You will watch videos throughout this project about aerogels. You are to record answers as you hear them. You will have to watch multiple videos to get all the answers.

1. Define/describe an aerogel

2. What are some chemical, physical, mechanical, etc. properties of aerogels?

3. What are the uses of aerogels?

4. From what are aerogels made?

5. What is compressive strength? What is a substance that has high compressive strength? Low compressive strength?

6. What does compressive strength have to do with aerogels?

7. What is an emulsion? What is a common everyday emulsion?

8. What is an emulsifying agent?

9. What do emulsions have to do with aerogels?
The Situation

When you shake a bottle of oil and vinegar salad dressing and look at it (before the layers separate), you are looking at an emulsion. An *emulsion* is a heterogeneous mixture of two or more *immiscible* substances dispersed in each other. Often, a chemical called an emulsifying agent is added to prevent the layers from separating back.

Engineers might research aerogels to create coatings for clothing or masks which can filter out contaminants and thus improve our health. It is also being done to create better matrices for cells to grow on to fight disease, aid injuries, etc.

This research involves the creation of an aerogel by first creating a gel polymer emulsion. Unfortunately, the emulsifying agent and dissolved liquid cannot simply be evaporated because the holes left behind in the gel will collapse. Thus, a multistep solution exchange process is performed to get rid of them and leave the holes left behind intact. This involves the sample being soaked in a solution for 24 hours, put into a (different) solution for 24 hours, and then a third liquid for 24 hours before the sample is soaked and dried with supercritical liquid carbon dioxide. The result is a solid with lots and lots of pores (holes) in it called an aerogel.

Due to their unique structure, aerogels have many properties that make them very useful. However, aerogels are not widely used because it is still expensive to make them.

Today, you are a materials engineer. Your job is to start with a mixture and come up with a means of eliminating part of the mixture without destroying the holes left behind. Your sample “gel” is chocolate chip cookie dough.

**Design Challenge:** Find a means for removing chips from chocolate chip cookie dough and leave the holes left behind intact.

**Design Constraints.** Record the design constraints your class decided upon below.

______________________________________________________________________________________________
______________________________________________________________________________________________
______________________________________________________________________________________________
______________________________________________________________________________________________
Imagine/Brainstorm. Draw, Sketch, or Write. . .

Spend time thinking how you will solve your challenge. When everyone in the class has completed the first box, you will meet with your group members, and brainstorm together.

<table>
<thead>
<tr>
<th>My Ideas</th>
<th>My Partners’ Ideas</th>
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Our Groups Decision: **Explain**
Project Planning Log

Discuss the questions with your group members and answer questions. Each person in the group must complete their own log.

1. What is the time period for this log (2 days, 1 week, etc.)? ___________
2. What are your group’s goals (task to be completed) for this time period?

3. What task(s) will you complete?

4. What other tasks must be completed? Record the name of the person completing each task.

5. What percent of the work will you complete? ____
6. What percent of the work will each other person complete?

7. If someone is absent and has the group flashdrive or other important paper/file causing the rest of the group members to not be able to get work done on that day. What will you plan be to make up for time?

8. If you end up being absent during this project, what will you do so that you don’t lose points and cause your group to fall behind and risk losing points?

9. List the names of your group members and their plan for making up work if they are absent at any time throughout the session.
10. If someone in the group is absent and doesn’t make up the work, what will your group do?
Reflection. Complete this at the end of the given time frame.

11. What percent of the group’s work did you complete? What tasks did you complete?

12. What other tasks were completed? Record the name of the person completing each task. Estimate the percentage of work completed by each person.

