Solar Cookers International (SCI)
Teacher-designed Unit

* Lessons were designed for 50-60 minute class periods, one time per week for 4 weeks.
* Supply amounts will vary depending on class size.
* Lessons were influenced by new NGSS Standards.
* These lessons were conducted with grades 1-6. Modification for grades K-8 may be needed.

MATERIALS

Aluminum foil
Painter's tape
Cardboard sheets
Food (s'mores, quesadillas, etc)
Clothing/blankets/food for carrying
Water jugs
Candles and lighters
Thermometers
WAPI
SCI solar cooker CooKits
3 lb roaster pots
Whiteboards and markers
Construction paper
Scissors
Glue
Worksheets (if desired)

LESSON 1

1. CHECK FOR PRIOR KNOWLEDGE

   Check for understanding about why the sun is important to life on Earth.*
   Check for understanding about what it means to be an "ally" (for use on a global scale).
   *This information was learned across various grades in the Earth Science and Physical Science units.
   We reviewed these topics briefly at the start of this engineering unit:

   Why is the sun important?
   What is the sun made of?
   Can you see UV light/why should we wear sunscreen?
   How far away is the sun?
   How big is the sun compared to other stars?
   Why does your shadow change during the day?
   What effect does the sun have on water on Earth?
   What is the difference between renewable and non-renewable resources?
   What are some examples of ways you are helping to reduce the use of non-renewable resources?
   What is inside a thermometer?
   What happens to a thermometer when the temperature changes?
   Review climate regions throughout the world. Extend on causes for different climates.
   What is an ally?

2. DISCUSSION OF HUMAN NEEDS

   Have students use whiteboards to brainstorm with a partner:

   a. "What are the 5 most important things for you to live a happy, healthy, and successful life?" (Money is not an option.) Answers will vary tremendously across grade levels.
   b. Note nearly all students will say food and water.

   Follow up with questions of:

   a. "What could make it hard to get those things you need?"
   b. Illustrate additional hardships with photos of refugees, wildfires, mudslides, etc.

   Introduce the United Nations and Human Rights.

   a. "Wouldn't it be a cool job to try and make sure everyone in the world has those things you said you need to be happy, healthy, and successful? It would be a very hard job too…"

Ask students how they cook their food. Show younger grades/ELL photos. Burn a match (for visible smoke) and ask if anyone knows a way to use something that does not cause fires, smoke, pollution, or non-renewable resources. Review non-renewable resources if necessary.

3. INTRODUCTION TO SOLAR COOKERS
   Show students unlabeled solar cooker (photo and actual item) and see if students
   a. know what the photo is showing
   b. know what the parts are made of
   c. can explain how the solar cooker works

   Introduce Solar Cookers International and their work all around the world! Have students view solar cooking video clips found online.

4. INTRODUCTION TO ENGINEERING CHALLENGE
   Introduce student engineering challenge; let students explore materials they will use as a group (~4 students per group). Suggested materials are: cardboard sheets, aluminum foil, unlimited tape, SCI cooking pots. Design solar cooker prototype sketch as a group.

   Note: Design sketches were collaborations between 2 partners. When it came time to build the solar cookers in Lesson 2, additional collaboration and compromise between 2 groups of partners (4 students total) took place.

LESSON 2

1. REVIEW OF PREVIOUS PLANNING

   Review why solar cookers are important to humankind at this time in our history. Review the benefits of solar cookers for people who have lost their homes because of war or natural disasters (lightweight, durable, free energy, etc). Show again the photos such as life as a refugee, wildfires, mudslides, etc.

   Review student designs for building a solar cooker. Complete hypothesis portion of solar cookers worksheet.

2. TEAMWORK IN ENGINEERING

   Head outside and work in teams to build solar cookers based on student design plans.

   Make sure to note temperature changes on the thermometer. While students are waiting for their s'mores (or other food choice) to cook, questions on the back of the worksheet should be answered.

   After 20-30 minutes of outdoor time and worksheet recording, enjoy s'mores (or other food choice)!

   Clean up and review discussion questions as a class, especially what additional supplies, structures, weather changes, etc students wish they had.

LESSON 3

1. ENGINEERING REVIEW
   Class review of effective ideas/ideas that were not effective in group solar cookers. Address challenges encountered.

2. HUMANITARIAN REVIEW AND DEMO
   Review why solar cookers are important to humankind at this time in our history. Review the benefits for people who have lost their homes because of war or natural disasters (lightweight, durable, free energy, etc). Show again the hardships such as life as a refugee, wildfires, mudslides, etc.

   Ask student volunteers to be part of my refugee family. We will attempt to carry all of the things we need to survive and cook our food (solar cooker, pot, clothes/blanket, beans and tortillas). This amount should be light enough to carry between our group. But we need to have water!

   Put items down and go over the amounts of water we use daily to live. Remind students that we simply go to the water fountain if we need a drink. Have filled and capped water jugs that match the amount needed for daily use, with some bottles filled with "dirty" colored water.

   Pick up all of the items we need to carry, but then try to add the water we need for a day. It's impossible to carry everything! Especially if we are walking miles and miles every day!

   Make it a point that people often have to rely on water that they find when they are travelling, but water might look like… (photos and "dirty" water jugs).

   Ask what may happen if students drink dirty water. Have students read about the reality of child deaths annually because of unclean water.

   Inquire, "What does this have to do with solar cookers?"

3. WATER PURIFICATION VIA SOLAR COOKERS
   Show photos of the WAPI water purifier and ask if students can explain why scientists would invent this thing.

