Summer Academy 2014
What materials should I use when I build my house?

Description: In this lesson you will examine various aspects of materials used in building homes including foundations, insulation and siding.

Objectives:

- Students will compare and contrast the materials used to build foundations of a home
- Students will record data from various types of insulation then graph their results
- Students will calculate the amount of siding needed for a model house using various formulas.

Standards covered:

- 9-10.1.1 Explain how models can be used to illustrate scientific principles.
- 9-10.6.1 Use appropriate technologies and techniques to solve a problem

Session Organization

9:00-9:30	Cultural connection and general organization
9:30-10:00	Background information
10:00-10:45	Internet activity with foundation materials (individual and group)
10:45-12:00	Activity on insulation
12:00-12:30	Lunch
12:30-1:30	Activity on siding
1:30-2:30	Activities on energy efficiency
2:30-3:00	Wrap up/clean up

Activity One: Background information from the internet on types of foundations. For each type of foundation material, list at least one advantage, one disadvantage, and other information about this material.

Individual results:

Concrete:

Metal:

Concrete block:

Brick or stone:

Wood:

Group results:

Concrete:

Advantages: Disadvantages:

Other information

Metal:

Advantages: Disadvantages:

Other information

Concrete block

Advantages: Disadvantages:

Other information

Brick or stone

Advantages: Disadvantages:

Other information

Wood

Advantages: Disadvantages:

Other information

What is insulation:

Insulation is material designed to prevent heat or sound from being transmitted from one area to another. It's normally used to keep heat and/or sound in or out of your home. Insulation can work in a number of different ways, but it most commonly incorporates materials that consist of

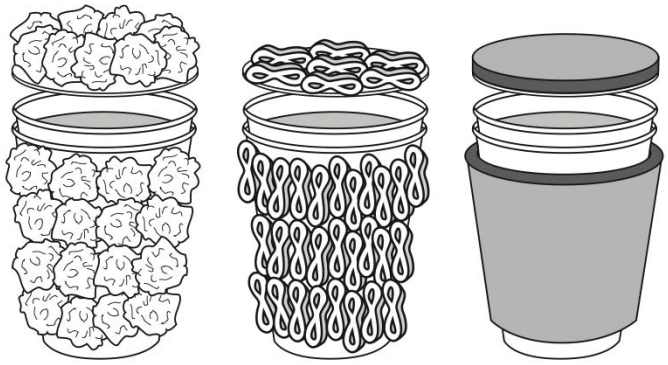
millions of tiny pockets of air. Still air is an extremely good insulator, and trapped pockets of air are what give most types of insulation their high thermal resistance.

Activity 2: How well does insulation work?

In this activity, you are going to take a Dixie cup, cover it with insulation and record the temperature of warm water over 10 minutes. You will need to make three different insulated cups using the materials provided. When you finish, you will graph your results to compare the different types of insulation.

Procedure:

1. Take a Dixie cup and cover it with one type of insulation. Cut out a circle of construction paper to cover the top of your cup. Make sure they are covered with the same material as the cup. There is a diagram below:



2. Pour 50 ml of warm water into the cup.
3. Insert your temperature probe into the cup. If you are using a CBL or lab quest, make sure you have it programed to record the temperature every 30 seconds for 10 minutes (600 seconds).
4. Press start and collect data for 10 minutes
5. While your temp is being recorded, set up your next insulated cup.
6. When your CBL has stopped collecting data, record the time and temperature in the table.
7. Repeat this procedure for a total of three different types of insulation.

Results:

Type of insulation _____

Time (sec)	Temp (C°)	Time (sec)	Temp (C°)
0		330	
30		360	
60		390	
90		420	
120		450	
150		480	
180		510	
210		540	
240		570	
270		600	
300			

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Make a graph of your results. Make sure your x-axis, independent variable, is time, and the y-axis, is temperature. You should have three lines for the different types of insulation and a key that identifies each type. Make sure you label each axis and use units, plus your graph needs a title that describes your graph.

