, which meant the children would have to learn basic sight words as well as decoding rules. Reading comprehension, because reading to extract information would be so vital in junior and senior high school, was centrally important. Also,

the children had to learn to write a basic declarative sentence in English.

Common to all these needs was English grammar. The students' most common mistakes would have to be covered: operator foul-ups ("Are you go to school everyday?" "Does she eating?"); subject-verb agreement ("Is they in Crownpoint?" "Do she live there?"); possessives ("It's Alfred pen."); pronouns ("Bonnie? He's right here."); tenses ("Are you going yesterday?"); and sentence structure, a serious problem stemming from interference with Navajo ("Me restroom." "Me playing ball you.").

For several weeks I worked with students individually, not only to understand their capabilities, but also to get to know them. During this time, I toyed with the idea of building a greenhouse as a year-long language arts project. I was encouraged to get the kids involved in a project similiar to what the Title I fifth and sixth graders had accomplished the previous year. Under the supervision of the Title I Language Arts Specialist, the children had learned to operate a 35mm camera by reading a "how-to" manual that the instructor had developed. The kids took pictures, developed them, learned oral communication in the process, and put together a yearbook. Results from the Peabody test indicated that the students made significent progress in the test areas.

There were a lot of good reasons to go after a greenhouse. It would be a long project including a wide variety of oral language tasks; using the telephone, purchasing merchandise in a store, following directions, giving directions, asking questions, relating past and future events, as well as describing events in the present tense. In building the greenhouse there'd be lots of action. The children would learn by doing. Their learning would be meaningful to the extent that if they didn't learn, they'd suffer natural consequences. A 2x4 wouldn't fit or a nail wouldn't be long

enough.

A greenhouse would cover the reading priorities I had outlined. Hopefully, it would solve the most difficult problem of getting the children to want to read. In developing a "how-to" manual, I could isolate specific grammar points and work on them without focusing entirely on grammar. The manual would serve as syllabus, grammar, workbook, and source of information; in a sense, it would tie all our work together into a cohesive whole. This final aspect appealed to me greatly. I had found over the course of those first several weeks that the students had many needs in common. They could profit from working on them together. And I could better plan the sequence in which language would be taught.

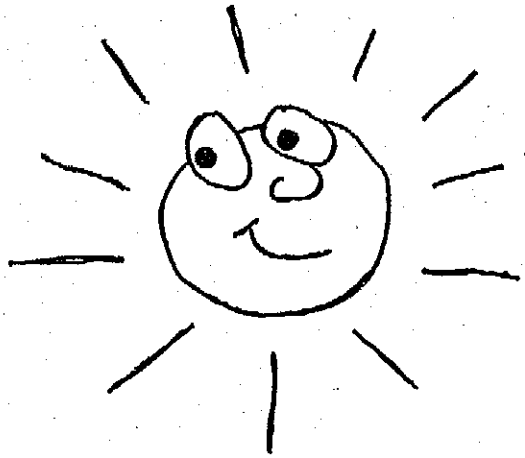
I had the background and interest in carpentry, as well, having spent many summer vacations working on carpenters' crews. This was a vital prerequisite. As I had envisioned, much later during the greenhouse's actual construction I not only had to guide what the children built, but I also had to go back over the children's work to make sure it was structurally sound. Without carpentry skills, I would have been at a distinct disadvantage.

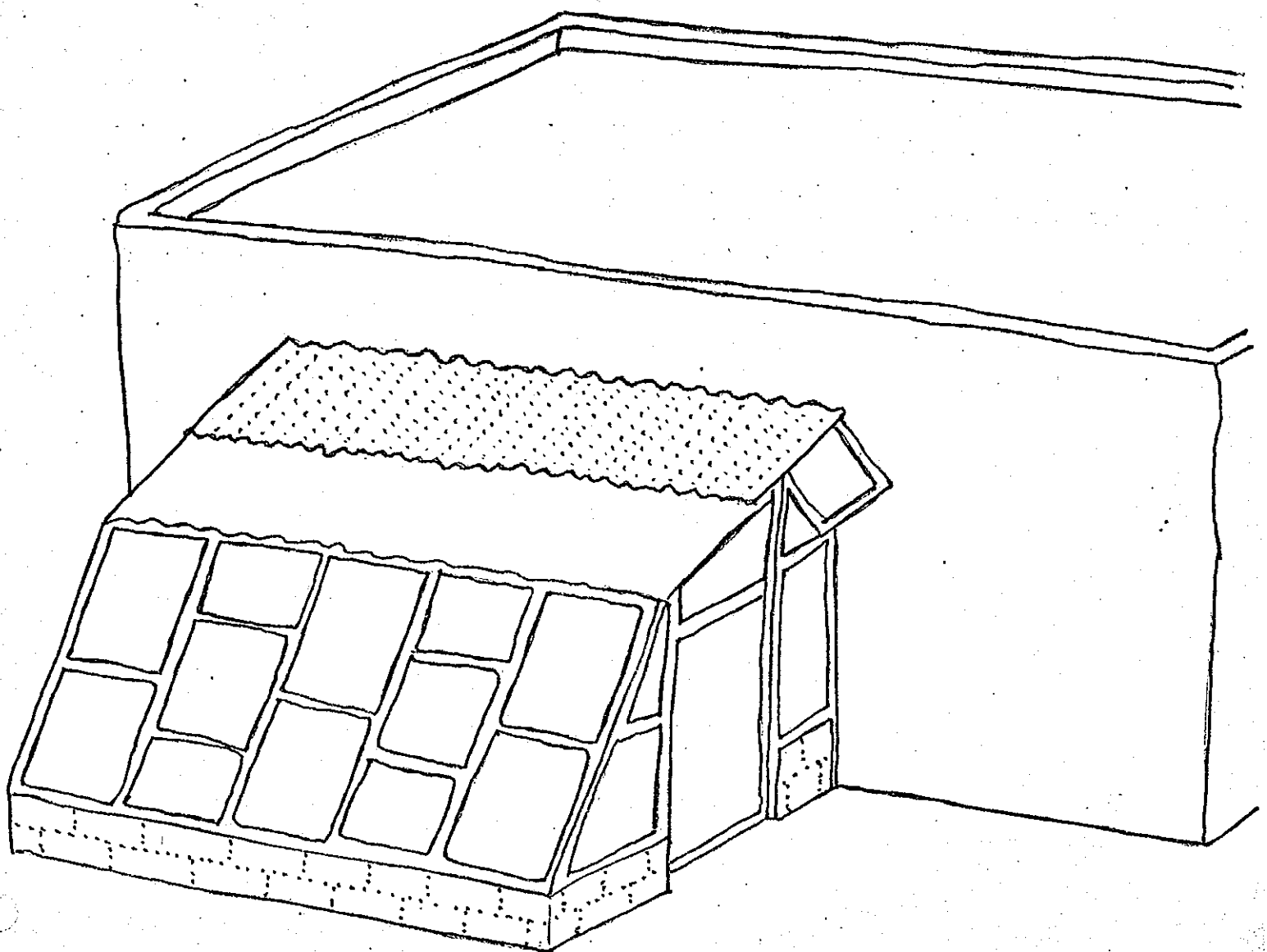
Fortuitously, I discovered the New Mexico Solar Energy Association of Santa Fe, New Mexico. They were a tremendous resource in developing our greenhouse's design, coming up with cost figures, providing materials for classroom use, and much later, helping us with difficult and time consuming phases of greenhouse construction. They steered us in the direction of building a heat and food producing structure, a "solar greenhouse," which added another dimension to the greenhouse project. With uranium and coal mining becomming a reality throughout the reservation, the children could learn about alternatives to the industrial intrusion

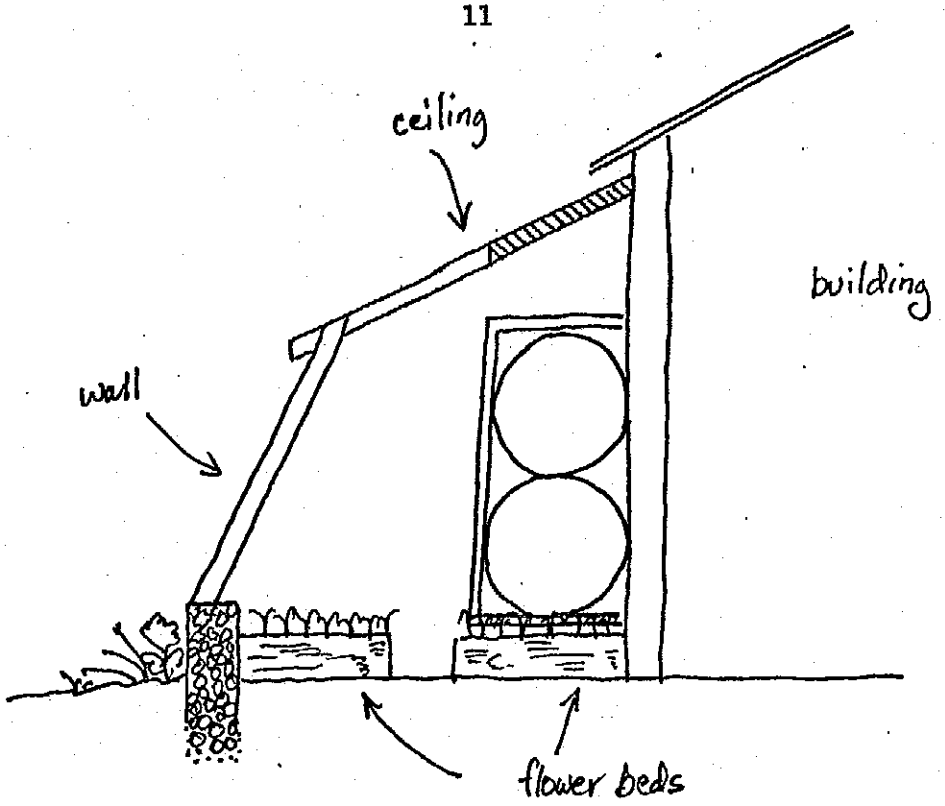
into their lives. They could begin looking at the problems of mining, energy shortages, and sociological change while actually doing something about them.

What follows is the greenhouse project. It represents the work that the fifth and sixth grade Borrego Pass School Title I children did in planning and building a solar greenhouse.

The greenhouse project







A greenhouse has two functions. It's a place to grow things, and it's a place to collect heat from the sun's energy. You can grow your own food and heat a house with a greenhouse. That's why it can save money.

A greenhouse has walls and a ceiling which lets in sunlight. They are made of wood and plastic. The floor is made of gravel. Plants and vegetables grow in flower beds. Sometimes the flower beds are in the floor and sometimes they are in boxes. Sometimes they are even in old tires.

A greenhouse has to face the south because that's where it can get the most sunlight. Because of this, it can stay warm in the coldest weather. You can grow things all year round, even during the winter.

1) What are a greenhouse's functions?

2) How can you save money with a greenhouse?

3) What's a greenhouse made of?

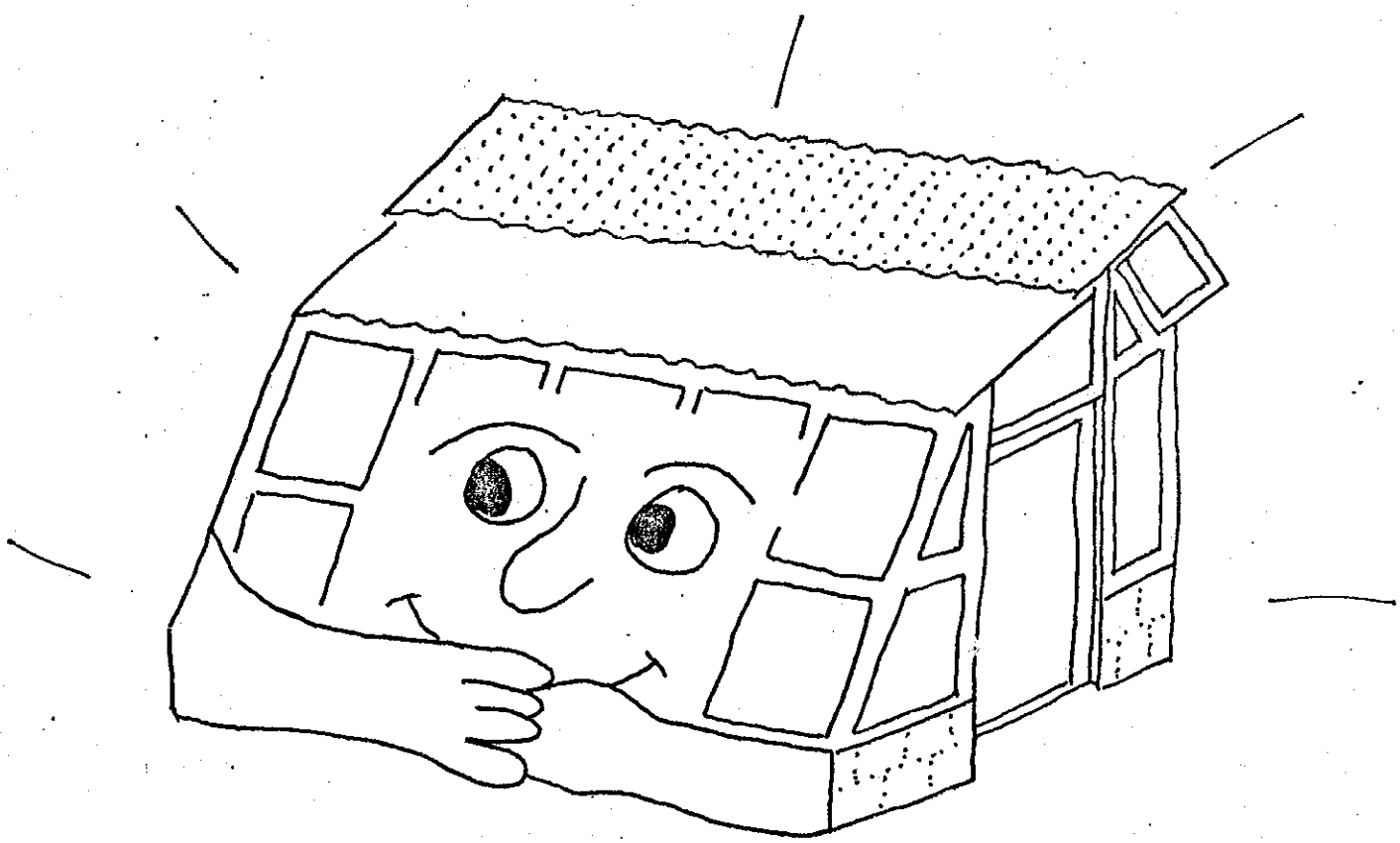
4) Why does a greenhouse have to face the south?

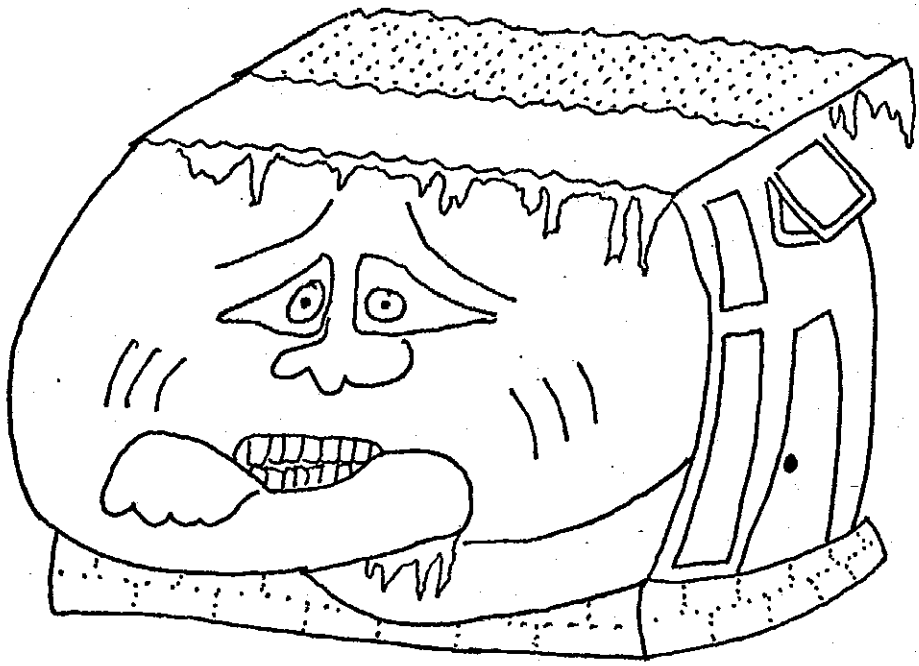
5) When can you grow things in a greenhouse?