   Start with giving them a hint about what is inside the WAPI. Light a candle at each table for observations and ask what happens when the wax gets hot. Urge connections about what is the temperature of the solar cookers:

a. “Why would we want to make dirty water hot?”
b. “Why would melting wax be significant?”

Show chart of what temperatures are necessary to rid water of different disease-causing organisms.

Demonstrate how WAPIs sit in the pots and when users know when the water is purified. Ask how students would reuse the WAPI after the wax melts. Younger grades may need to be shown that the WAPI can slide across the string before the conclusion of turning the WAPI upside-down.

Finally, ask students why people wouldn’t just use a thermometer! It’s much easier! But call on a student to repeat what temperatures are safe for water pasteurization (many will have already forgotten). Steer students to realize that thermometers are made of glass compared to the plastic WAPI. Cite the inability to use thermometers if the glass breaks (especially if the week prior you had any accidents with glass thermometers). Forgetfulness and glass are just a few reasons why the WAPI is a great invention; can students think of any other reasons?

4. ART DESIGN

Remind students about the United Nations and Human Rights associated with basic needs, and why SCI would choose their logo as seen on the board. (Responses may include helping hands, looks like a sun, etc.)

Ask students what they would like to see in the world for the future (everyone has food, everyone has clean water, everyone can get an education, world peace, etc) and show them the teacher art example.

Students make their own SCI logo by tracing, cutting out, and gluing their handprints together, with a wish on the front. Connect SCI and their wishes to ally behavior.

Tell students what to expect next week… using official SCI solar cookers!

LESSON 4

1. ENGINEERING REVIEW
   Class review of effective ideas/ideas that were not effective in group solar cookers. Address challenges encountered.

   Review maximum temperatures reached inside group solar cookers from Lesson 2. Predict temperatures that will be reached with SCI solar cookers.

2. SCI SOLAR COOKERS
   Set up SCI solar cookers, remembering angle of solar rays which was often something students learned to consider after Lesson 2. Monitor temperature changes. Discuss why SCI solar cookers are getting hotter (likely), cooler, or the same as the solar cookers we engineered in Lesson 2.

   After 20-30 minutes of outdoor time, enjoy quesadillas (or other food choice)!

   Clean up and review discussion questions as a class, especially what additional supplies, structures, weather changes, temperature differences between solar cooker models between groups and between lessons, etc students wish they had.

3. ASSESSMENT
   *Assessment can be formal (written, scored, etc) or informal (class or group discussions, etc).

   Students should be able to:
   Explain why solar cookers are effective alternatives for food preparation.
   Understand differences between renewable and non-renewable energy sources.
   Recall challenges that would make it difficult to use solar cookers on a daily basis.
   Understand and explain the engineering process, including revisions.
   Explain how WAPIs work and why they are preferred over thermometers.
   Understand current events and situations of people living in need worldwide.
   Connect how Human Rights tie into ally behavior and our daily lives.

4. FOLLOW UP IDEAS
   Compare nutritional values of foods used in solar cookers, and in daily diets.
   Improve SCI solar cooker designs.
   Plan for other portable inventions that utilize renewable energy.
   Investigation of women's rights and education worldwide.
   Learn what local action groups are assisting those in need.
   Fundraise for worldwide sustainability efforts.

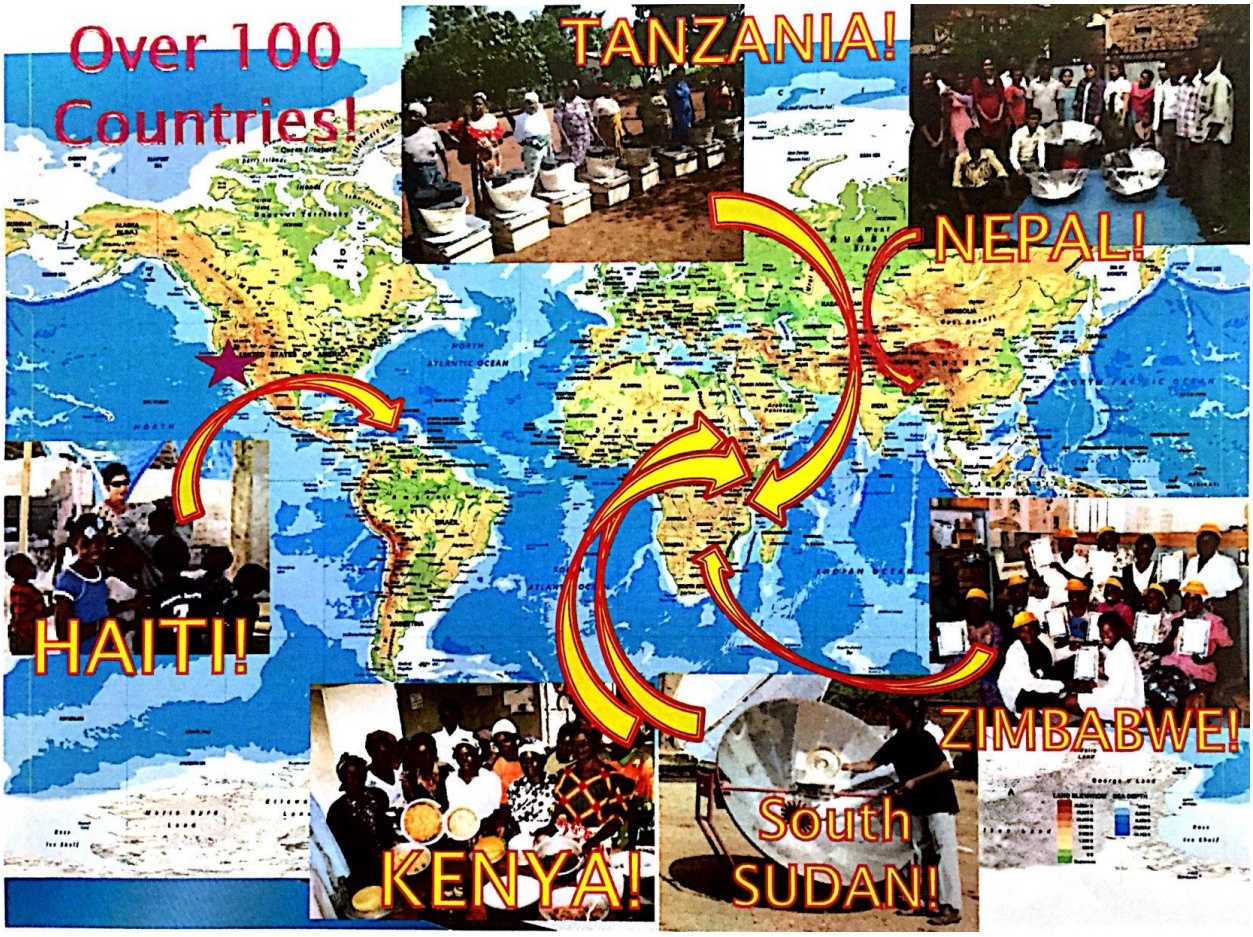
PHOTOS, SAMPLE POWERPOINT SLIDES, & STUDENT WORK APPENDIX