Questions:

1. Based on your results, which insulation works the best?

2. What are some factors that determine what type of insulation you should use in your house?

3. Based on what your learned today, what type of insulation would you use in your house?

Siding:

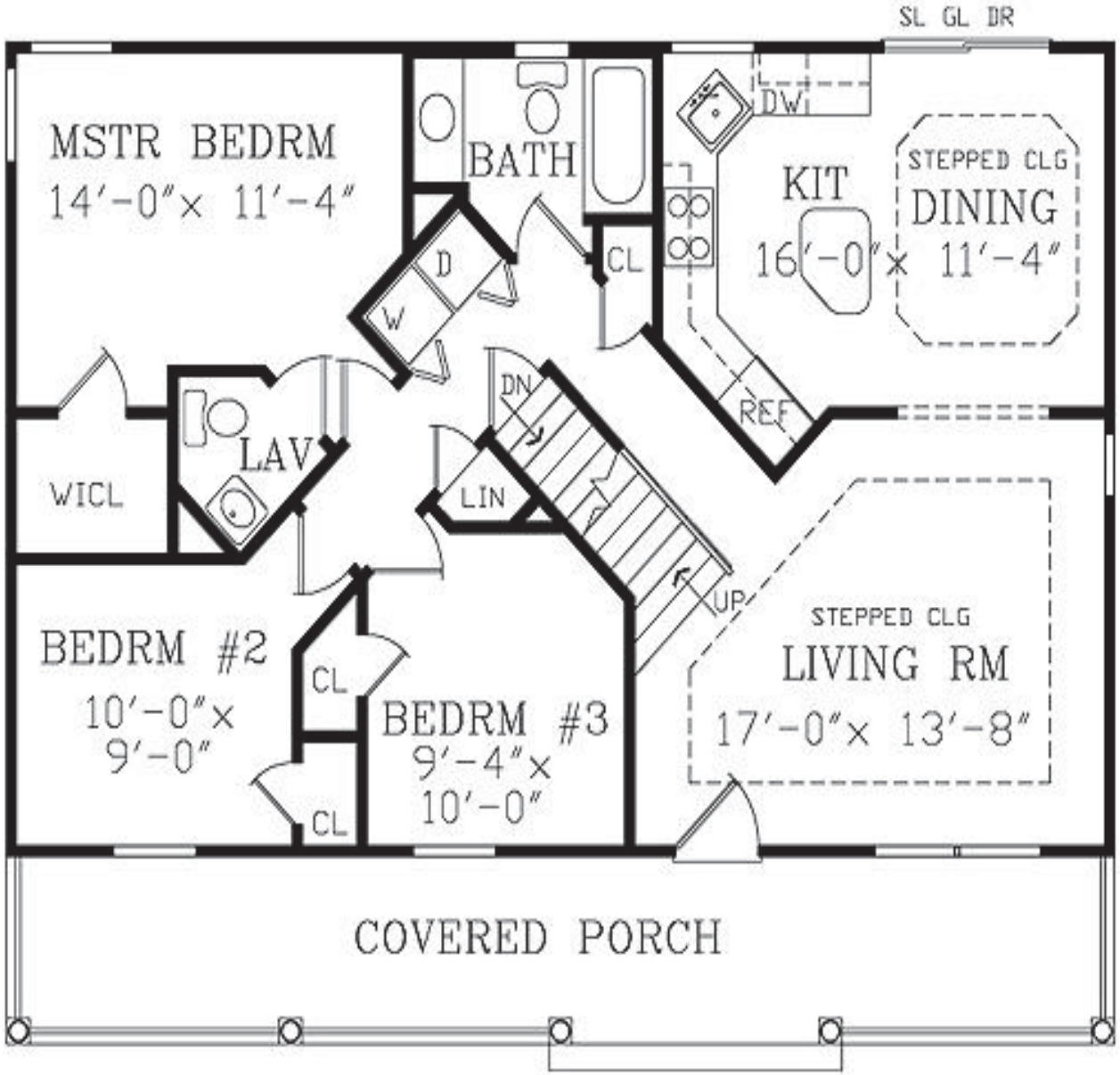
Siding is the exterior material applied to the walls of a house or other building meant to shed water, protect the walls from the effects of weather, and is a key in the aesthetics of the structure.

Activity: Finding the amount of sliding for your house

The unit of area used in the measurement of house siding is a square.