When you choose a site for a greenhouse, three things are important. First, a greenhouse has to face the south. During the coldest time of the year when a greenhouse needs the sun's energy most, the sun is in the south.

Second, it's good to build a greenhouse where the ground is flat. It's important that the greenhouse won't be flooded during stormy weather. It's also much easier to build if you don't have to do a lot of digging.

Third, it's important to have a site that is free from the shadows of other buildings and trees. A greenhouse gets heat from the sun. It can't get the sun's energy if there are things in the way.





"not enough heat!"

A greenhouse can get enough heat from the sun when the sun is out. But at night and on bad days, when there is no sun, there must be a way of heating the greenhouse.

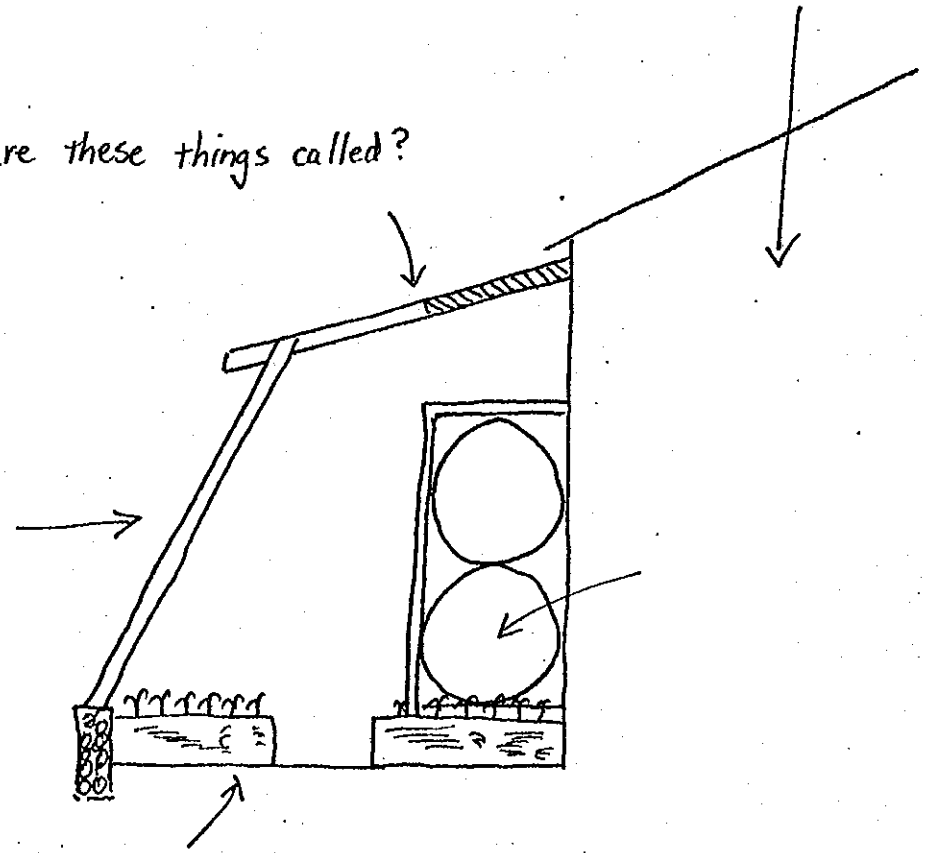
There are lots of ways of heating a greenhouse. The best and cheapest way is with large barrels. The sun heats water in the barrels during the day. At night, the hot water keeps the greenhouse warm.

In the summer, when it gets very hot, there has to be a way of cooling the greenhouse. If you build vents in the north and south sides, you can keep a greenhouse from getting too hot.

Fill in the blanks to write a complete paragraph.

The cheapest way of _____ _____ is with _____ _____. Hot water _____ _____ heats _____ during _____ In the summer, it's important to have _____. Vents _____ _____.

What are these things called?



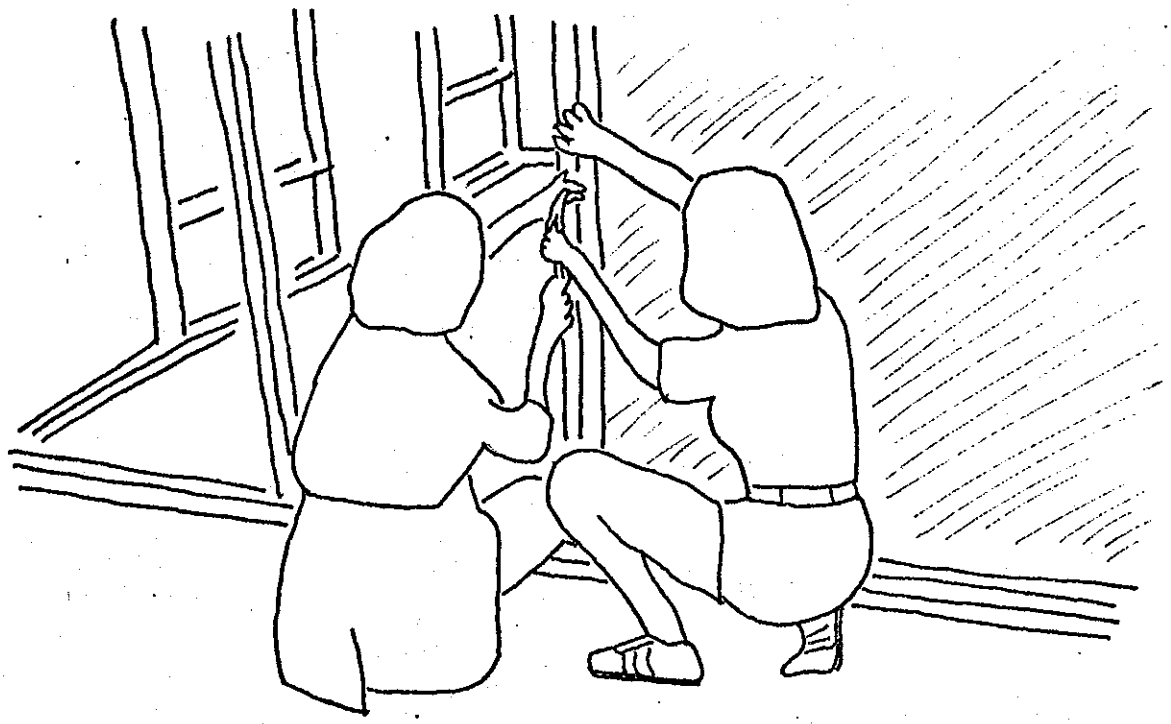
A greenhouse has three parts. It has a foundation, walls, and a ceiling. These three parts are made of many things.

The foundation is made of blocks and cement. Metal bars in the foundation make it strong. The floor inside the foundation is made of gravel.

The greenouse's walls are made of wood, plastic, and fiberglass. They are built with nails.

The ceiling is made of metal, fiberglass, wood, and plastic. It, too, is built with nails.

Many other things are needed. We need barrels to heat the greenhouse. We need paint to paint it. We also need many tools.



Unscramble these sentences:

1) parts has three greenhouse a

_____.

2) made is of foundation of lots the cement

_____.

3) wood greenhouse's plastic the and fiberglass walls made of are

_____

_____.

4) barrels need the greenhouse we to heat

_____.

5) will paint we need to some

_____.

that's all !

Materials List for 10' x 16' Attached Solar Greenhouse

1 bag masonry
5 bags Portland
1 yard sand
1 yard 3/4" aggregate
2 yards dry pumice or pea gravel
80 full pumice-blocks
25 half pumice-blocks
8 6" anchor bolts
72' rebar
30 8' 2 x 4's
3 10' 2 x 4's
2 16' 2 x 4's
2 8' 1 x 4's
40' 1 x 12 (for floor beds and shelving)
400' wood lattice moulding (for trim and tables)
½ lb. concrete nails
300-400 aluminum nails or 3 lbs. small galvanized nails
10 lbs. No. 16 common nails
5 lbs. No. 8 common nails
2 lbs. No. 8 finishing nails
3 lbs. blue sheetrock nails (for sheetrock)
6 sets hooks and eyes
1 set 3½" or 4" butt hinges (for door)
2 sets 2" butt hinges (for vents)
7 2 x 4 joist hangers
2 4 x 4 joist hangers
3 pulls
8 corner braces (to reinforce door and larger vent)
2 2'x 8'x 2" styrofoam panels
150 sq. ft. of 4" or 6" fiberglass insulation 24" wide
2 packages 3/8" foam strip (weather-stripping)
32' corrugated stripping (foam or redwood)
4 pieces 1/4" or 3/8" sheetrock
2 pieces 3/4" Celotex or equivalent exterior sheathing or paneling, i.e., 64 sq. ft. rough lumber.
4 pieces 8' corrugated roofing material
2 tubes silicone caulk - clear
1 tube regular caulk
1 gallon good quality white latex paint
1 gallon good quality dark color latex
1 pint dark stain (for lattice moulding)
200 sq. ft. flat fiberglass/acrylic (greenhouse quality)
250 sq. ft. polyethylene (greenhouse quality)
6 55 gallon drums with tops (water tight) and/or a number of smaller water tight containers

Cost of Materials for a 10' x 24' Greenhouse
Based on Figures for a 10' x 16' Structure x 20%

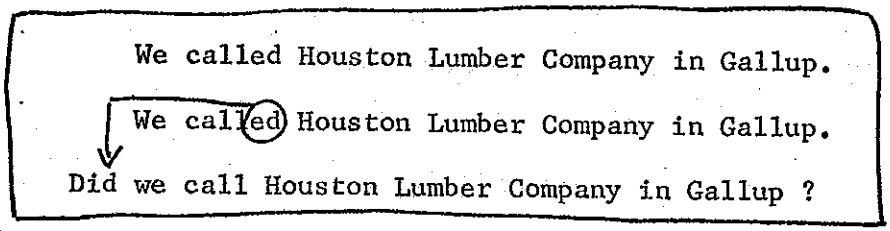
5 bags concrete mix @ $2.85 ea.	$14.25
1 yard sand	13.81
1 yard 3/4" aggregate	12.15
2 yards pumice @ $16.81 ea.	33.62
80 full pumice blocks @ .56 ea.	44.80
25 half pumice blocks @ .39 ea.	9.75
8 6" anchor bolts @ .26 ea.	2.08
4 20' pieces rebar @ $2.35 ea.	9.40
30 8' 2 x 4 @ $1.63 ea.	48.90
3 10' 2 x 4 @ $2.01 ea.	6.03
2 16' 2 x 4 @ $3.17 ea.	6.34
2 8' 1 x 4 @ .80 ea.	1.60
2 10' 1 x 4 @ $1.00 ea.	2.00
40' 1 x 12 @ $4.50/10'	18.00
400' lattice moulding @ .11 ft.	44.00
½ lb. concrete nails	.65
3 lbs. small galvanized nails	2.55
10 lbs. #16 common nails	6.50
5 lbs. #8 common nails	3.25
2 lbs. #8 finishing nails	1.30
1 lb. small finishing nails	.65
3 lbs. sheetrock nails	2.55
6 sets hooks and eyes @ .30 ea.	1.80
1 set 4" butt hinges	2.60
2 sets 2" butt hinges @ $1.19 ea.	2.38
7 2 x 4 joist hangers @ .22 ea.	1.54
3 pulls @ .69 ea.	2.07
8 corner braces @ .24 ea.	1.92
2 2' x 8' x 2" styrofoam panels @.16/sq. ft.	5.12
150 sq. ft. 4" fiberglass insulation 24" wide @ .30/sq.ft.	45.00
2 packages 3/8" weatherstripping @ $1.98 ea.	3.96
32' corrugated redwood stripping @ 8'/$1.14	4.56
4 pieces sheetrock @ $4.71 ea.	18.84
2 pieces 3/4" Celotex @ $3.85 ea.	7.70
4 pieces 8' corrugated roofing material @ $5.10 ea.	20.40
2 tubes silicon caulking @ $4.69 ea.	9.38
1 tube regular caulking	1.99
1 gallon white latex paint	7.99
1 gallon black latex paint	7.99
200 sq. ft. flat fiberglass/acrylic @ .43 sq. ft.	86.00
70 sq. ft. corrugated fiberglass/acrylic @ .43 sq. ft.	30.10
250 sq. ft. polyethelene @ .06 sq. ft.	15.00
12 55-gallon drums @ $7.00 ea.	84.00
Total	$641.27
+ 20%	128.25
Total Estimated Cost	$769.52

Last month, lots of students called Houston Lumber Company in Gallup. Each person looked up the company's number in the phone book. Then everyone picked up the telephone. After that, the students listened for the dial tone. The dialed the number. Each person told the operator our phone number. They spoke loudly and clearly. Then they asked for Ken.

Give the past of these verbs.

take	_____	have	_____
give	_____	do	_____
is	_____	get	_____
are	_____	run	_____
put	_____	see	_____

Look at these sentences.



Now, change these statements to questions.

Everyone looked up Houston Lumber Company's phone number.

_____?

Each student picked up the phone.

_____?

We dialed the number.

_____?

All of the students told the operator our number.

_____

_____?

This is What the Sixth Grade Did to Learn About Greenhouses

1. We made a trip to Crownpoint High School's greenhouse.

a. We drew pictures of plants.
b. We measured the greenhouse.
c. We did an energy experiment with sunlight.
1)_____ d. We drew pictures of the greenhouse.

2. We read in our workbooks.

a. We read about a greenhouse's two functions.
   1. A greenhouse is a place to grow things.
2)_____ 2. A greenhouse collects energy from the sun.
b. We read about a greenhouse's parts.
   1. A greenhouse has walls.
   2. A greenhouse has a ceiling.
   3. A greenhouse has a floor.
   4. A greenhouse has flower beds.
c. We read about where to build a greenhouse.
   1. It's good to build a greenhouse facing the south.
   2. It's good to build a greenhouse of flat ground.
3)_____ 3. It's good to build a greenhouse where there are no shadows.

3. We decided where to build our greenhouse.

   a. We chose the kindergarten building as the best place.
4)_____ b. We chose other places, too. But they weren't as good.

4. We read about how to heat and cool a greenhouse.

   a. You can heat a greenhouse with barrels, water, and sunlight.
5)_____ b. You can cool a greenhouse with vents.

5. Each person drew designs for the greenhouse.

What the Sixth Grade Did to Learn About Greenhouses (continued)

6)_____

6. We read some more.

   a. We read about a greenhouse's parts and what they are made of.
   b. We found a materials list from a book about building greenhouses.

7)_____

8)_____

7. We made telephone calls to Houston Lumber Company in Gallup to find out how much each thing costs.

9)_____

   a. We found the prices for all the materials.
   b. We found out the total cost of our greenhouses.

10)_____

What are the past tense forms of these verbs?

take_____	run_____
give_____	see_____
have_____	sing_____
is_____	think_____
are_____	fight_____
do_____	buy_____
ride_____	bring_____
speak_____	mean_____
throw_____	put_____
know_____	hit_____
come_____	write_____

Change these sentences to questions.

Sam rode in the Littlewater Rodeo last year.

_____?

Lorraine went into Gallup to buy groceries.

_____?

Change these sentences into negative statements.

John and Jim saw Star Wars.

_____.

He gave it to me.

_____.

Remember the Rules!

Example — Johnny went home.

? — Did Johnny go home?

NO — Johnny didn't go home.

Franklynn rode in the rodeo.

? _____?

NO _____.

Virginia came to school

? _____?

NO _____.

Alvin bought a new pickup.

? _____?

NO _____.

Teddy saw Coyote on the mesa.

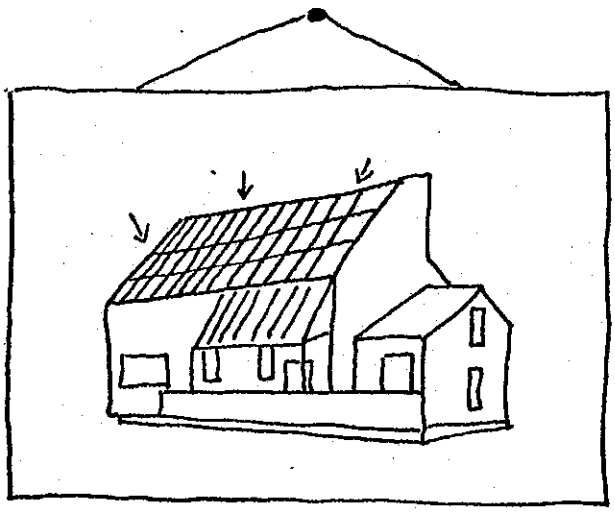
? _____?