RUDOLPH


Solar CookIt
SCI

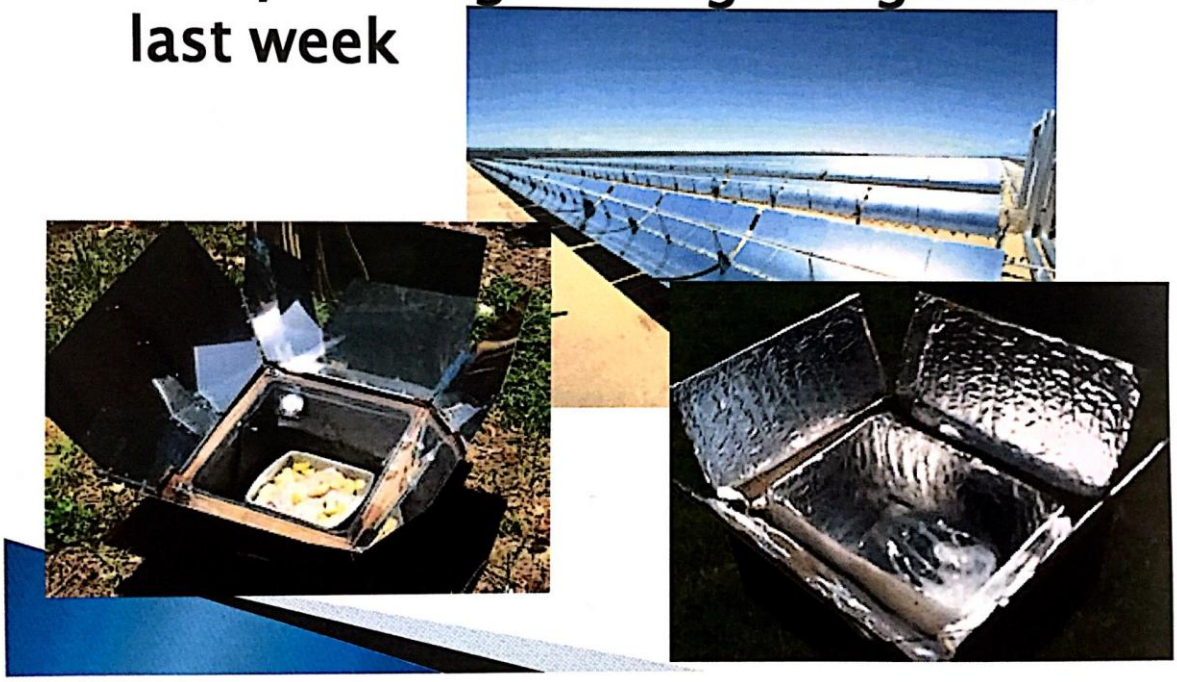
What is a free, renewable, clean, safe way to cook food?

