

## Renewable Resins and Composites

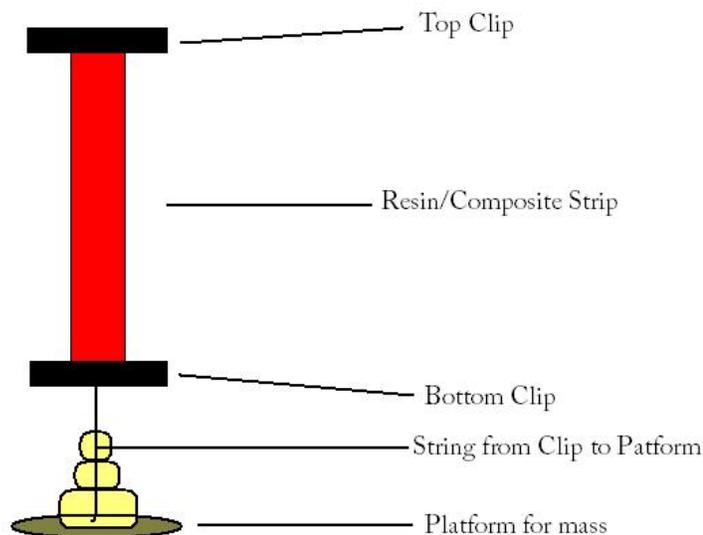
Author: David Gardner  
 Date Created: Summer 2009  
 Subject: Biology, Chemistry and Environmental Science  
 Level: High School  
 Standards: 1: Analysis, Inquiry and Design  
 4: Physical Setting and Living Environment  
**Schedule: 80 -120minutes (single period for set up and then a double lab period plus more if needed for preparing and testing the product) More needed to analyze decomposing product if this step is added**

<b>Objectives:</b>	<b>Vocabulary:</b>	
<p>Make a biodegradable resin and test it for mechanical properties using simple materials available in a high school</p>	<b>Biodegradable, mechanical property, resin,</b>	<b>Tensile strain/strength, Percent composition</b>
<b>Students will:</b>	<b>Materials:</b>	
<ul style="list-style-type: none"> <li>• Mix resins of varying concentrations that will dry to form a flexible sheet</li> <li>• Make composites with select materials to improve the quality of the product</li> <li>• Test resin strips to determine their ability to stretch and support weight</li> <li>• Determine the best composite and resins</li> </ul>	<b>For Each Student:</b> -fruit puree -spoon -spatula -lab packet -water -non-stick drying forms/trays or glass petrie dishes -Non-stick spray/wax paper - Oven	-composite material such as thread, cloth, paper etc. -small gram weights or equivalents -string -clips -ruler -scale -beakers -Pencil -scissors/paper cutter
<b>Safety:</b> Oven will get hot. When using glassware, goggles are suggested and required in NYS labs. If decomposition activity is added, molds/fungus that may result could have an adverse affect on breathing/allergies of those in contact.		

**Science Content for the Teacher:** It is assumed that students come into the high school level with some idea of the concept of renewable materials. However, it is important to give a brief mention of what it means to be renewable. In regards to the fruit being used, perhaps that it can be taken/harvested and will grow again in the next season assuming proper conditions. If something natural/organic is left alone, the elements will start to break it down/decompose releasing nutrients back into the surroundings

**Preparation:** Typical Lab set-up as necessary:

- Fruit puree is ready and available in larger containers to allow for easier removal
  - A pourable container would be suggested
  - This can be store bought or actually cooked and mashed beforehand
- Wax paper cut into shapes consistent with fitting into the tray
- Lab stations set up for each student/group with beakers, rulers, scales etc.
- Testing area set up (suggested to use a clip attached to one end of the “resin” or “composite” with the other end attached to a second clip that has small weights on it that can be added. See below. The top clip can be attached to a ring stand or similar



- Extra pencils are always handy in the classroom
- Plentiful copies of the lab/one for each student minimum



## Classroom Procedure:

### *Engage (Time: 15 minutes )*

- Introduce the importance of renewable materials and the increased awareness of our limited supply of materials (A good precursor to this could also be done the previous day with a showing of The Story of Stuff (<http://TheStoryofStuff.com>))
- Show examples of excess packaging on products (toys, games, etc.)
- Discuss the use of glues and other bonding agents that are toxic (you would not want to burn them etc.)
- Show examples of resins made during RET II experience and discuss Poster completed showing in-depth processes.