NO _____.

There's a lot of talk these days about energy. Energy costs a lot and it's hard to get. Our country doesn't have enough oil, so oil and gasoline are expensive. Natural gas is expensive, too. Uranium is difficult and costly to mine. There's a lot of coal and it doesn't cost much, but it's dirty to use.

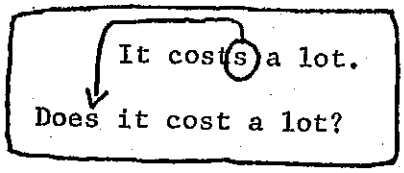
Because other energy is either expensive or dirty, solar energy seems like a good idea. It comes from the sun. For this reason, it's clean and cheap. It works with water and sunlight. The energy from the sun heats water in barrels. Then the water heats a home or another building. Scientists use solar energy to make electricity, too. They make solar panels which turn the sun's energy into electricity.

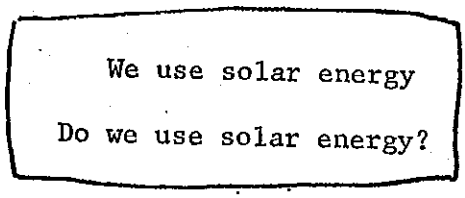
People don't think solar energy is a good idea now, because they don't know enought about it. But someday, it may power the cars we drive and provide the heat and electricity we use.



Here's a house with solar panels.

Look at these sentences.





Change these sentences to <u>questions</u>.

He has a nice pickup.

_____?

They make solar energy panels in Los Alamos.

_____?

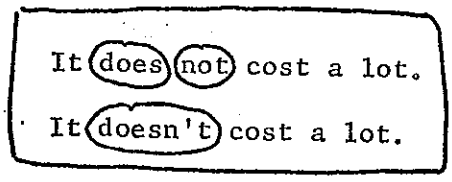
People think solar energy is expensive.

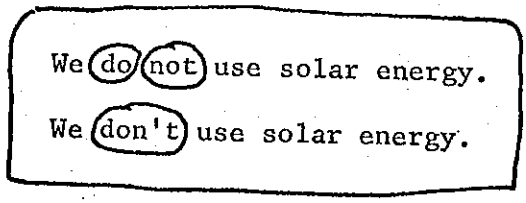
_____?

She drives to Crownpoint every day.

_____?

Look at these sentences.





Change these sentences to <u>negative</u> statements.

I have a new Ford pickup.

_____.

Our country has enough oil.

_____.

Coal costs a lot.

_____.

Answer these questions with complete sentences.

Where does our country's energy come from?

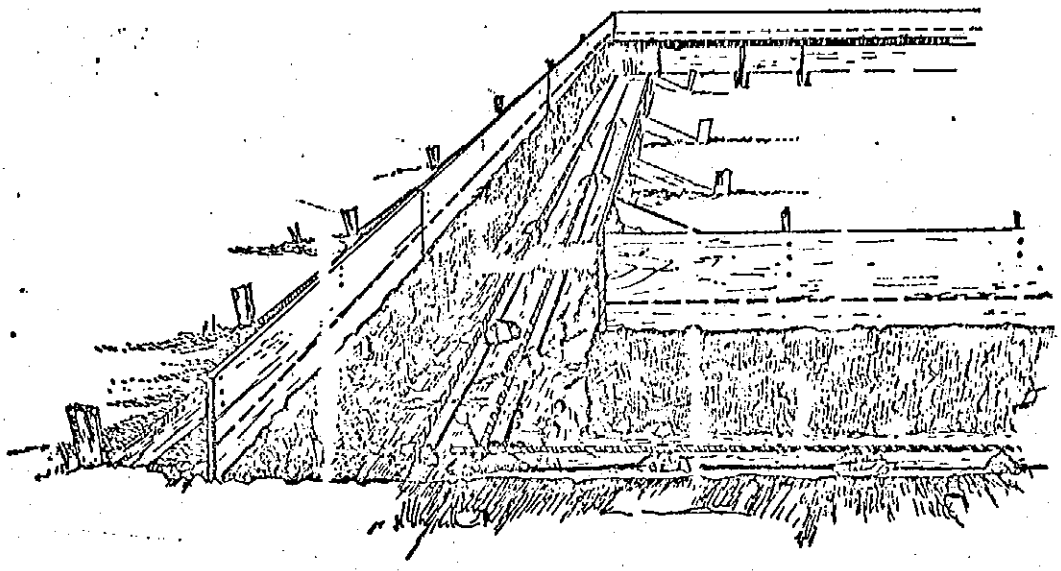
Which kinds of energy cost a lot?

Where does solar energy come from?

How does solar energy heat a building?

How does solar energy make electricity?

What do you think is the best kind of energy? Why?



Look at the picture above. It's a picture of a greenhouse's foundation. There's a trench. There're stakes, pieces of wood, some rocks, and pieces of rebar.

We'll do the same thing for our greenhouse. First, we'll dig a trench with shovels. It'll be 12 inches wide and about 12 inches deep. Next, we'll have to get the trench level. We'll put stakes into the trench every 4 or 5 feet. I'll put a long board on top of the stakes. Then you'll see if the trench is level with a level.

Then, we'll be ready to put the wooden boards along the sides of the trench, like in the picture. That'll be the next job.

This is a level.

I will study = I'll study
You will study = You'll study
He will study = He'll study
She will study = She'll study
It will rain = It'll rain

We will study = We'll study
They will study = They'll study

Use contractions.

I will dig the trench.

_____

They will build the walls.

_____

Teddy will carry the cement.

_____

Ask the question.

Maritta will help us.

_____

You'll mix the mortar.

_____

We'll build the greenhouse together.

_____

I'll study -- I won't study
You'll study -- You won't study
He'll study -- He won't study
She'll study -- She won't study
It'll rain -- It won't rain

We'll study -- We won't study
They'll study -- They won't study

Make these negative.

Virginia will be here tomorrow.

_____

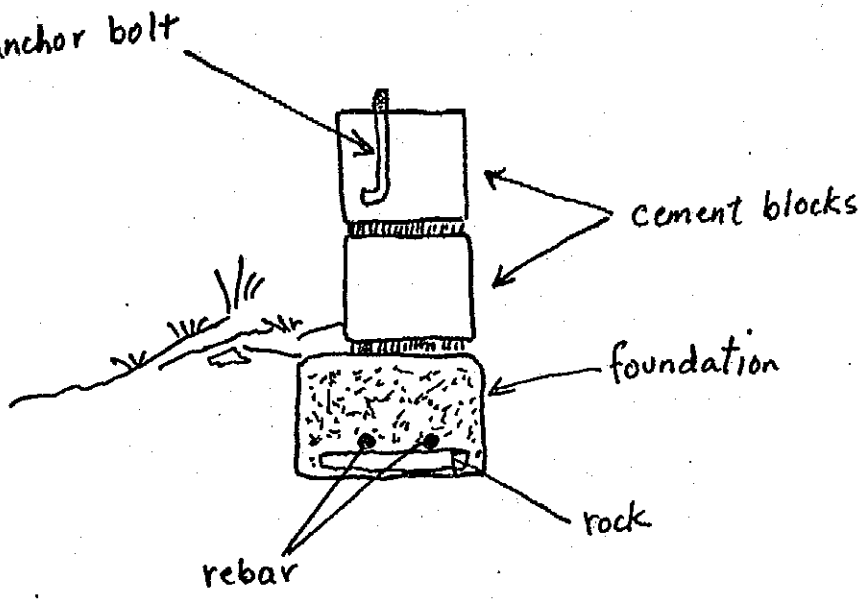
Make these <u>negative</u> (continued).

They'll come soon.

_____

I'll do it later.

_____



Last week, we finished the foundation of our greenhouse. Now, we can begin building the walls.

First, we must put in anchor bolts. The anchor bolts will hold down a wooden 2x6. Then, we can make walls on top of this wooden plate.

We must put the anchor bolts inside the holes of the cement blocks. Then we can pour cement in the holes. We must hold the anchor bolts steady. They can't move while the cement becomes hard.

We won't be ready to add on the walls until this is finished.

Make questions out of these sentences.

We can begin building the walls soon.

_____

We must put in the anchor bolts.

_____

The bolts can't move while the cement becomes hard.

_____

We won't be ready to build the ceiling.

_____

We will finish the greenhouse before school ends.

_____

Make contractions.

will not =

can not =

must not =

Answer these questions.

Now that we finished the foundation, what must we do?

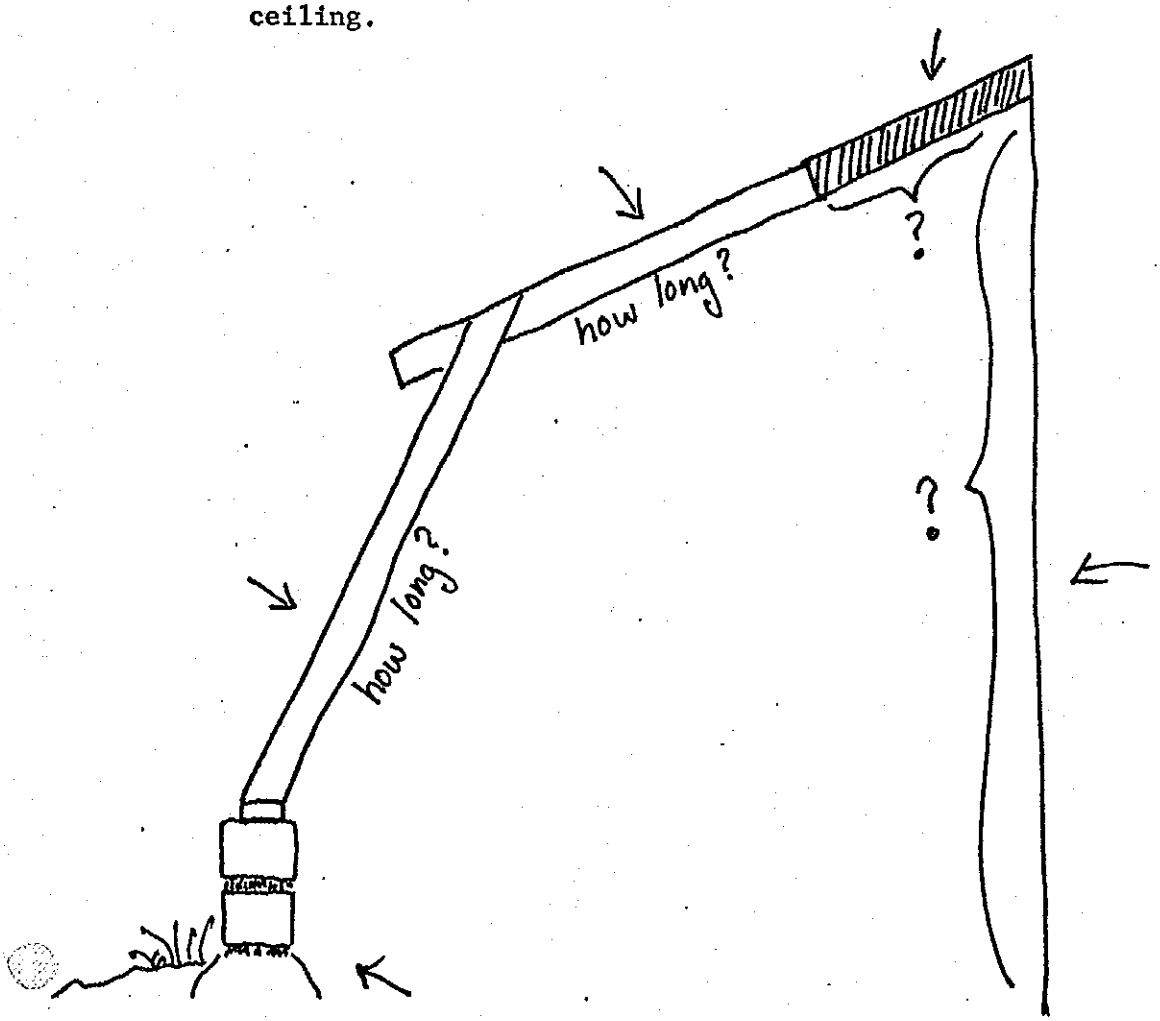
Why can't we use nails instead of anchor bolts?

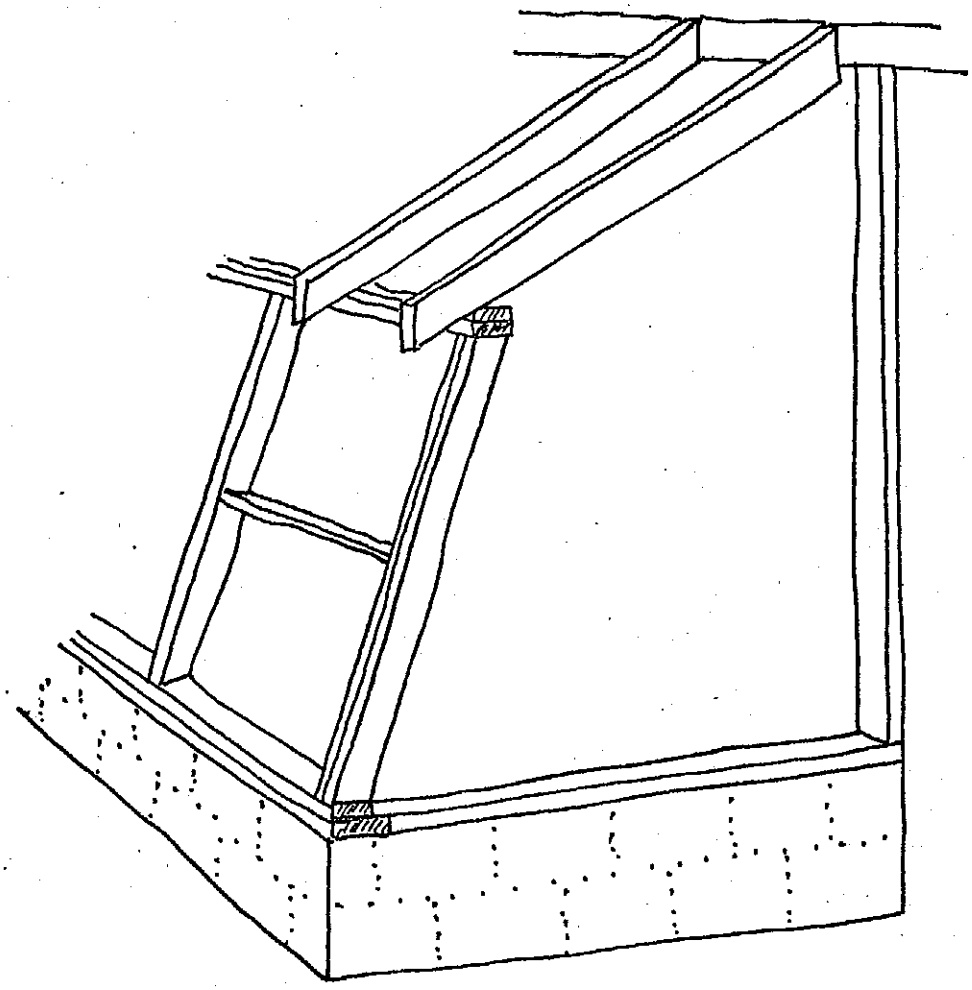
Where will the anchor bolts go?

How can we make the anchor bolts strong and steady?

Two weeks ago, we dug the greenhouse's foundation. Then we poured cement. Next, we put in rebar. We finished building the foundation with blocks.

Now, we can begin building the walls. We must find out how long the greenhouse's walls and ceiling are. To do this, we have to measure the kindergarton wall and measure the kindergarton ceiling. Then we'll draw the greenhouse on graph paper. After we draw everything, we can measure the greenhouse's walls and ceiling from the drawing. From this, we'll know how long to make the walls and ceiling.