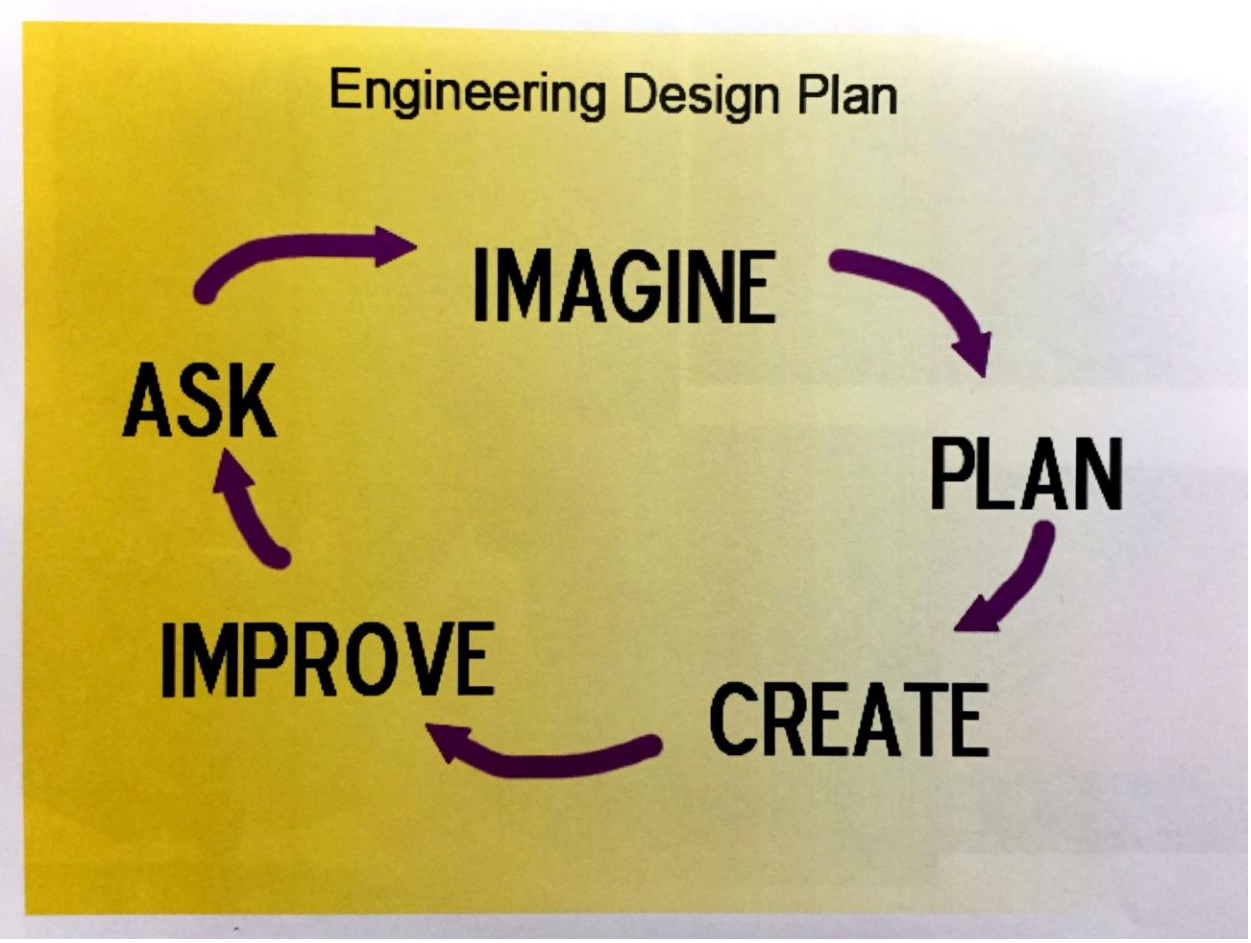

WILDFIRE FORCES HISTORIC EVACUATION
NIGHTLY NEWS


Over 100 Countries!
TANZANIA!
NEPAL!
HAITI!
ZIMBABWE!
KENYA!
South SUDAN!

Building a Solar Cooker

- Use your engineering design from last week



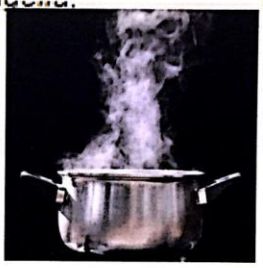

Engineering Design Plan
IMAGINE
PLAN
CREATE
IMPROVE
ASK


LDFIRE FORCES HISTORIC EVACUATION

WAPI

How does it work?

Microbe	Killed Rapidly At
Worms, Protozoa cysts (*Giardia, Cryptosporidium, Entamoeba*)	55°C (131°F)
Bacteria (*V. cholerae, E. coli, Shi... Salmonella typhi*), Rotavirus	60°C (140°F)
Hepatitis A virus	65°C (149°F)



Why Pasteurize?

Worldwide, unsafe water is a major health problem. Over 1 billion people do not have access to safe water. Preventable waterborne diseases are responsible for approximately 80% of all illnesses and deaths in the developing world. Children are especially susceptible, with nearly two million deaths each year.

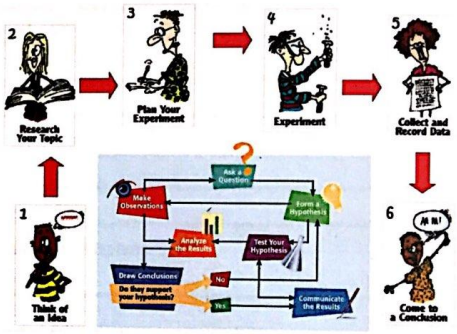
Solar cookers are changing the world!

Solar Cookers

Name_____

Purpose: **Will your engineered solar cooker be able to make s'mores?**

1. ***Hypothesis:*** _____
   _____
2. ***Procedure: Week 1***
   a. As a group, design the shape of your solar cooker.
3. ***Procedure: Week 2***
   a. Create your solar cooker using teamwork.
   b. Don't forget the thermometer!
   c. Record the temperature before, during, and at the end of our time using the solar cooker.
   d. Continue completing the questions to the solar cooker lab.
   e. Enjoy the food!