13. Was anyone absent? Did they complete the work they were supposed to complete? Explain.

14. What letter grade would you give each person? Provide comments.

15. Were any tasks not completed? If so, complete the chart below.

<table>
<thead>
<tr>
<th>Task Not Completed</th>
<th>Person Responsible</th>
<th>Reason Why</th>
<th>Adjustment that must now be made</th>
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16. What are the group’s goals for tomorrow?
Lab Notes:

Use the space below for data tables, observations, sketches, or other important information as you work through your challenge.
## Mini Presentation Rubric

Presenters: ____________________________

<table>
<thead>
<tr>
<th>Logistics</th>
<th>Score</th>
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<tbody>
<tr>
<td>□ Was a cover page included with an appropriate title, the team name, (first and last) student names, and date arranged nicely?</td>
<td></td>
</tr>
<tr>
<td>□ Was an ending slide included (Thank you for listening!; Conclusion; etc.)?</td>
<td></td>
</tr>
<tr>
<td>□ Did EACH speaker speak loudly enough the entire time?</td>
<td></td>
</tr>
<tr>
<td>□ Did EACH speak at a good pace—not too fast/slow?</td>
<td></td>
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<tr>
<td>□ Did EACH face the audience and maintain eye contact or did they simply read from their visual aids (Prezi, PowerPoint slides, etc.)?</td>
<td></td>
</tr>
<tr>
<td>□ Was a cover page with an appropriate title, the team name, student names, and date arranged nicely?</td>
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<tr>
<td>□ Were terms pronounced correctly? Was proper grammar used?</td>
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<td>□ In the visual aids, were all words spelled correctly? Was proper capitalization shown? Proper spacing shown? Was the text large enough? <strong>Does every slide have a title showing appropriate capitalization?</strong></td>
<td></td>
</tr>
<tr>
<td>□ Were main ideas—not details and lots of writing—written on the slides?</td>
<td></td>
</tr>
<tr>
<td>□ Did the pictures help express the ideas? Were they arranged nicely?</td>
<td></td>
</tr>
<tr>
<td>□ Does it look nice overall?</td>
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</table>

5  4  3  2  1  0
## Content

- Was a slide mentioning basic aspects of aerogels included?
- Was the engineering design process included on one or more slides?
- Was the design challenge included on a slide?
- Was how the challenge relates to aerogels included on a slide?
- Were the design constraints included on a slide?
- Were two brainstormed ideas mentioned?
- Were we told why they chose the strategy they chose or why they rejected those that were rejected?
- If the project didn’t work, were we given ideas as to why or about other strategies they will try and why?
- Was a slide mentioning the 21st century skills included?
- Was a situation showing growth in the 21st century skills (critical thinking, collaboration, creativity, communication, conflict resolution, perseverance) on a slide and CLEARLY explained?
- Was the presentation thorough? Did it follow a logical progression? Were supportive pictures provided? Did it make sense?
- Did they answer questions well, if asked?

## Teamwork

- Did it seem like EVERYONE contributed to the preparatory work? (Did each person know the information or did it seem like only one or two people understood it?)
- Was the presentation shared equally? (Did one or two persons dominate the presentation or did everyone speak the same amount?)
Comments (Restrict comments to the presentation and not the presenter(s). Provide only helpful comments. You must provide comments if you assign a less than perfect grade.)

Overall, how would you rate the presentation?

5 · 4 · 3 · 2 · 1 · 0
Peer Feedback ‘Post-It’ (Gallery Walk) Activity

When instructed, review your sticky notes as a team, split them up, and place them in the appropriate boxes below to help you with your redesign.

One great aspect of this project:

One thing to consider/Area of Growth/Idea to Try:

Teacher Initials: _____
Redesign Constraints

Record the design constraints your class decided upon below.

______________________________________________________________________________________________
______________________________________________________________________________________________
______________________________________________________________________________________________
______________________________________________________________________________________________

Imagine/Brainstorm (Redesign)
Record/Draw your/ your group's new idea.

<table>
<thead>
<tr>
<th>New Ideas</th>
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</table>
Project Planning Log (Redesign)

Discuss the questions with your group members, answer questions #1-10 and have initialed. Each person in the group must complete their own log.

1. What is the time period for this log (2 days, 1 week, etc.)? __________
2. What are your group's goals (task to be completed) for this time period?

3. What task(s) will you complete?

4. What other tasks must be completed? Record the name of the person completing each task.

5. What percent of the work will you complete? ____
6. What percent of the work will each other person complete?

7. If someone is absent and has the group flashdrive or other important paper/file causing the rest of the group members to not be able to get work done on that day, how will you make up for lost time?

8. If you end up being absent during this project, what will you do so that you don't lose points and cause your group to fall behind and risk losing points?