Write the question with the given words. Then answer it.

how long south wall 2x4s USE WILL

_____

_____.

how wide greenhouse foundation USE DID

_____

_____.

Write the question. Then answer it (continued).

how tall kindergarten wall USE IS

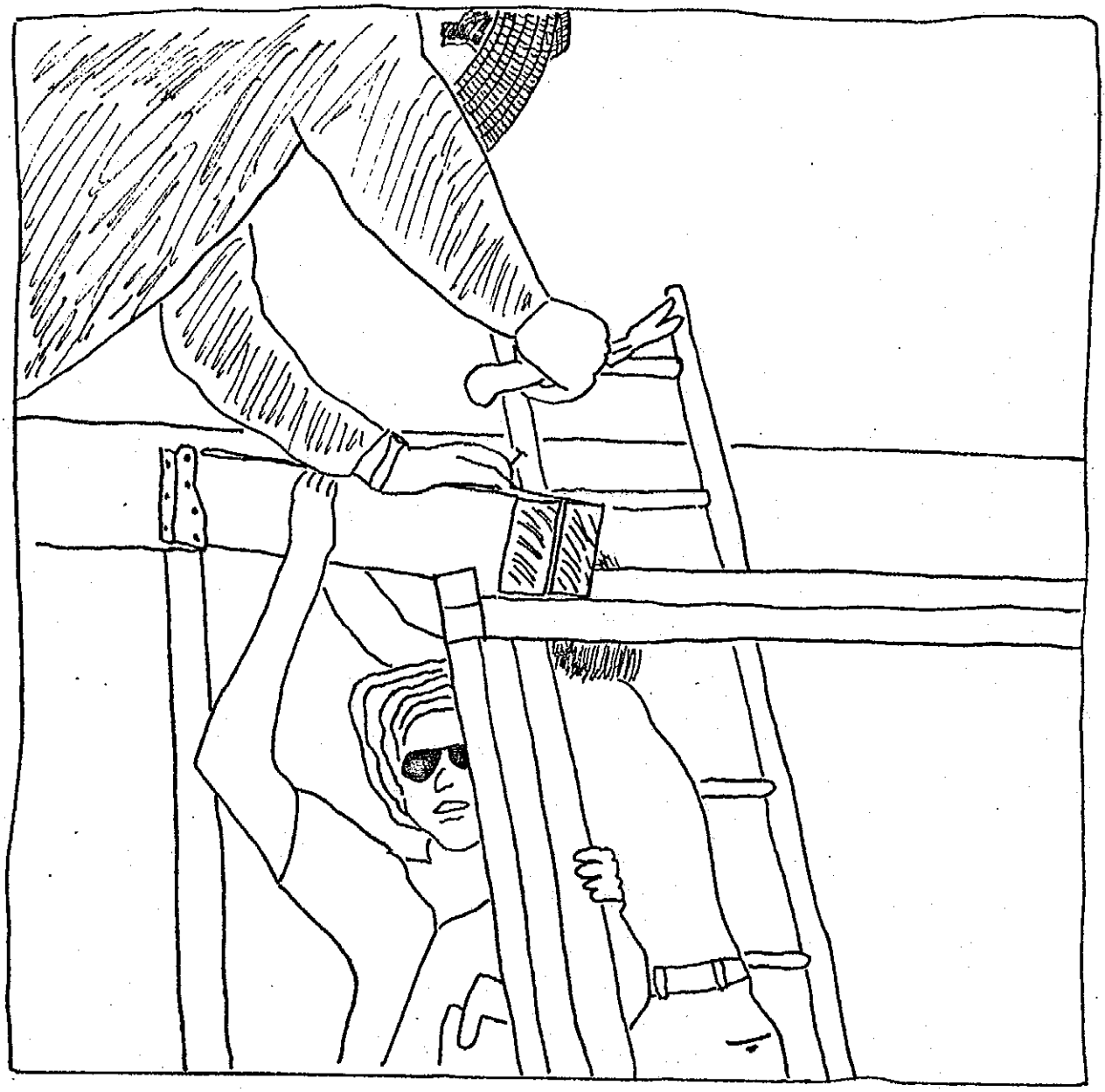
_____

_____.

how long greenhouse roof 2x6s USE GOING TO

_____

_____.



Directions for making the roof.

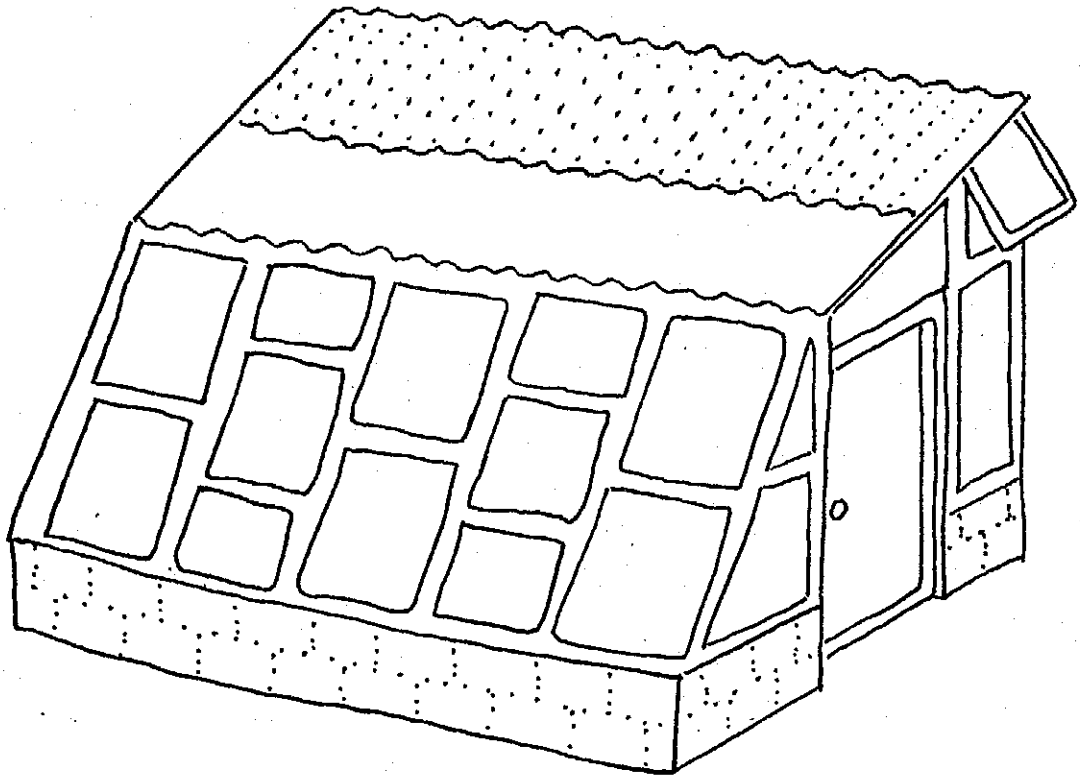
Get 10' 2 x 6s together.

Make marks every 4 feet where the rafter hangers go.

Make marks every 4 feet where the rafters meet the wall's top plate.

Put notches in the rafters.

Nail the rafters to the rafter hangers and the top plate.



... almost finished!

This week or next week, we should finish the greenhouse. But there are many things still to do.

First, we'll finish the roof. We'll cover one half of the roof with metal. We'll cover the other half with clear fiberglass.

Next, we have to put clear fiberglass on the east and south walls. On the west wall we must put some fiberglass and some boards.

Then, we're going to build the vents. After we finish building the vents, we're going to build the door. Both the vents and the door are going to be made of 2 x 4s and clear fiberglass.

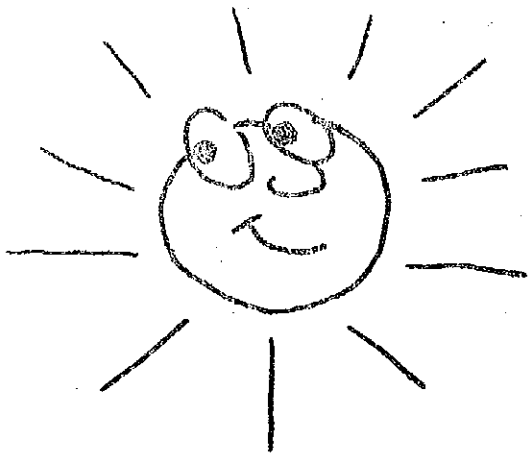
After all that, we should put insulation inside the greenhouse. Then the insulation should be covered with sheetrock.

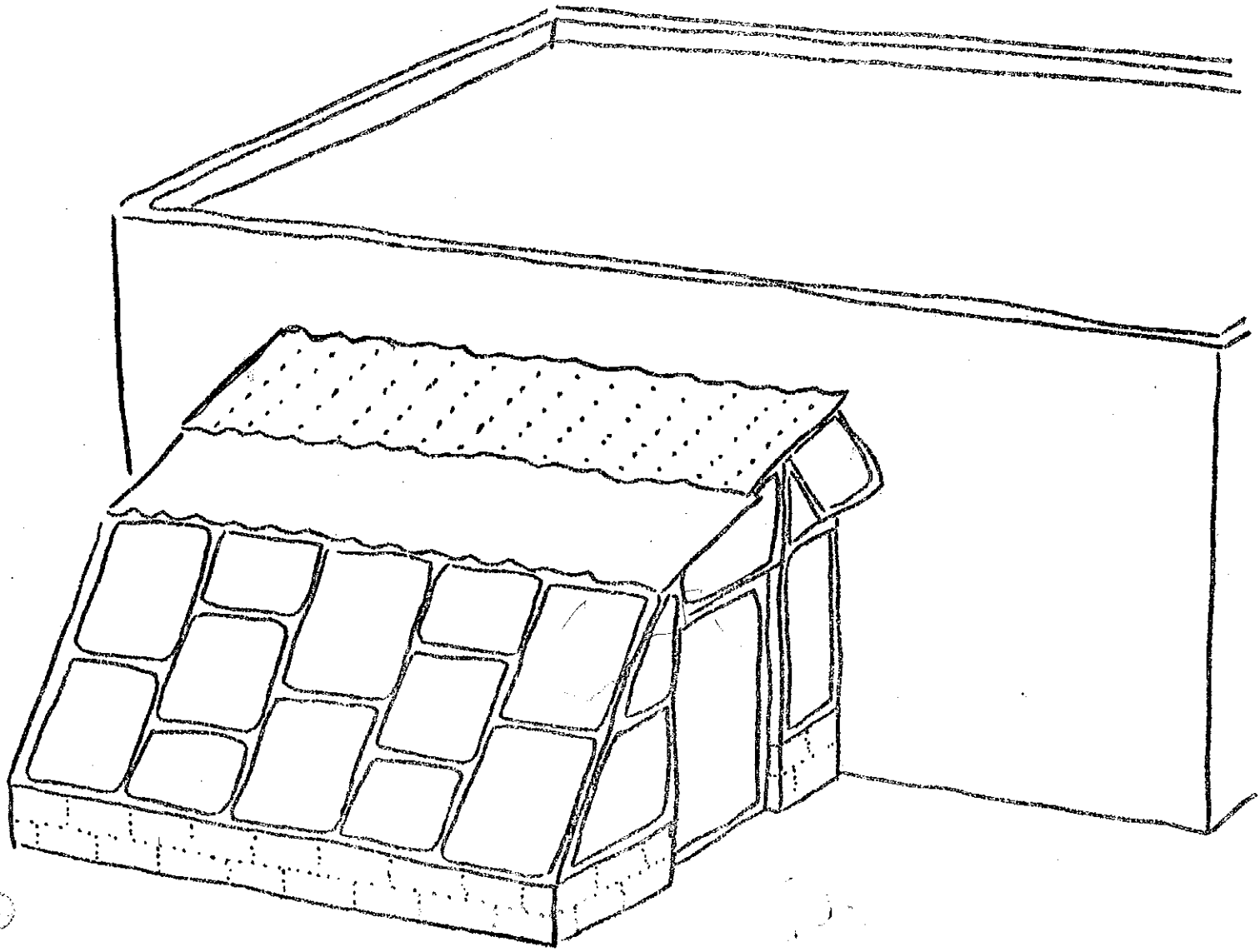
At that time, we should be almost finished!

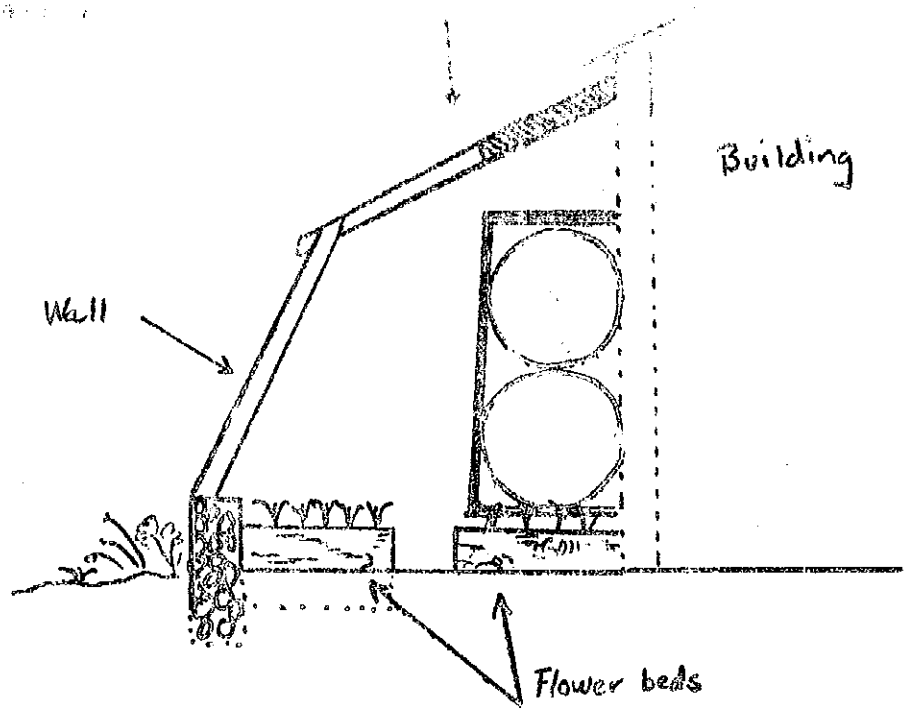
Appendix

N.B. The appendix differs from the greenhouse project previously described. It contains all of the students' work. In one copy of this I.P.P. (there are two), it includes the work of Franklyn Woody, a sixth grader; in the other copy, it includes the work of Dujuan Tolth, a fifth grader. The fifth and sixth grade workbooks follow a slightly different syllabus. Each is aimed at the needs of each class.

All about a greenhouse







A greenhouse has two functions. It's a place to grow things, and it's a place to collect heat from the sun's energy. You can grow your own food and heat a house with a greenhouse. That's why it can save money.

A greenhouse has walls and a ceiling which lets in sunlight. They are made of wood and plastic. The floor is made of gravel. Plants and vegetables grow in flower beds. Sometimes the flower beds are in the floor and sometimes they are in boxes. Sometimes they are even in old tires.

A greenhouse has to face the south because that's where it can get the most sunlight. Because of this, it can stay warm in the coldest weather. You can grow things all year round, even during the winter.

1) What are a greenhouse's functions?

Its functions are to grow plants and to collect heat.

2) How can you save money with a greenhouse?

You can grow vegtables. and

3) What's a greenhouse made of?

It's made of wood, plastic and energy

4) Why does a greenhouse have to face the south?