4. ***Data:***

TEMPERATURE

a. Before _____
b. After 15 mins_____
c. After 30 mins_____

Sketch your solar cooker

5. ***Conclusion:***

   a. **What are some limits to solar cookers?**

   _____

   _____

   b. **What other things would you use next time to build a solar cooker?**

   _____

   _____

   c. **Where and when would you use a solar cooker?**

   _____

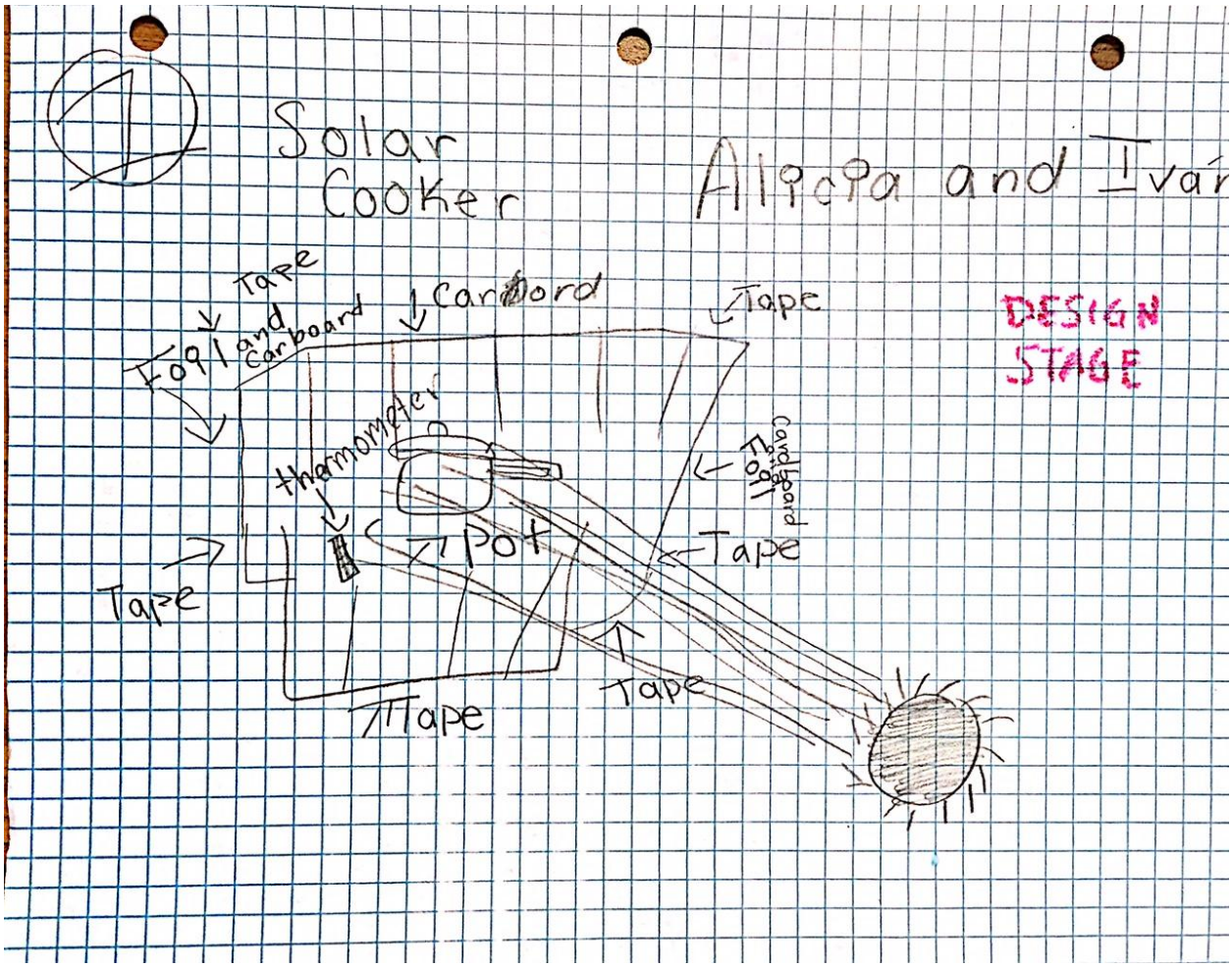
   _____

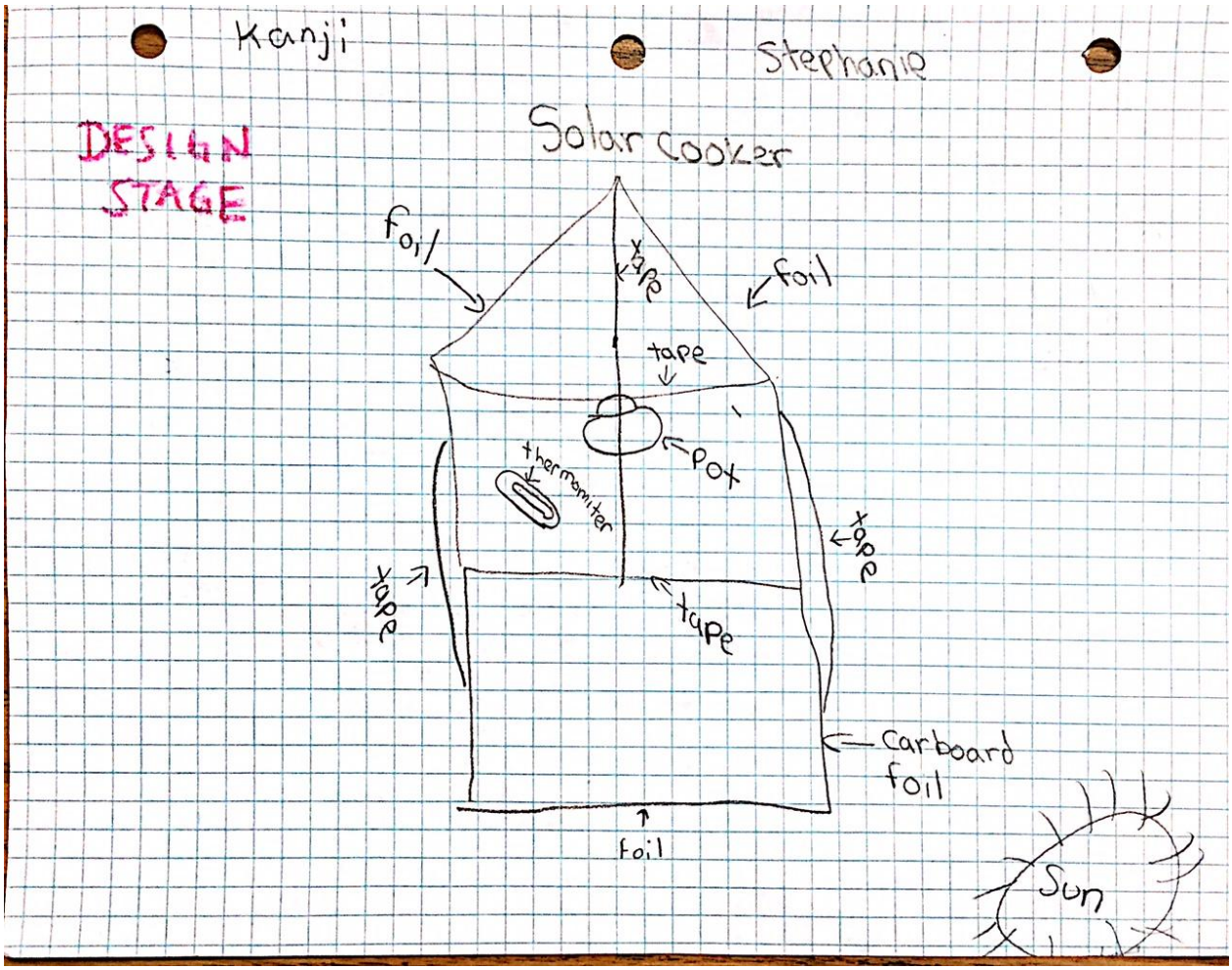
   d. **What are 2 reasons why solar cooking helps humans care for the environment?**