9. List the names of your group members and their plan for making up work if they are absent at any time throughout the session.

10. If someone in the group is absent and doesn't make up the work, what will your group do?
Reflection. Complete this at the end of the given time frame.

11. What percent of the group's work did you complete? What tasks did you complete?

12. What other tasks were completed? Record the name of the person completing each task. Estimate the percentage of work completed by each person.

13. Was anyone absent? Did they complete the work they were supposed to complete? Explain.

14. What letter grade would you give each person? Provide comments.

15. Were any tasks not completed? If so, complete the chart below.

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16. What are the group's goals for tomorrow?
Redesign Lab Notes:

Use the space below for data tables, observations, sketches, or other important information as you work through your challenge.
Final Presentation and LinkedIn Page

Presenters: ________________________________

Logistics

☐ Were appropriate cover page & final pages included (See Mini Presentation)?
☐ Did EACH speaker speak loudly enough the entire time?
☐ Did EACH speak at a good pace—not too fast/slow?
☐ Did EACH face the audience and maintain eye contact or did they simply read from their visual aids (Prezi, Powerpoint slides, etc.)?
☐ Were terms pronounced correctly? Was proper grammar used?
☐ In the visual aids, were all words spelled correctly? Was proper capitalization shown? Proper spacing shown? Was text large enough? Does every slide have a title showing appropriate capitalization?
☐ Were main ideas—not details & lots of writing—written on the slides?
☐ Did the pictures/videos help express the ideas? Were they arranged nicely?
☐ Does it look nice overall?

5  .  4  .  3  .  2  .  1  .  0
### Content

- Was a slide mentioning **five** basic aspects of aerogels included in after the cover page?
- Next, was the engineering design process included on a slide?
- Next, was the design challenge included on a slide?
- Next, was how the challenge relates to aerogels included?
- Next, were the original design constraints included on a slide?
- Was the info from the Mini Presentation found on the slides in the middle?
- Next, were the new design constraints included on a slide?
- Next, was the new/altered idea mentioned?
- Were we told why they chose that idea?
- If the project didn't work, were we given ideas as to why or about other strategies they would try and why?
- Was a slide identifying the 21st century skills (critical thinking, collaboration, creativity, communication, conflict resolution, perseverance) included?
- Were **two** situations showing growth in the 21st century skills on a slide and CLEARLY explained?
- Was the presentation thorough? Did it follow a logical progression? Were supportive pictures/video provided? (Did it make sense?)
- Did they answer questions well, (if asked)?

### Teamwork

- Did it seem like EVERYONE contributed to the preparatory work? (Did each person know the information or did it seem like only one or two people understood it?)
- Was the presentation shared equally? (Did one or two persons dominate the presentation or did everyone speak the same amount?)

---

**Score:** 5.0

Aerogel Cookies Activity – Engineering Design Notebook
TeachEngineering – [www.teachengineering.org](http://www.teachengineering.org)
Comments (Restrict comments to the presentation and not the presenter(s). Provide only helpful comments. You must provide comments if you assign a less than perfect grade.)

Overall, how would you rate the presentation? 5 · 4 · 3 · 2 · 1 · 0
Self, Peer, and Group Evaluation

Answer.

1. What tasks on this project were completed by you? What percentage of the work did you complete?

2. Were you absent during any part of the project? If so, did you still complete your share of the work? **Explain.**

3. How would you grade yourself on this assignment? A · B · C · D · F

   **Provide comments.**

4. Record the names of your group members and the tasks that each of them completed. What percentage of the work did each person complete?

5. Was anyone absent during the project? If so, did each still complete his/her share of the work? **Explain.**

6. How would you grade your group members on this assignment? **Provide comments.**

   Name ____________________   A · B · C · D · F
   Name ____________________   A · B · C · D · F
   Name ____________________   A · B · C · D · F

   **Comments:**

7. How would you grade your group on the following? **Provide comments.**

   Producing a product
   A · B · C · D · F

   Getting along/resolving conflict
   A · B · C · D · F

   Sharing responsibilities equally
   A · B · C · D · F

   Helping each other
   A · B · C · D · F
Comments:

8. Is there anything else you would like your instructor/coach to know?