### *Explore (Time: 65 minutes-may be split between 2 days)*

- Students will follow along with and complete the lab activity “Renewable Resins and Composites”
  - Students will prepare resin mixtures of varying concentrations
    - use scales to mass
    - determine percent by mass value
    - pour resin into appropriate container with wax paper lining
  - Students will heat their mixtures in an oven over night at about 140°F or about 60°C
  - On the following lab session, students will carefully remove resins from the wax paper and cut into strips about 1 or 2 cm wide (a larger width if small masses are unavailable) by about 10 cm long
  - Students will clip resin into set-up as seen in diagram above and will add weights until sample stretches and snaps. It is suggested to wait about 5-10 seconds after addition of a mass before a new mass is added. Consistency is important.
  - Record the mass that was the highest that could be supported before breakage as well as the mass that caused the breakage.

### *Explain (Time: 5 minutes)*

- Have student get together with a partner and come up with an explanation of the benefits and costs of using renewable resins

### *Expand (Time: 15minutes...and beyond)*

- Students should research other materials/companies that use renewable packaging and incentives in place to recycle these.
- Students can complete an extra credit assignment or a classroom poster representing the process and importance of using renewable materials.



**Assessment:** (Evaluation...the 5<sup>th</sup> E)

The following rubric can be used to assess students during each part of the activity. The term “expectations” here refers to the content, process and attitudinal goals for this activity. Evidence for understanding may be in the form of oral as well as written communication, both with the teacher as well as observed communication with other students. Specifics are listed in the table below.

1= exceeds expectations

2= meets expectations consistently

3= meets expectations occasionally

4= not meeting expectations

	Engage	Explore	Explain	Expand/Synthesis
1	Student took an interest in the introduction and was able to express real life situations. Student gave examples of materials in their house that were excessive or used non-renewable materials	Student is self motivated and follows all directional procedures, completing the lab accurately. Completes resin/composite set-up correctly and offers assistance to those around them	Worked well with a partner and came up with a logistical reasoning for the question posed	Student brought/looked at 5+ additional items/companies and provided information on these regarding renewable use and incentives. Completes a Poster as well with all information
2	Student was focused during intro and took part in activities, but may not have given examples	Completes lab on their own successfully	Worked with partner to come up with a generic or broad idea for the question	Student brought/looked at 3 additional items/companies and provided information on these regarding renewable use and incentives. Poster has only the limited information collected.
3	Student was off task at times during the intro and made some errors in the suggested materials	Complete lab, but with errors and units missing	Discussed some with partner, but spent time off task talking to other people. Idea was not totally related to the question	Student brought/looked at 1-2 additional items/companies and provided information on these regarding renewable use and incentives. Poster shows limited information.
4	Does not show interest during the introduction or provide examples	Does very little to complete assignment on their own. Tries to get all answers from neighbors	Did not participate with a partner or come up with ideas on their own	Student did not bring/look at any additional items/companies and did not provide any information on these regarding renewable use and incentives. Poster not included.



**Extension Activities:** Recycling contests, or awareness and start up at schools, Composting instructions (how to and bin building)

**Supplemental Information:**

**Safety:** Oven will get hot. When using glassware, goggles are suggested and required in NYS labs. If decomposition activity is added, molds/fungus that may result could have an adverse affect on breathing/allergies of those in contact. Paper cutter can be sharp and cut fingers if care is not taken.

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