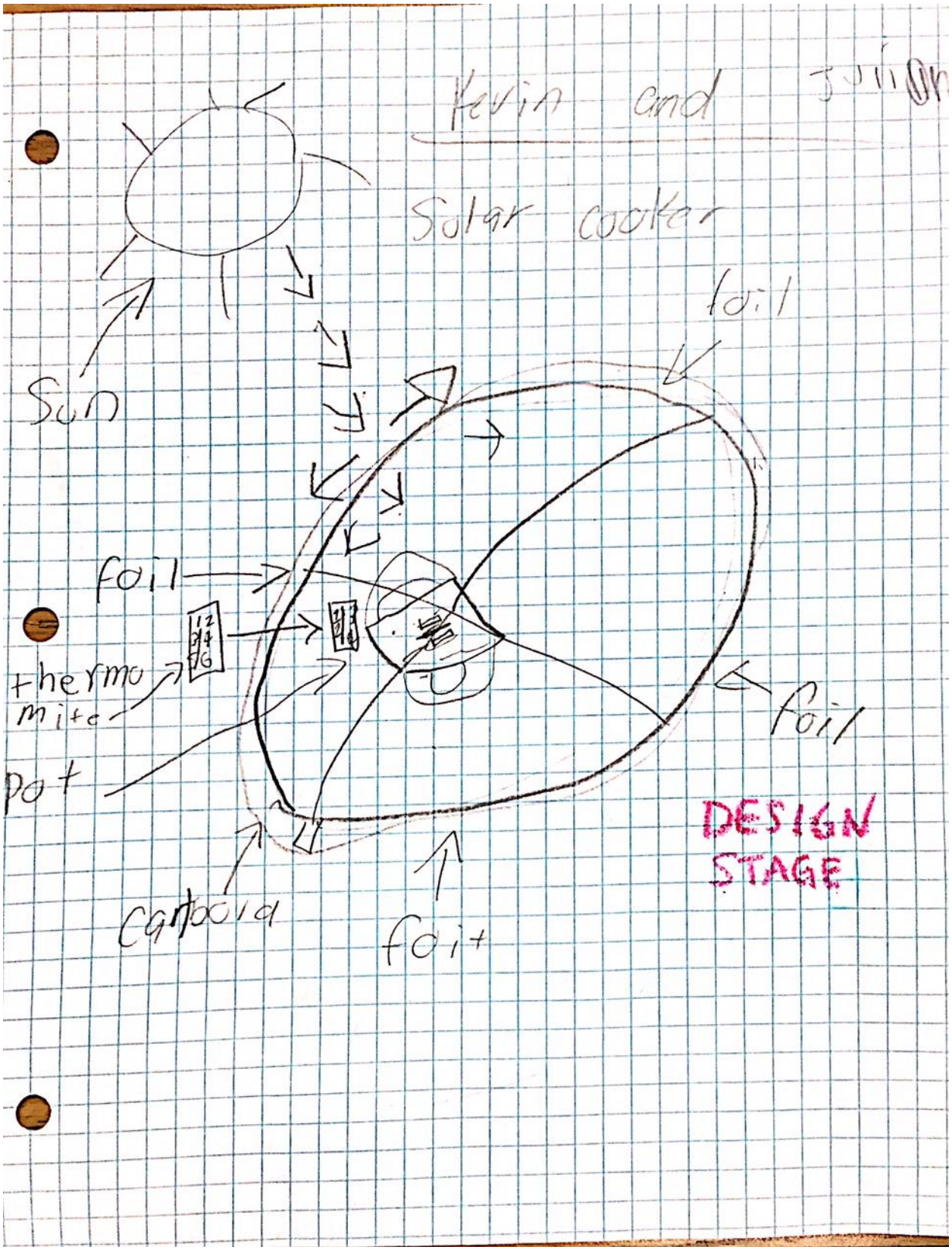
   _____

   _____

   e. ***Were you successful in cooking your s'mores?*** _____


Solar Cooker
Aliqqa and Ivár
DESIGN STAGE
Tape
Foil and Carboard
Carboard
Tape
Thermometer
Pot
Foil
Carboard
Tape
Tape
Tape
Tape


