

Summer Academy 2014 (Student copy)
Alternative Roofs

Description:

In this lesson students will explore the benefits of green roofs on different building structures, whether in urban or rural communities. Students will test different colors to see what colors would work best for roofs and graph their data.

Objectives:

TSWBAT identify the benefits of installing “green roofs” for structures

TSWBAT explain the two different types of “green roofs”

TSWBAT construct a miniature model of a structure with a green roof

TSWBAT report on a specific “cool roof” that was assigned

TSWBAT compare the temperature differences inside a box with their assigned colored roof with other colors

TSWBAT graph the temperature data onto graph paper

TSWBAT write a formal letter to someone in higher power explaining the benefits of a green/cool roof

North Dakota State Standards:

9-10.1.1.

9-10.2.1.

9-10.2.3.

9-10.2.7.

9-10.2.8.

11-12.2.2.

11-12.7.1.

11-12.7.2.

Schedule:

9:00am – 9:30am	cultural connection
9:30am – 9:45am	introduction of green roofs
9:45am – 10:15am	activity 1
10:15am – 10:45am	activity 2
10:45am – 11:00am	break
11:00am – 12:00pm	activity 3
12:00pm – 12:30pm	lunch
12:30pm – 1:00pm	presentations from activity 3
1:00pm – 2:00pm	activity 4
2:00pm – 2:30pm	activity 5
2:30pm – 2:45pm	conclusion
2:45pm – 3:00pm	cleanup

Activity 1:

Urban Island Heat Effect

Directions: In your group, go to the website below to do some reading. There are questions for this activity for you to answer in complete sentences that go along with the website.

<http://epa.gov/heatisland/index.htm>

Define the following terms:

Heat Island:

Albedo:

Green roofs:

Intensive green roofs:

Extensive green roofs:

Answer the following questions:

1. How much more warmer can an urban environment be compared to its surroundings?
2. During the evenings, the difference in temperatures can be how high?
3. As urban areas develop, what types of changes occur? What is being replaced?
4. During a hot summer day, the roof of a building can be how much hotter than the air?
5. What are some reasons that cause cities like Chicago to have a higher temperature during the day than its surroundings?
6. If the Heat Island Effect is responsible for increasing urban temperatures, then what would you expect to happen with the energy of controlling the interior of a building? Explain.
7. Studies suggest that the heat island effect is responsible for what percentage to keep buildings in cities cool?

8. What are some health risks involved with warmer days and nights along with air pollution?

9. What are some ways to reduce this heat island effect?

10. Electrical companies typically rely on what to keep up with the high demand of electricity to cool buildings?

11. From the above answer, if burning fuels is increasing to supply the demand of electricity, we can conclude that what else will be increasing into our air?

12. List 5 primary pollutants from power plants.

13. What is particulate matter (PM)? What is it made of?

14. The 5 primary pollutants contribute to complex air quality problems such as what? List three of them.

15. The Centers for Disease Control and Prevention estimates that from 1979-2003, excessive heat exposure contributed to how many premature deaths in the United States?

Activity 2:

Construct a Miniature Structure with Green Roof

Directions: In your same groups as activity 1, here your group will be creating a miniature model of a building/house/structure with a green roof on it. This is the time to be creative with your group. Decorate it and make it look pretty. Make it look like the real thing, just a miniature version. When your group has completed your building, please answer the few questions that follow in complete sentences.

Materials:

Cardboard box (cube)

Packaging tape

Sheet moss

Markers

Construction paper

Scissors

Reflection questions:

1. List two benefits of having a green roof.

2. What type of green roof would you have; intensive or extensive? Explain.

Activity 3

Cool Roofs

Directions: First, you will be divided up to make nine total groups. In this activity, you are your group will do research on a particular “cool roof” that will be assigned to you. After you become experts, you will be expected to share with the rest of the class the information you learned. Visual aids are always a good thing, such as PowerPoint or a poster board to help teach your peers. You will have an hour to do the research and create a visual aid. Below are some questions to get you started with your research. Remember, the more information the better!

1. What does the cool roof do?
2. What materials is it made of?
3. How do you install one on your home?
4. What’s the cost?

Activity 3 (continued):

Presentations

Directions: One group at a time, you will come to the front to teach the others about the research you did on your “cool roof.”

Activity 4:

Measuring Interior Temperature of Different Colored Roofs

Directions: In this activity, you will remain in the same group as you were in for your presentations (so there should be 9 groups again). Your group will be assigned a box in a certain color. Each group will be assigned a different color. You and your group will be recording the interior, surface and ambient temperature of the box. If it is nice out, the boxes will be in the sun. If it is not so nice, the boxes will be inside with a lamp over them. We are looking to see what colors absorb and reflect light better.

You will be recording the temperature at the start, and every two minutes after that for the duration of thirty minutes. On the next page is a chart for you to record your temperatures.

When we have finished recording all the temperature, we will use this data to create a graph on graph paper. Each student is expected to make his or her own graph. Label the x-axis as minutes and the y-axis as temperature. You will have made three different graphs.

After you have completed your graph, answer the questions on the next page.

1. What was the difference in your initial temperature from the ending temperature?
2. With your colored box, do you see it being a good color for a roof of a house? Why or why not?
3. What reason do you think your colored box did well or not well keep the interior temperature steady?

Time (x-axis)	Ambient Temperature (y-axis)	Surface Temperature (y-axis)	Interior temperature (y-axis)
0 minute			
2 minutes			
4 minutes			
6 minutes			
8 minutes			
10 minutes			
12 minutes			
14 minutes			
16 minutes			
18 minutes			
20 minutes			
22 minutes			
24 minutes			
26 minutes			
28 minutes			
30 minutes			

Activity 5:

Formal Letter for Green Roof

Directions: For the last activity of the day, you will be creating a formal letter to your schools principal. Using all of the information you have learned today about green roofs, you will write a persuasive letter to have the principal push for a green roof on your own school. Explain why it should be done.

When you think you are all done, call an instructor over for them to look at it. When it looks good to them, print it out. Sign it at the bottom, under your name and hand it to an instructor.