To find the number of squares of siding you need for your home, you need to do the following calculations:

1. Find the perimeter of your house. Measure the floor plan of the house in this lesson, using centimeters. Perimeter is the continuous line forming the boundary of a closed geometric figure. (add them together)
2. To find the height you need to measure from the foundation to the eaves of your house. (your house is 17.5 feet from foundation to eaves)
3. Multiply Perimeter (P) x Height (W) to get square footage (SF)
4. Measure the height and length of each Gable (see images for your Gables)
5. Height x Length by $\frac{1}{2}$ to find Gable Square foot (GSF).
6. Add GSF + SF = Total Square footage (TSQ)
7. Divide TSQ by 100 to determine # of squares needed


SL GL DR
MSTR BEDRM
14′-0″× 11′-4″
BATH
DW
KIT
16′-0″
STEPPED CLG
DINING
11′-4″
CL
D
W
DN
REF
LAV
WICL
LIN
UP
STEPPED CLG
LIVING RM
17′-0″× 13′-8″
BEDRM #2
10′-0″×
9′-0″
CL
BEDRM #3
9′-4″×
10′-0″
CL
COVERED PORCH

Gables-Don't use the numbers on the image, they are just there to help you with your measurements. Your house has 3 gables that are the same size.

Show your calculations below:

How many squares of siding do you need for your house?

What factors do you need to look at when decided what type of siding you want for your house?

Research siding, list the cost of at least 4 kinds, the advantages and disadvantages, tell me which one you would use and why?

Multiple Choice Questions-Energy efficient home

1. For energy efficiency, in placement of windows, one should consider: a) air flow through house b) seasonal changes in sun's angles c) summer indirect lighting d) all answers a, b, and c

2. In winter the sun's radiance on south facing windows is:
a) at a lower angle b) at a higher angle c) the same as in summer
d) shifted to north

3. Which flooring takes the most advantage of thermal mass? a) carpeting
b) astro-turf c) vinyl d) tile

4. Insulation should be installed: a) in ceilings b) in walls
c) around windows d) all answers a, b, and c

5. Which statement is true? a) all appliances have the same energy cost per minute b) the direction a house faces has no effect on its energy costs c) many windows should be constructed on the north side of a home d) money can be saved if windows, house placement, and design are planned for solar heating and cooling

6. A thermal chimney : a) burns only gas logs b) allows hot air to escape c) is a turbine d) includes a 2 sided fireplace through high windows

7. By incorporating renewable energy sources in their plans, builders can use: a) solar water heating systems b) photovoltaic systems c) passive solar heating d) all answers a, b, and c

8. When you build your home, which R-Value would provide the best insulation in your ceilings? a) R = 10 b) R = 30 c) R = 5 d) R = 15

9. In purchasing your dryer, washing machine, oven or other appliance, an important factor to consider for operating cost is: a) color b) number of button options, shape c) its tested energy efficiency d) programming choices

10. Learning about how to have a more energy efficient home: a) could help you in the future b) is not important c) could save you money
d) answers a and c

Student Worksheet for Energy

Appliance	Power (watts)	Time used	Electricity consumer (Kwh)	Energy Price	Daily Cost	Weekly Cost	Annual Cost	Notes
Example Television	130	4	=(130)(4)/1000=0.52	.10	0.52 X 0.10 = $0.052	0.52 X 0.10 = $0.052	0.364 X 52wks =$18.93	Plasma screen televisions cost 4 times more.
Computer (in use)	220	24		.10				Even having your computer in sleep mode costs money. Try turning it off altogether.
Computer (asleep)	6	24		.10				
Lamp (incandescent)	60	2		.10				Compare this to the cost of switching to a compact fluorescent bulb (avg. 13 watts).
Clock Radio	5	24		.10				
Cell phone charger	3	8		.10				Only 5% of power drawn from a cellphone charger is actually used to charge the phone. The rest is wasted by leaving it plugged in.
Curling iron	150	.5		.10				
Hair dryer	1200	.083		.10				
DVD Player	20	2		.10				

Below is a list of common household appliances. Rank the appliances from 1 (lowest) to 10 (highest) according to the amount of energy you think they use. For example, if you think Next, figure out how each household appliance uses energy by filling in letters in the column "What Am I" for each appliance from the letters in the column "How Do I Use Energy?"

	Ranking	What am I?	How Do I Use Energy?
Television			A. I use energy to spin and keep you cool.
Stereo			B. Even though I am always plugged into an outlet, energy is consumed only when I am turned on to heat food.
Refrigerator			C. I use energy to produce pictures on a screen.
Washing machine			D. I use energy to rinse and spin.
Water heater			E. I use energy when I am plugged in and turned to a certain temperature.
Range top (stove)			F. I use a large amount of energy derived from electricity or gas to cook food.
Ceiling fan			G. I use energy to receiver radio waves in your home.
Toaster			H. I use a lot of energy because I am always cooling and freezing.
Iron			I. I use a large amount of energy so that you can take warm showers and have hot water.
Microwave			J. I use energy to heat coils that cook your food.