Kanji
Stephanie
DESIGN STAGE
Solar Cooker
foil
foil
tape
tape
pox
thermometer
tape
tape
tape
cardboard
foil
foil
Sun

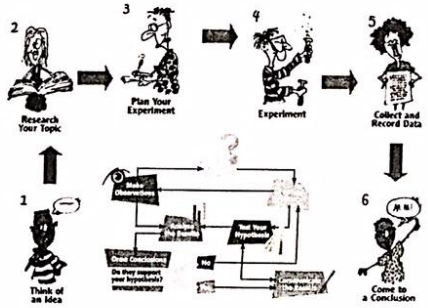

Kevin and
Solar cooker
foil
Sun
foil
thermo
mite
pot
foil
DESIGN
STAGE
cardboard
foil

Solar Cookers

Name Kathleen 3RD GRADE

Purpose: **Will your engineered solar cooker be able to make s'mores?**

1. ***Hypothesis:*** I thought that my solar cooker will melt my marshmallow and chocolate.
2. ***Procedure: Week 1***
   a. As a group, design the shape of your solar cooker.
3. ***Procedure: Week 2***
   a. Create your solar cooker using teamwork.
   b. Don't forget the thermometer!
   c. Record the temperature before, during, and at the end of our time using the solar cooker.
   d. Continue completing the questions to the solar cooker lab.
   e. Enjoy the food!

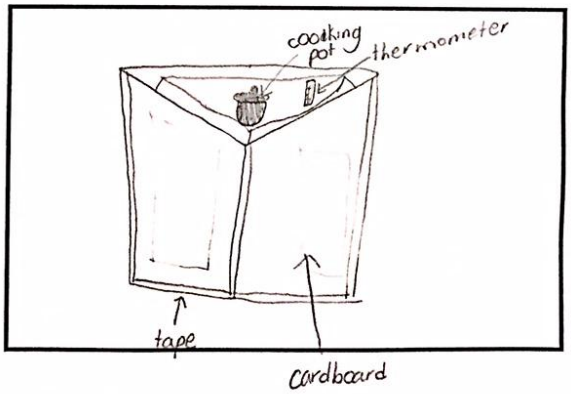


4. ***Data:***

TEMPERATURE

a. Before 70°
b. After 15 mins 72°
c. After 30 mins 80°

Sketch your solar cooker



5. *Conclusion:*

a. What are some limits to solar cookers?

The solar cookers won't work with out sun. cold weather. shade and shadows.

b. What other things would you use next time to build a solar cooker?

I thought that I would use bigger cooking pots. bigger cardboard

c. Where and when would you use a solar cooker?

I would make a solar cooker in front of the sun so it will cook. I would also use a solar cooker like a weather like sunny.

d. What are 2 reasons why solar cooking helps humans care for the environment?

One of the reasons why solar cookers are important because it could not burn fire or smoke The next reason why solar cookers are important is that they can clean water.

e. Were you successful in cooking your s'mores? It was successful because my chocolate melted

G Q Z H Z Y C E Z L B I E J N V T S M O R E S Q I H N B B L
N P U P S R F Q C P V M Z Y X E U Q X V G D H X E G Z O L O
W P A V F U C Q H C O C W O T S N N Q K I L C I T S D P I W
A P Y K V R S S G A Z T B T X S E V I C S C G W T O N F W K
E J U Q J E G T T T C K Z N X O D O I T G Q T O A L U U S I
G C I Z V F Y U A O H L O G F Y L G R R E N V K D A T T K S
S A M X U L Y D H I S E O V M O Y T D H O D F A D R A D E P
S R W T I E Z G Q B N S R D O T G E C J S N N X Z R P B F V
R D V H T C T R P H O A C M M K H H E S U C M A Q M E I W A
T B A V O T H F N D C A B I O Q Z R V X N S O E T N Z W C H
D O E K C I F E O Y I W E I E M G H T C R H P O N I A Z Q O
N A R V V O R K K I D B C F L N E B I C T O H C K T O X N Q
A R W R V N B W S F L B B Z Q I C T B L E T M M M E M N O I
A D S D G T E M P E R A T U R E T E E J Y A U C W V R F S W
E L X F G C Y A X F H R I H M F D Y O R V X J H I G B D U Q

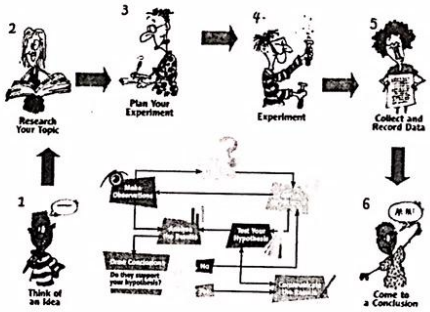
temperature
thermometer
cardboard
science
tape
cooker
pot
hot
sustainability
united nations
environment
reflection
smores
solar
foil
sun

Solar Cookers

Name T.h. 3RD GRADE

Purpose: **Will your engineered solar cooker be able to make s'mores?**

1. ***Hypothesis:*** Yes because the sun is really hot.
2. ***Procedure: Week 1***
   a. As a group, design the shape of your solar cooker.
3. ***Procedure: Week 2***
   a. Create your solar cooker using teamwork.
   b. Don't forget the thermometer!
   c. Record the temperature before, during, and at the end of our time using the solar cooker.
   d. Continue completing the questions to the solar cooker lab.
   e. Enjoy the food!