Because The sun is in south

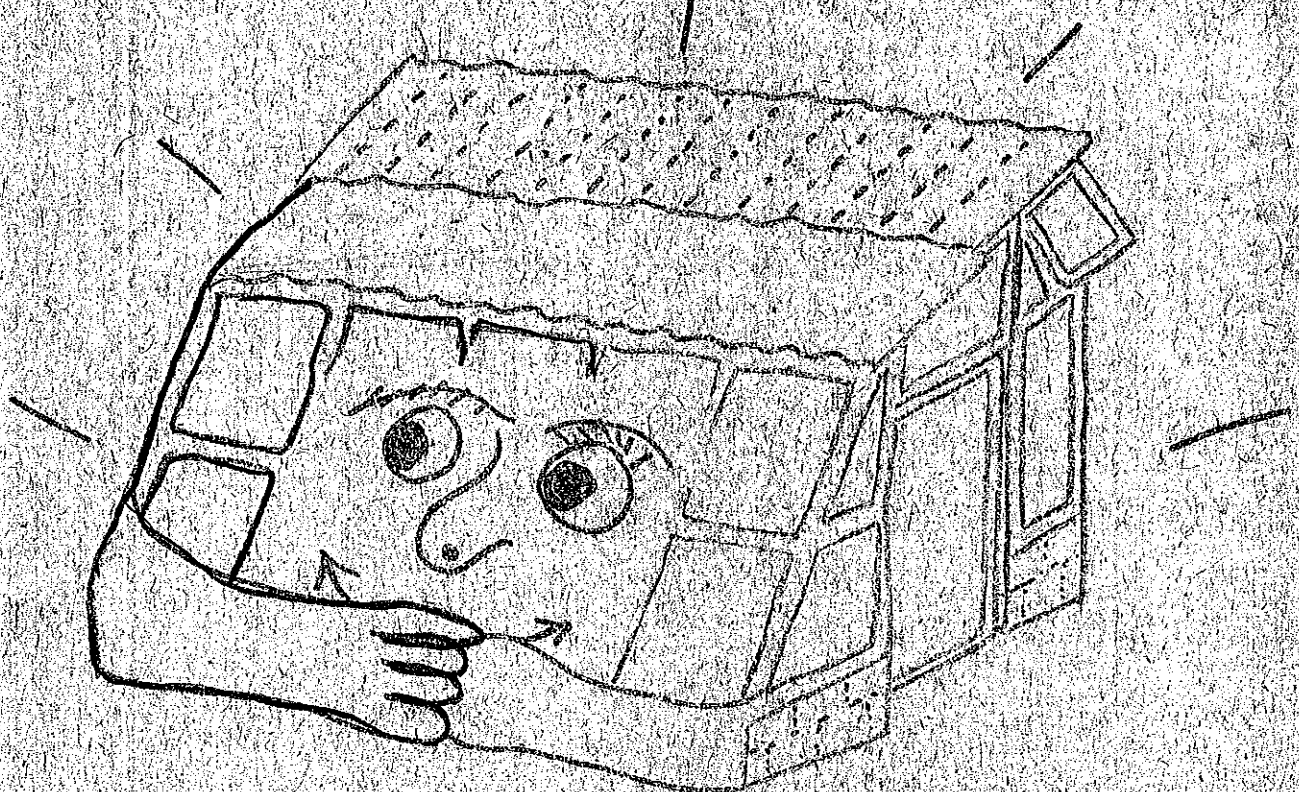
5) When can you grow things in a greenhouse?

You can grow Plants all year round

When you choose a site for a greenhouse, three things are important. First, a greenhouse has to face the south. During the coldest time of the year when a greenhouse needs the sun's energy most, the sun is in the south.

Second, it's good to build a greenhouse where the ground is flat. It's important that the greenhouse won't be flooded during stormy weather. It's also much easier to build if you don't have to do a lot of digging.

Third, it's important to have a site that is free from the shadows of other buildings and trees. A greenhouse gets heat from the sun. It can't get the sun's energy if there are things in the way.



Write complete sentences to these questions------

1) What's the first thing to think about when choosing a greenhouse site?

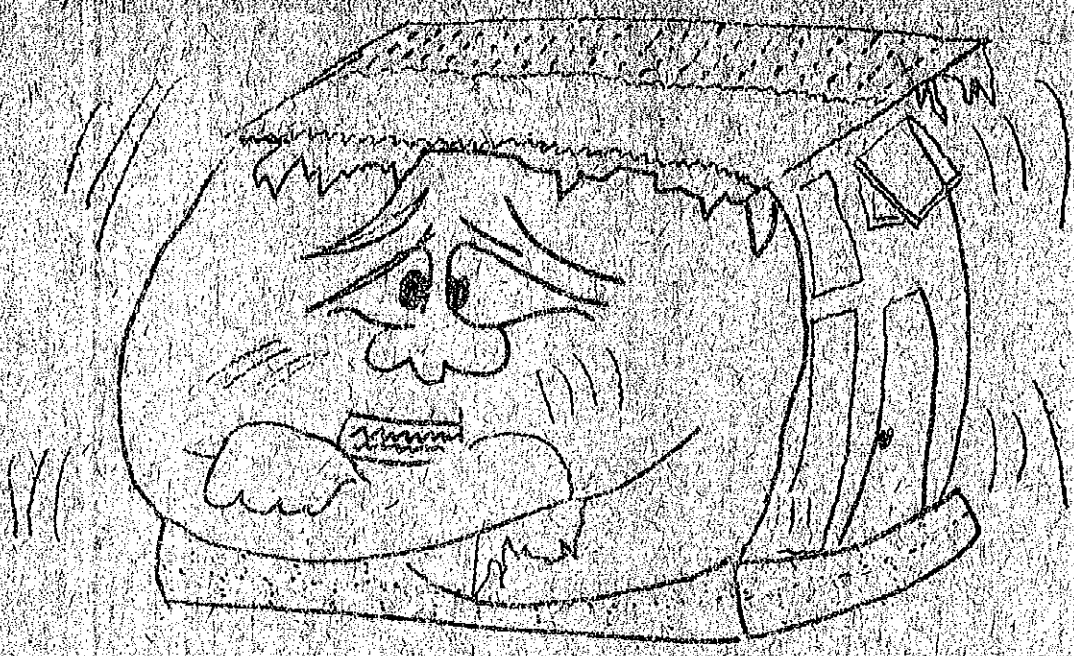
It has to face The South

2) Why is it important to choose a flat building site?

because It's important that the greenhouse won't be flooded

3) Why is it important not to have shadows on a greenhouse site?

It can't get The sun's energy if there



A greenhouse without enough heat.

A greenhouse can get enough heat from the sun when the sun is out. But at night and on bad days, when there is no sun, there must be a way of heating the greenhouse.

There are lots of ways of heating a greenhouse. The best and cheapest way is with large barrels. The sun heats water in the barrels during the day. At night, the hot water keeps the greenhouse warm.

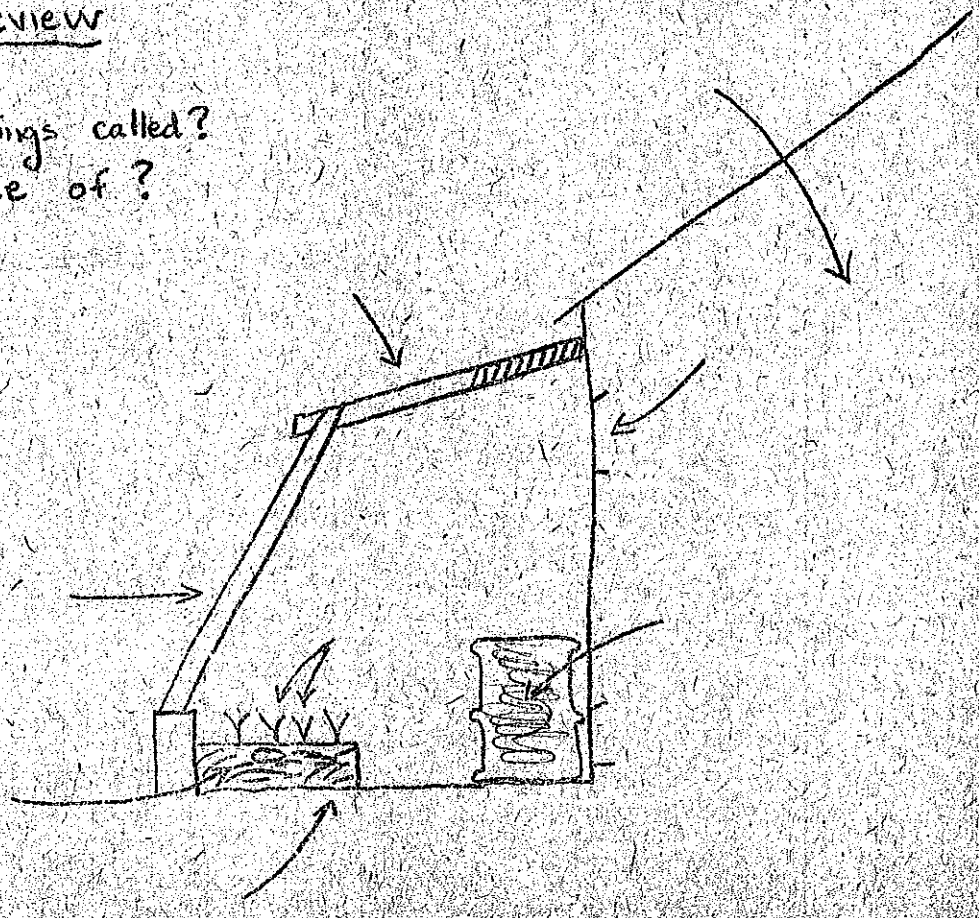
In the summer, when it gets very hot, there has to be a way of cooling the greenhouse. If you build vents in the north and south sides, you can keep a greenhouse from getting too hot.

Fill in the blanks to write a <u>complete paragraph</u>.

The cheapest way of heating a greenhouse is with barrels. Hot water in the barrel heats the greenhouse during the night. In the summer, it's important to have cooling. Vents can cool the greenhouse.

Review

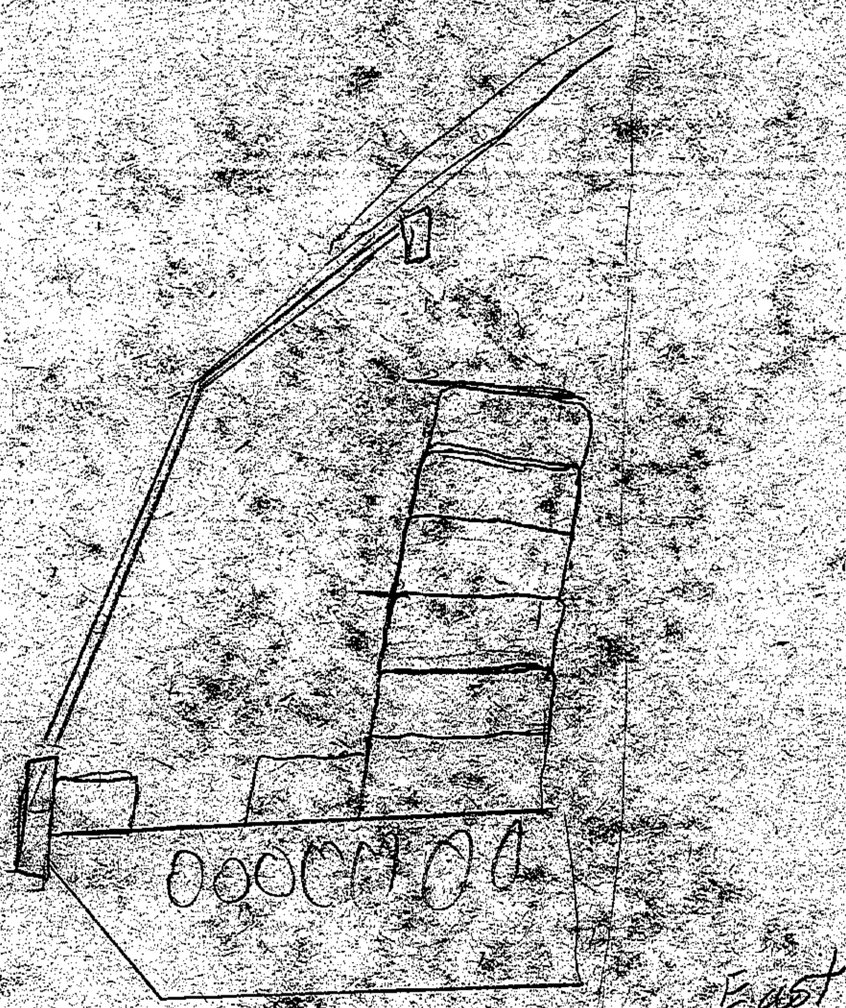
What are these things called?
What are they made of?

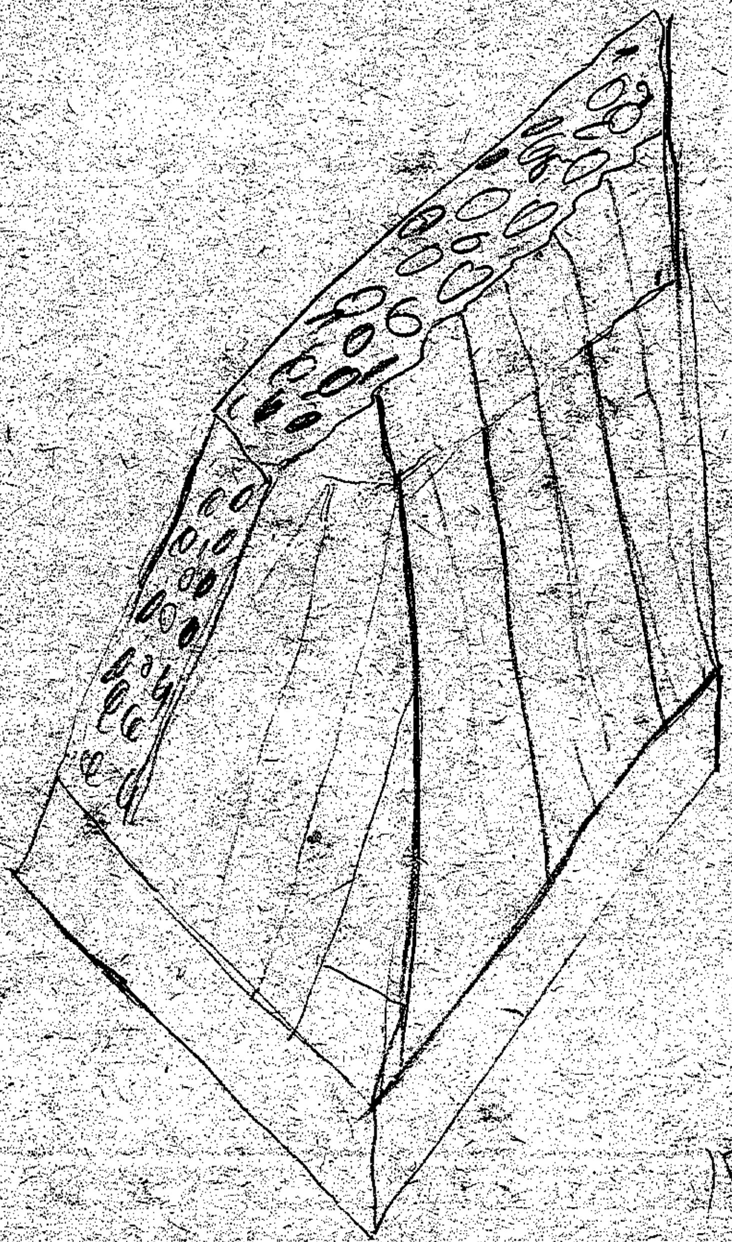


Brianna Zaleski

If I build a greenhouse it will be fifteen feet long and ten feet wide. It will have fan and vents I'll try to grow flowers, ~~[illegible]~~, ~~[illegible]~~, and ~~[illegible]~~, This way I can ~~[illegible]~~ ~~[illegible]~~)

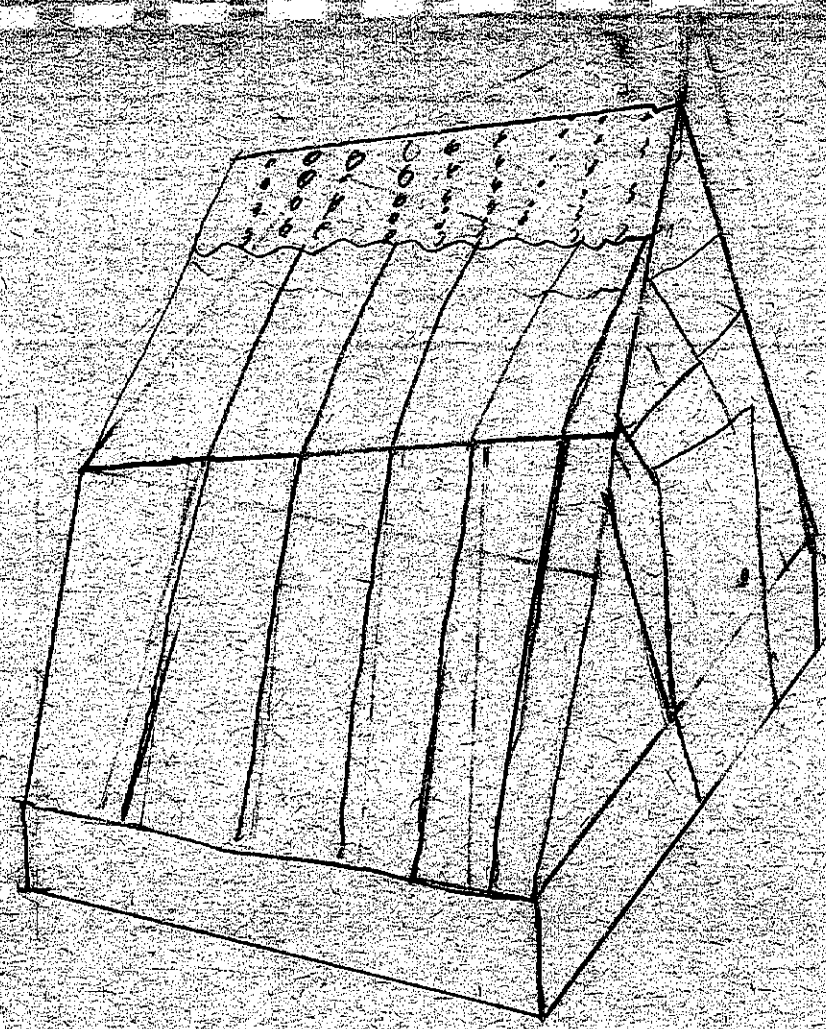
Frank





②

South-east



Southeast ①

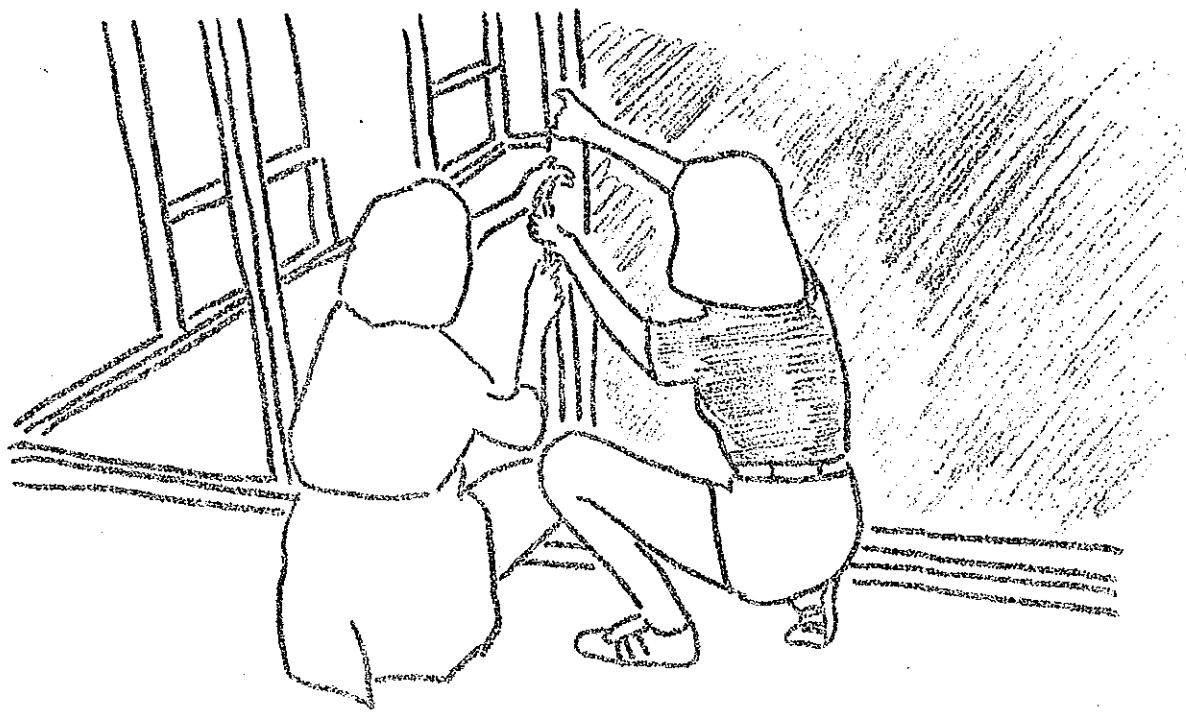
A greenhouse has three parts. It has a foundation, walls, and a ceiling. These three parts are made of many things.

The foundation is made of blocks and cement. Metal bars in the foundation make it strong. The floor inside the foundation is made of gravel.

The greenhouse's walls are made of wood, plastic, and fiberglass. They are built with nails.

The ceiling is made of metal, fiberglass, wood, and plastic. It, too, is built with nails.

Many other things are needed. We need barrels to heat the greenhouse. We need paint to paint it. We also need many tools.



Unscramble these sentences

1) parts has three greenhouse a

A greenhouse has Three Parts.

2) made is of foundation of lots the cement

The foundation is made of lots cement.

3) wood greenhouse's plastic the and fiberglass walls made of are

The greenhouse's Walls are made of wood, Plastic and fiberglass.

4) barrels need the greenhouse we to heat

We need barrels to heat the greenhouse.

5) will paint we need too some

We will need some Paint too.

That's all

MATERIALS LIST FOR 10' x 16' ATTACHED SOLAR GREENHOUSE

1 bag masonry
5 bags Portland
1 yard sand
1 yard ¾" aggregate
2 yards dry pumice or pea gravel
80 full ~~pumice~~ blocks
25 half ~~pumice~~ blocks
~~8 6" anchor bolts~~
72' rebar
30 8' 2x4's
3 10' 2x4's
2 16' 2x4's
2 8' 1x4's
2 10' 1x4's
40' 1x12 (for floor beds and shelving)
400' wood lattice moulding (for trim and tables)
½ lb. concrete nails
300 - 400 aluminum nails or 3 lbs. small galvanized nails
10 lbs. No. 16 common nails
5 lbs. No. 8 common nails
2 lbs. No. 8 finishing nails
1 lb. small finishing nails
3 lbs. blue sheetrock nails (for sheetrock)
6 sets hooks and eyes
1 set 3½" or 4" butt hinges (for door)
2 sets 2" butt hinges (for vents)

2x4 joist hangers
2 4x4 joist hangers
3 pulls
8 corner braces (to reinforce door and larger vent)
2 2'x8'x2" styrofoam panels
150 sq. ft. of 4" or 6" fiberglas insulation 24" wide
2 packages 3/8" foam strip (weather-stripping
32' corrugated stripping (foam or redwood)
4 pieces ¼" or 3/8" sheetrock
2 pieces ¾" Celotex or equivalent exterior sheathing or paneling, i.e., 64 sq. ft. rough lumber
4 pieces 8' corrugated roofing material
2 tubes silicone caulk—clear
1 tube regular caulk
1 gallon good quality white latex paint
1 gallon good quality dark color latex
1 pint dark stain (for lattice moulding)
200 sq. ft. flat fiberglass/acrylic (greenhouse quality)
70 sq. ft. corrugated fiberglass/acrylic (greenhouse quality)
250 sq. ft. polyethylene (greenhouse quality)
6 55 gallon drums with tops (water tight) and/or a number of smaller water tight containers

Cost of Materials for a 10' x 24' Greenhouse based on
Figures for a 10' x 16' Structure x 20%

5 bags concrete mix @ $2.85 ea.	$14.25
1 yard sand	13.81
1 yard 3/4" aggregate	12.15
2 yards pumice @ 16.81 ea.	33.62
80 full pumice blocks @ .56 ea.	44.80
25 half pumice blocks @ .39 ea.	9.75
8 6" anchor bolts @ .26 ea.	2.08
4 20' pieces rebar @ 2.35 ea.	9.40
30 8' 2x4 @ 1.63 ea.	48.90
3 10' 2x4 @ 2.01 ea.	6.03
2 16' 2x4 @ 3.17 ea.	6.34
2 8' 1x @ .80 ea.	1.60
2 10' 1 4 @ 1.00 ea.	2.00
40' 1x1 @ 4.50/10'	18.00
400' lattice moulding @ .11/ft	44.00
½lb. concrete nails	.65
3 lbs. small galvanized nails	2.55
10 lbs. #16 common nails	6.50
5 lbs. #3 common nails	3.25
2 lbs. #8 finishing nails	1.30
1 lb. small finishing nails	.65
3 lbs. sheetrock nails	2.55
6 sets hooks and eyes @ .30 ea.	1.80
1 set 4" butt hinges	2.60
2 sets 2" butt hinges @ 1.19 ea.	2.38
7 2x4 joist hangers @ .22 ea.	1.54
3 pulls @ .69 ea.	2.07
8 corner braces @ .24 ea.	1.92
2 2'x8'x2" styrofoam panels @ .15/sq-ft	5.12
150 sq-ft 4" fibreglas insulation 24" wide @ .30/sq-ft	45.00
2 packages 3/8" weatherstripping @ 1.98 ea.	3.96
32' corrugated redwood stripping @ 8'/1.14	4.56
4 pieces sheetrock @ 4.71 ea.	18.84
2 pieces 3/4" Celotex @ 3.85 ea.	7.70
4 pieces 8' corrugated roofing material @ 5.10 ea.	20.40
2 tubes silicon caulking @ 4.69 ea.	9.38
1 tube regular caulking	1.99
1 gallon white latex paint	7.99
1 gallon black latex paint	7.99
200 sq-ft flat fibreglas/acrylic @ .43/sq-ft	86.00
70 sq-ft corrugated fibreglas/acrylic @ .43/sq-ft	30.10
250 sq-ft polyethelene @ .06/sq-ft	15.00
12 55 gallon drums @ 7.00 ea	84.00
Total	$641.27
+ 20%	128.25
Total Estimated Cost	$769.52

A Phone Call

"Hello. Is Ken there?"
"Who?"
"Is Ken there?"
"I'm not a hen! Who are you?"
"Me? I'm Johhny Yazzie. Is this Ken?"
"This is Tweedledee."
"Tweedledee??!! Isn't this Houston Lumber Company?"
"What? Houston Lumber Company?"
"Yes! Is this Houston Lumber Company?"
"No!"
"Isn't this Ken?"
"What? A hen?"
"No, not a hen. This is the wrong number."
"You're right. This is the wrong number!"
"Bye."
"Bye."

Look at these contractions.

I am = I'm	We are = We're
You are = You're	They are = They're
He is = He's	
She is = She's	
It is = It's	

Use contractions in these sentences.

Ken is here. Ken's here

You are right. You've right.

They are outside. They're outside

It is a nice day. It's nice day.

We are at school. We're at school.

She is pretty. She's pretty.

I am sorry. I'm sorrye

Look at these contractions.

I am not = I'm not	We are not = We aren't
You are not = You aren't	They are not = They aren't
He is not = He isn't	
She is not = She isn't	
It is not = It isn't	

Use contractions in these sentences.

This is not Tweedledee.

This isn't Tweedledee.

I am not a hen.

I'm not a hen

You are not late.

You aren't late.

We are not ready.

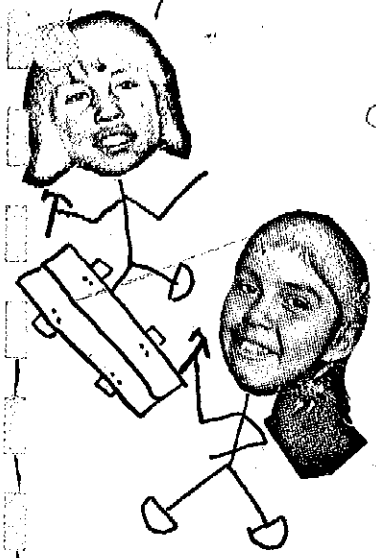
We arent reade

It is not cold today.

I isn't cold today

They are not in the classroom.

They arent in The classroom.



"Hey, Fatso, what's Sampson doing?"

"He's hammering, Skinny."

"What about Mary?"

"She's painting."

"What's she painting?"

"She's painting a greenhouse."

"Are you kidding?"

"No, I'm not kidding."

"Well, what's Junior up to?"

"Junior's sawing."

"Is he doing something with a greenhouse?"

"He sure is."

"Isn't that Clarance down there?"

"Yes, that's him. He's measuring a 2x4."

"What about Maritta?"

"Maritta's digging."

"Oh. Isn't that Julius over there?"

"Yes. He's holding a barrel."

"That's Lorraine, isn't it?"

"Yes. She's making a flower bed."

"Is that Frank?"

"Yes, it is. He's carrying some nails."

"What're Gina and Dujuan doing?"

"They're nailing some boards."

"Isn't that Gilbert up top?"

"It sure is. He's holding the picture together."

Is Ken There?

I'm not Ken Who are you?

I am Johnny Yuzie. Is This Ken?

This is Tweedledee

Tweedledee?

Isn't This Houston Lumber company?

What? Houston lumber company?

Yes. Is This Houston Lumber company?

NO.

Isn't This Ken?

What? A hen?

We are I a Ken This is wrong number

Number?

You're right. This is long Number.

Bye

Bye

Use Contractions in these sentences.

1) Sampson is not painting the greenhouse.

Sampson's not painting the greenhouse.

2) Mary is working outside.

Mary's working outside.

3) You are not sawing, are you?

You're not sawing.

4) I am going to call Gallup.

I'm going to call Gallup.

5) They are carrying some nails.

They're carrying some nails.

6) Gina, Dujuan, and Gilbert are not here today.

Gina, Dujuan, and Gilbert aren't here today

7) I am not going to hold the barrel.

I'm not going to hold the barrel.

8) Lorraine is making a flower bed.

Lorraine's making a flower bed.

9) Maritta, Clarance, and Junior are not doing anything.

Maritta, Clarance, and Junior aren't doing anything.

10) Frank and Julius are coming right now.

Frank and Julius're coming right now.

What

Chande these verbs into their Present Tense form by adding -ING.

go	going	sing	singing
do	doing	bring	bringing
talk	talking		
speak	speaking	take	taking
tell	telling	have	having
say	saying	ride	riding
see	seeing		
eat	eating	run	running
	-	put	putting

I'm going to Gallup.

I'm doing fine at home.

I'm talking to you at Albuquerque.

I'm speeking to you. for car

Hey Bay what did you say?

I see you at Crownpoint.

Junior's eating My cream

Junior's singing at California

Danny's running to Frank's house

Junior's riding a horse at his home

Turn these sentences into questions.

1) That is Tweedledee.
Is Tweedledee?

2) You are Ken.
are you Ken?

3) We are getting some lumber.
are We Getting Some lumber?

4) They are calling on the phone.
are They Callingon The Phone?

5) I am going to Gallup.
am I going to Gallup?

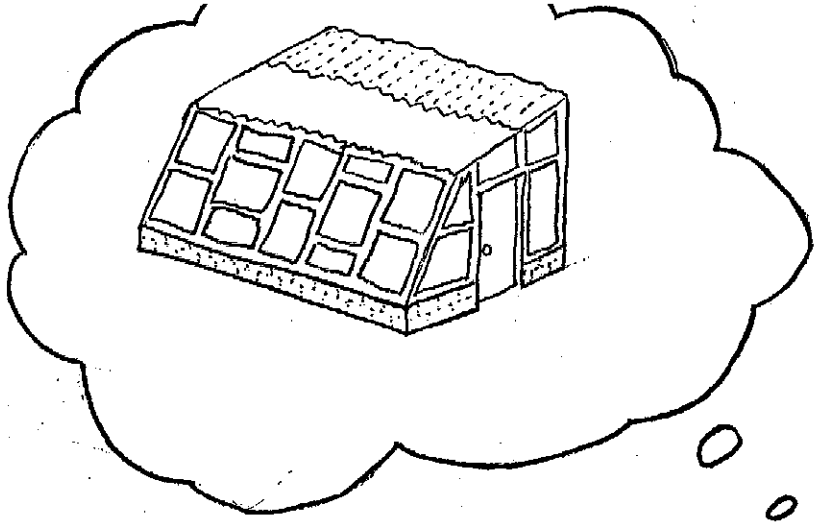
6) She's nailing some boards.
Is She nailing some boards?

7) They're painting the walls.
are They painting the walls?

8) I'm fixing the door
am I fixing the door?

9) We're buying some blocks.
are We buying some blocks?

10) You're ready.
are you ready?



"Hey, Danny! When are we going to build the greenhouse?" asked Frank and Gilbert.

"We're going to do it soon," Danny said. "But first we're going to need lots of things."

Lorraine and Maritta asked, "What are we going to need?"

"Well," said Danny, "we're going to use lots of tools. I'm going to find hammers, saws, shovels, paint brushes, and other things so everyone can work."

"Where are you going to get all that stuff?" asked Junior and Dujuan.

Danny said, "Don's going to lend us his tools and I'm going to lend mine, too."

"What about all of the materials from Houston Lumber Company?" asked Mary and Gina.