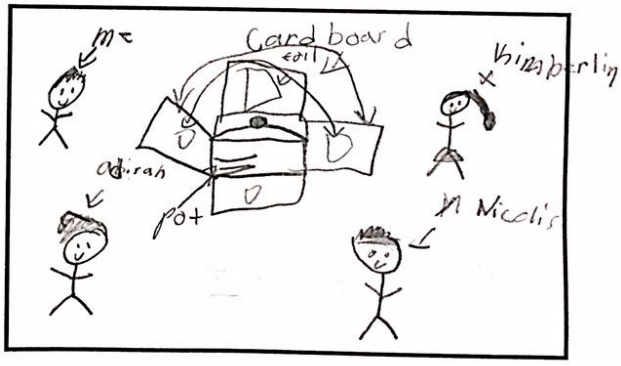


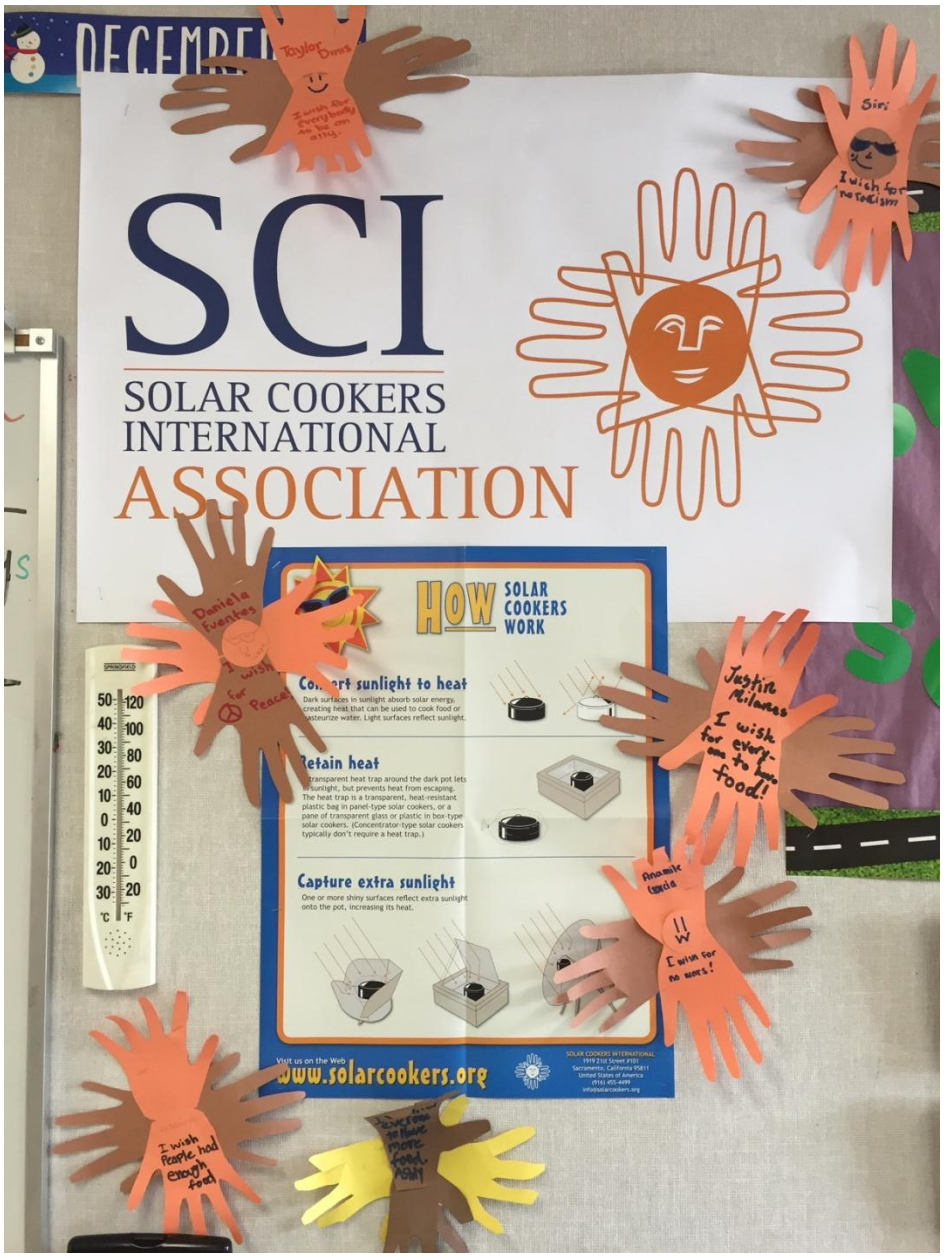
4. ***Data:***

TEMPERATURE

a. Before 70 °F
b. After 15 mins 99 °F
c. After 30 mins 100 °F

Sketch your solar cooker




SCI
SOLAR COOKERS INTERNATIONAL
ASSOCIATION
HOW SOLAR COOKERS WORK
Retain heat
Capture extra sunlight
One or more shiny surfaces reflect extra sunlight onto the pot, increasing its heat.
Visit us on the Web
www.solarcookers.org
Taylor Bmrs
I wish for everybody to be on attig.
Siri
I wish for no racism
Daniela Fuentes
I wish for Peace
Justin Milanes
I wish for everyone to have food!
Anamit Kaur
I wish for no wars!
I wish People had enough food