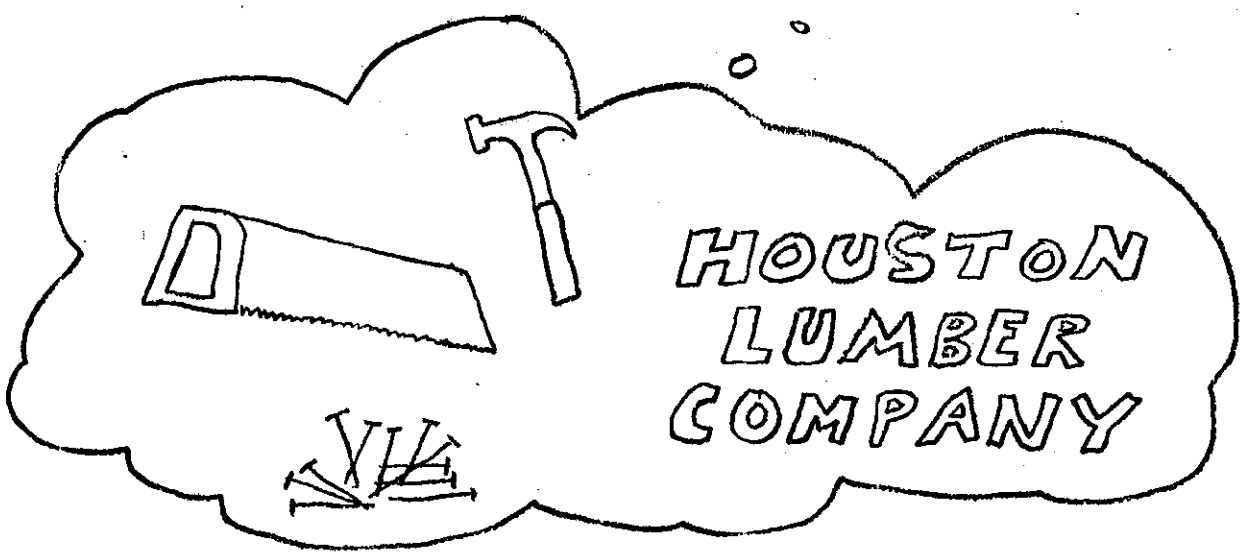
"We're going to go to Gallup. All of you are going to buy the materials yourselves," said Danny.

"Really?" shouted Sampson. "How are we going to get there?" asked Julius and Clarance.

Danny said, "We're going to go there by bus."

Then all of the fifth graders asked, "Are we going to buy the materials ourselves?"

"That's a big 10-4," said Danny. "It's going to be fun."



Unscramble these sentences.

1) ~~build~~ going ~~greenhouse~~ the ~~we're~~ ~~to~~ soon

We're going to build the greenhouse soon.

2) ~~to~~ where ~~stuff all~~ you that ~~are~~ ~~get~~ ~~going~~

where are you going to get all that stuff?

3) ~~grade's~~ ~~take to~~ bus ~~going~~ the ~~the fifth~~

The fifth grade's going to take bus.

4) us lend going to Don's tools his

Don's going to lend us his tools

5) buy materials to the we going are ourselves

we are going to buy the materials ourselves

6) Gallup how to get going fifth is the grade to

how is the fifth grade going to get to Gallup

7) lots of everyone's use going tools to

everyone going to use lots of tools

8) find to Danny's hammers, going saws other shovels stuff and

Danny's goin to find hammers, saws, shovels, and other stuff.

Make sentences with these words.

like this →

going get tomorrow

I'm going to get a new Ford pickup tomorrow.

1) He's to soon

He's going to California soon.

2) Are going him

Are you going to him?

3) She's to them

She's going to samyson house and them

She's going to Grast

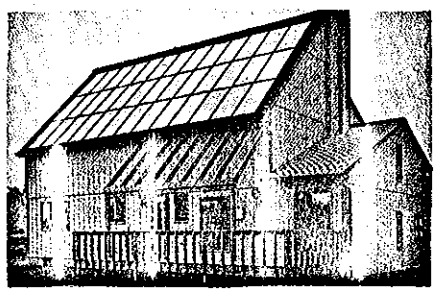
4) Is it David

Is That it said David

Many people talk a lot about energy. Energy costs a lot and it's hard to get. Our country doesn't have enough oil, so oil and gasoline are expensive. Natural gas is expensive, too. Uranium is hard to find. There's a lot of coal and it doesn't cost much, but it's dirty to use.

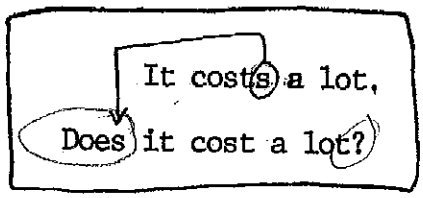
But there is also solar energy. It comes from the sun. For this reason, it's clean and cheap. It works with water and sunlight. The energy from the sun heats water in barrels. Then the water heats a home or another building. People in Los Alamos use solar energy to make electricity, too. They make solar panels which turn the sun's energy into electricity.

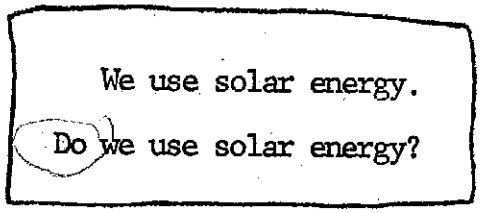
Many people don't think solar energy is a good idea now, because they don't know enough about it. But someday, it may power the cars we drive and make the heat and electricity we use.



Here's a house with solar panels.

Look at these sentences.





I. Change these sentences into questions.

1. He has a nice pickup.

Does He have a nice pickup.

2. Solar energy comes from the sun.

Does solar energy come from the sun?

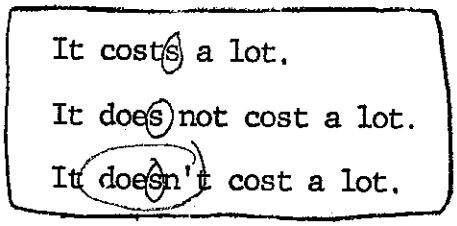
3. People think solar energy is expensive.

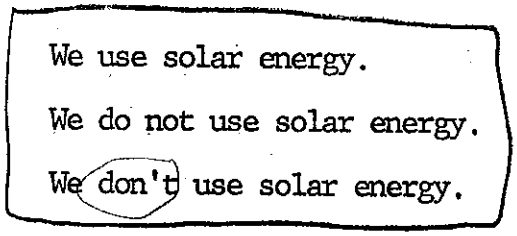
Do people thik solar energy is expensive?

4. Solar panels make electricity.

DO solar panels mak electricity?

Look at these sentences.





II. Change these sentences into negative sentences.

1. I have a new pickup.

I Don't have a new pickup.

2. Our country has enough oil.

our country Does't have enough oil.

3. Coal costs a lot.

coal Doesn't cost a lot.

Answer these questions with complete sentences.

1. Where does our country's energy come from?

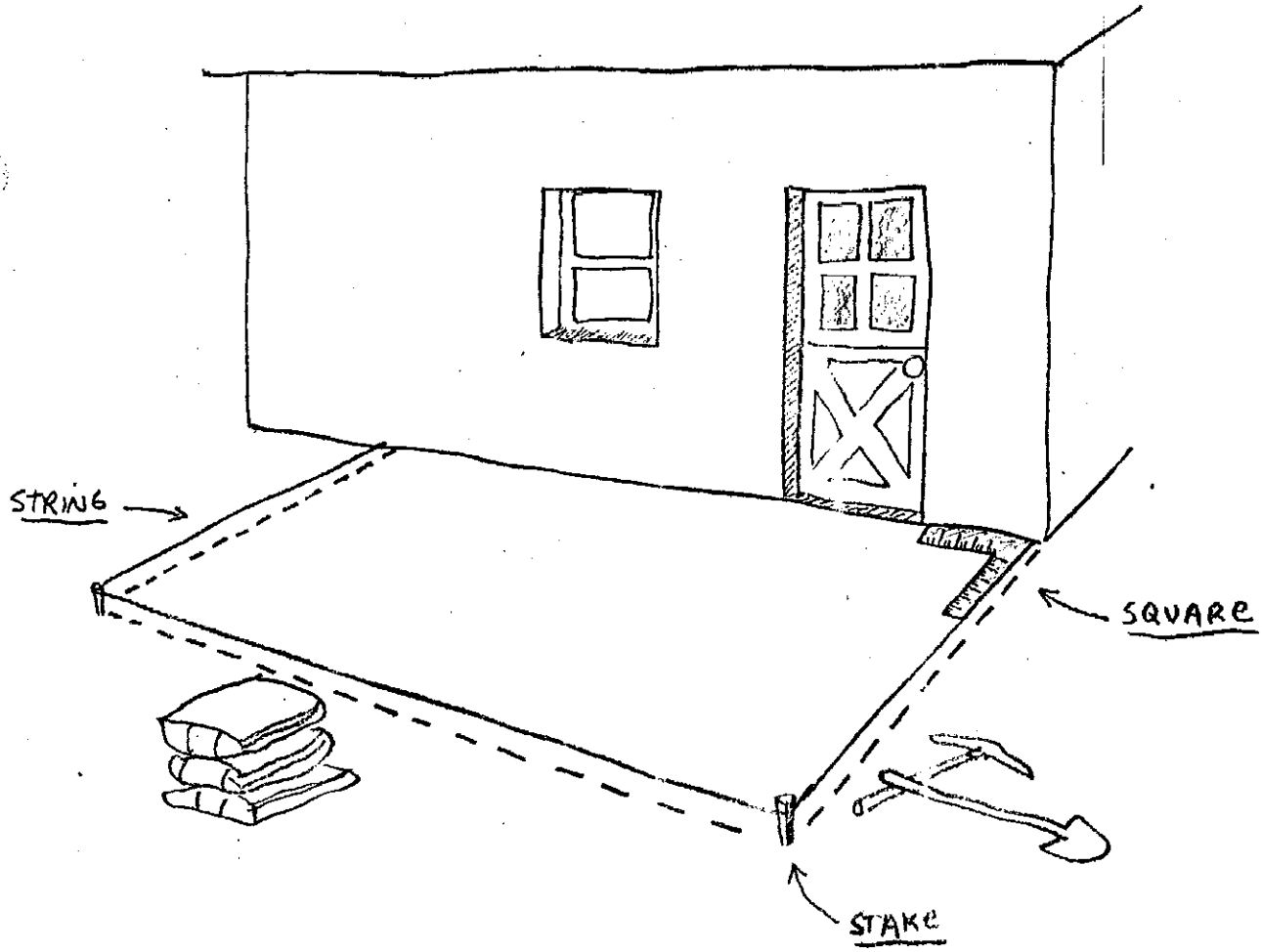
2. Which kinds of energy cost a lot?

3. Where does solar energy come from?

4. How does solar energy heat a building?

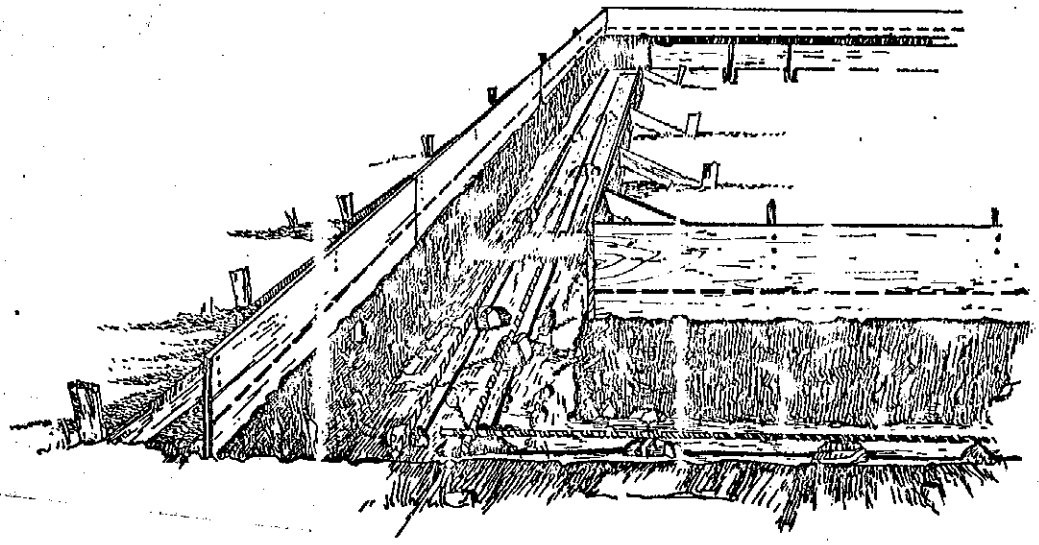
5. How does solar energy make electricity?

6. What do you think is the best kind of energy? Why?



Soon, we're going to buy the materials for our greenhouse. But we have to wait until next week. Now, we can begin making our greenhouse's foundation.

First, we need to measure the walls of the greenhouse. We have to get a square, some string, and some stakes. Then we have to make a rectangle with the stakes and the string. We want to be very careful. The strings and the stakes will soon be our greenhouse's walls.



Look at the picture above. It's a picture of a greenhouse's foundation. There's a trench. There're stakes, pieces of wood, some rocks, and pieces of rebar.

We'll do the same thing for our greenhouse. First, we'll dig a trench with shovels. It'll be 12 inches wide and about 12 inches deep. Next, we'll have to get the trench level. We'll put stakes into the trench every 4 or 5 feet. I'll put a long board on top of the stakes. Then you'll see if the trench is level with a level.

Then, we'll be ready to put the wooden boards along the sides of the trench, like in the picture. That'll be the next job.

This is a level.

I will study = I'll study
You will study = You'll study
He will study = He'll study
She will study = She'll study
It will rain = It'll rain

We will study = We'll study
They will study = They'll study

-Use contractions.

1. I will dig the trench.

I'll dig The trench.

2. They will build the walls.

They'll build The walls.

3. Teddy will carry the cement.

Tedd'll carry The cement

-Ask the question.

1. Maritta will help us.

will Martta help us.

2. You'll mix the mortor.

will you mix The mortor

3. We'll build the greenhouse together.

will build The greenhouse together

I'll study -- I won't study
You'll study -- You won't study
He'll study -- He won't study
She'll study -- She won't study
It'll rain -- It won't rain

We'll study -- We won't study
They'll study -- They won't study

-Make these negative.

1. Virginia will be here tomorrow.

Virginia won't be here Tomorrow

2. They'll come soon.

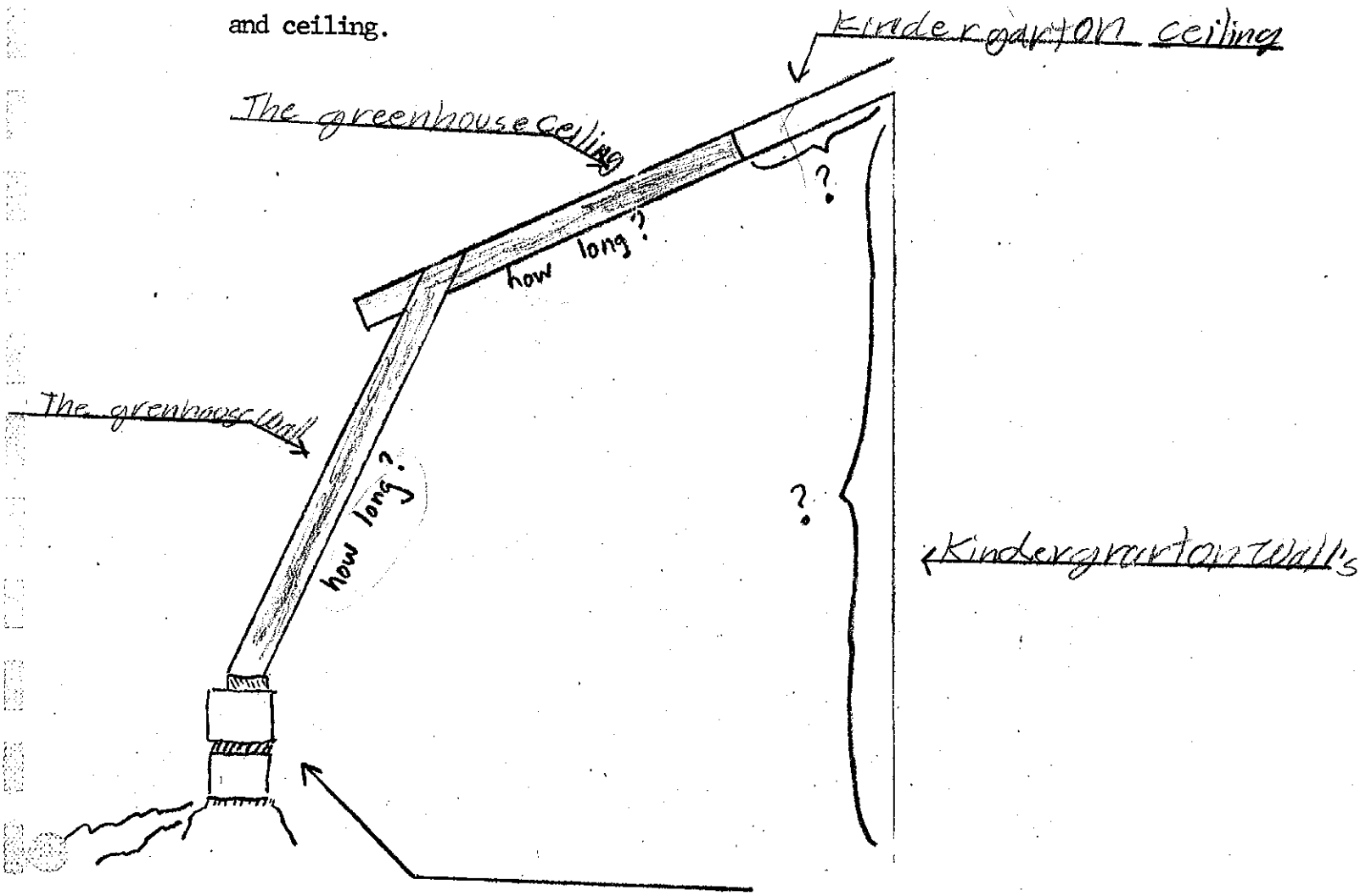
They won't come soon.

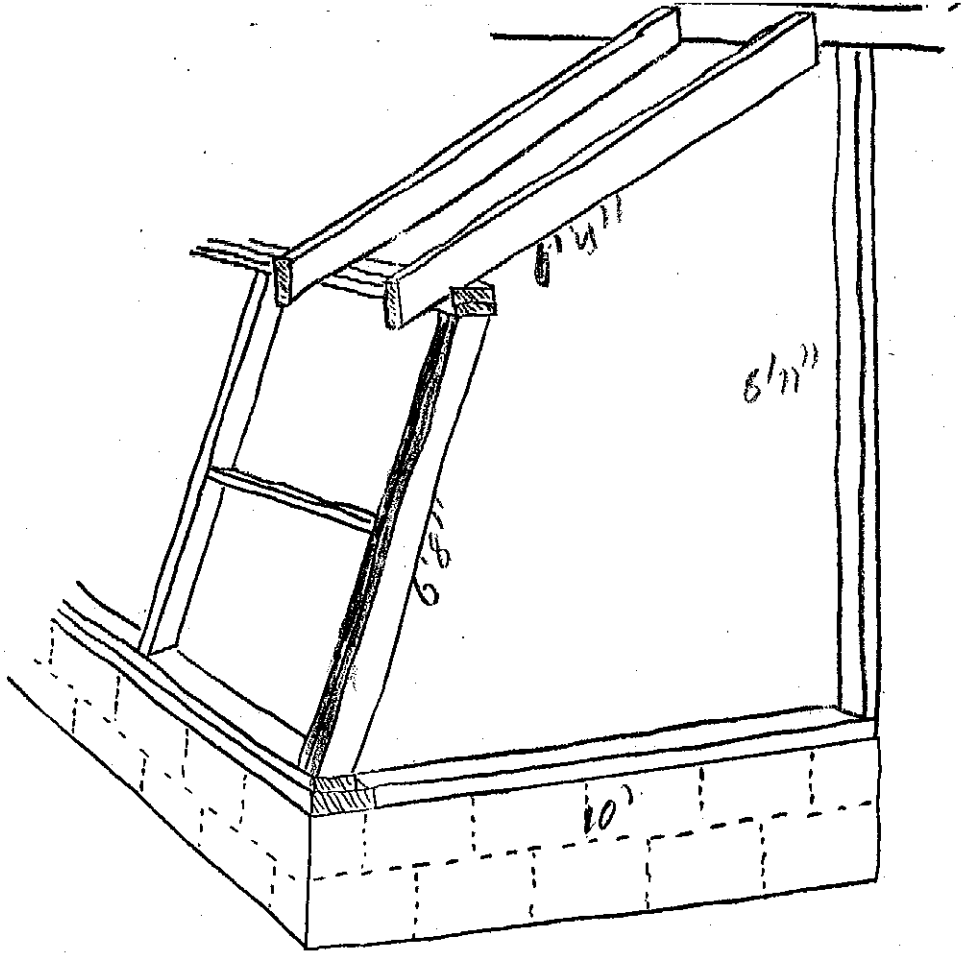
3. I'll do it later.

I won't do it later.

Two weeks ago, we dug the greenhouse's foundation. Then we poured cement. Next, we put in rebar. We finished building the foundation with blocks.

Now, we can begin building the walls. We must find out how long the greenhouse's walls and ceiling are. To do this, we have to measure the kindergarton wall and measure the kindergarton ceiling. Then we'll draw the greenhouse on graph paper. After we draw everything, we can measure the greenhouse's walls and ceiling from the drawing. From this, we'll know how long to make the walls and ceiling.





Write the question with the given words. Then answer it.

1. how long south wall 2x4s USE WILL

How long will the south wall be?

It'll be 6'11"

2. how wide greenhouse foundation USE DID

How wide did we make the foundation

We made it 10' wide.

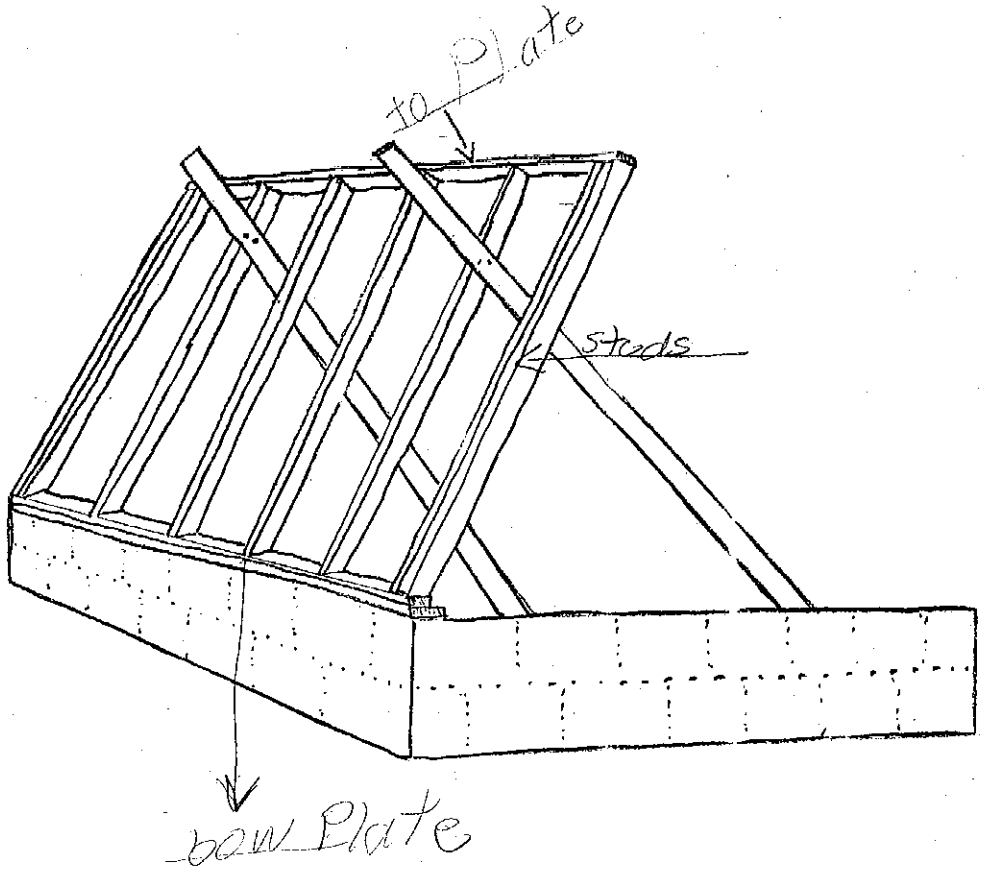
3. how tall kindergarton wall USE IS

How tall is the Kindergarten wall?

It's 8'11"

4. how long greenhouse roof 2x6s USE GOING TO

How long is greenhouse roof going to be? 6'4"



Directions for making the south wall.

1. Get the lumber together.
2. Cut it to the right size.
3. Make the top plate.
4. Put both plates on the ground.
5. Mark where the studs go.
6. Nail in the studs.

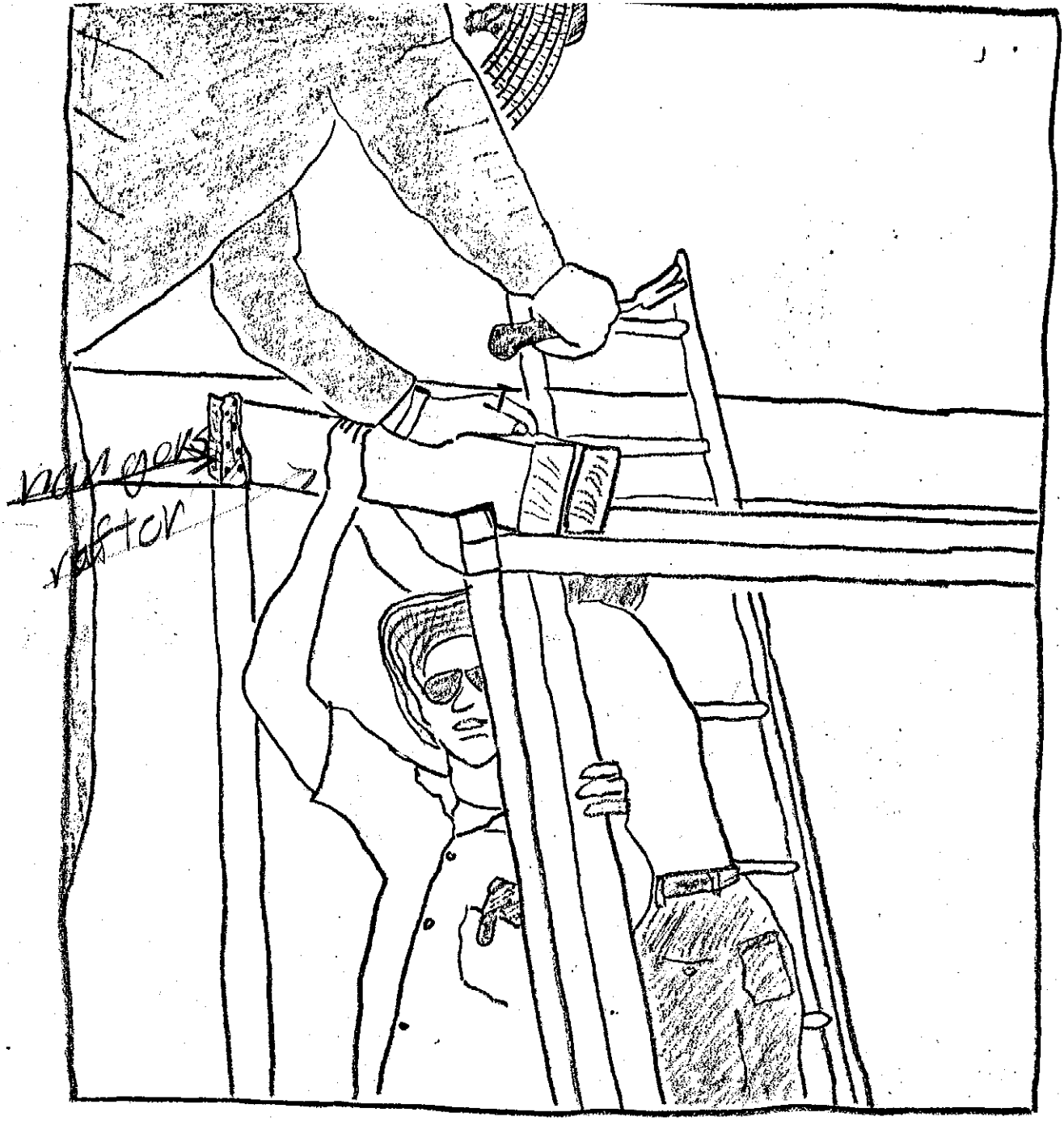
How are we going to make the south wall of the greenhouse?

Frist we're going to get The lumber together next we're going to cut it to the right size. Then we're going to Make the top Plate. Then we're going to put both Plates on the ground

How did we make it?

Frist we Get The lumber together next we cut The lumber to The right size. Then we made The to Plates. next we Put both Plates on the ground Then we Marked where the studs go Finally we nailed in the studs.

next we're going to
Mark where the studs go.
Finally we're going to
Nail in the studs.



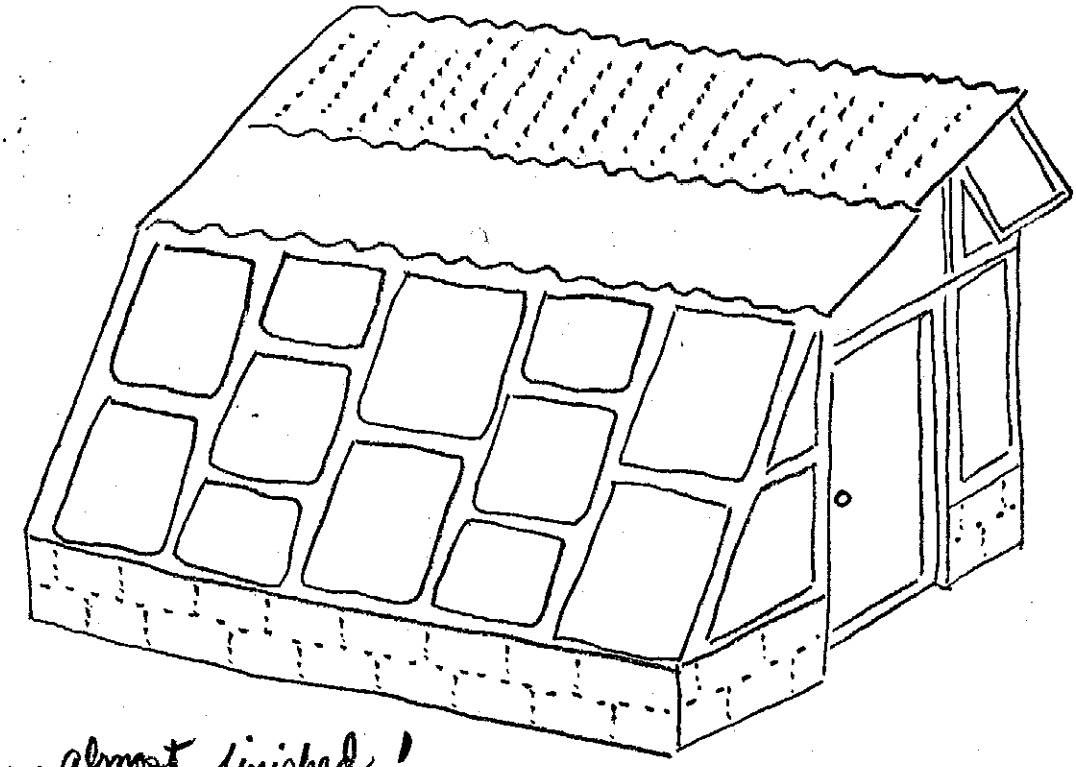
Directions for making the roof.

1. Get 10' 2x6s together.
2. Make marks every 4 feet where the rafter hangers go.
3. Make marks every 4 feet where the rafters meet the wall's top plate.
4. Put notches in the rafters.
5. Nail the rafters to the rafter hangers and the top plate.

What do we have to do to build the greenhouse's roof?

Frist We have to Get 10' 2x6 s Together. next We're going to make marks every 4 Feet where the Rafters hangen go.

What did we do to build the greenhouse's roof?



... almost finished!

This week or next week, we should finish the greenhouse. But there are many things still to do.

First we'll finish the roof. We'll cover one half of the roof with metal. We'll cover the other half with clear fiberglass.

Next, we have to put clear fiberglass on the east and south walls. On the west wall we must put some fiberglass and some boards.

Then we're going to build the vents. After we finish building the vents, we're going to build the door. Both the vents and the door are going to be made of 2x4s and clear fiberglass.

After all that, we should put insulation inside the greenhouse. Then the insulation should be covered with sheetrock.

At that time, we should be almost finished!