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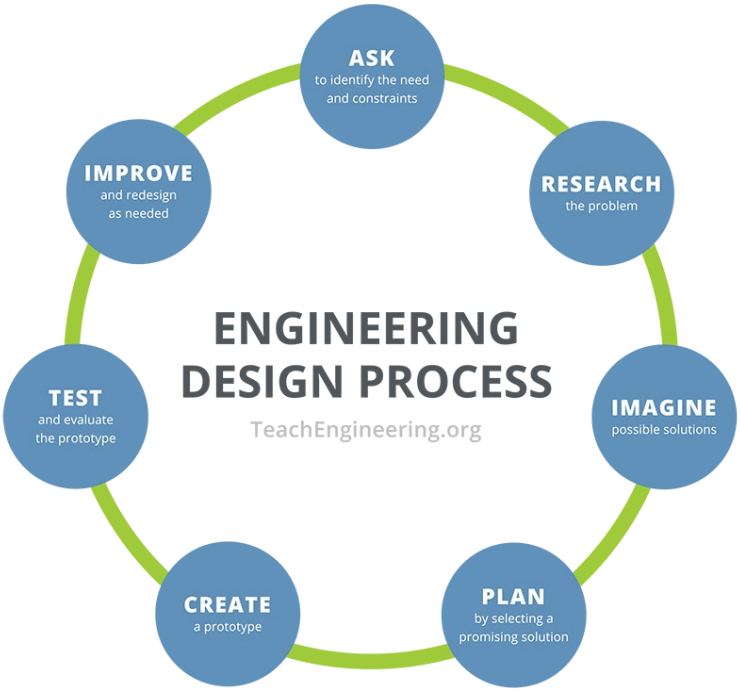
Aerogel Pre/Post-Quiz Answers

1. What is the engineering design process? Explain.



2. What is an aerogel?

An aerogel is a substance that is 99% air and has unique properties as a result.

3. What are aerogels made from?

Silicon dioxide, rice, polymers, grapheme

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

Some are amazing temperature insulators. Some are bulletproof. Some conduct electricity. Some are hydrophobic. Some are hydrophilic. They have a very low density. They can trap particles. They are very strong—compressive strength. Porous. Some are very tough (can be hit hard and not break)

5. What are aerogels used for?

They can be used for filtering purposes—NASA can use them to trap particles in space. They are used by NASA to insulate the MARS rover battery. They are used for winter coats. They can be used in airplanes due to their very low density.

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6. In 1-2 sentences, tell how aerogels are made.
   Answers vary

7. For what purposes are they currently being studied?

Creating aerogels with different sized holes are being created as it is believed they may provide a better option for matrices that cells/tissues are grown on. This is tissue engineering. Creating aerogels of different sized holes may expand coating and filtering applications. It can be added to clothing/masks to better filter out contaminants improving health.

8. How else could aerogels be used? Explain. Discuss the chemical, physical, mechanical, etc. property that leads to the use.

Open. They could be used in housing materials—especially in area of extreme climates—to moderate temperature since they are temperature insulators. They could be used in electronics and plugs so that they wouldn't feel so warm when we use them since they are temperature insulators but electrical conductors. They could be used in biohazard/military clean up operations since they can trap particulates in the holes. Since they are tough, they could be used for protection in police/military gear, vehicles, barracades, etc.

9. What are the current challenges facing scientists/engineers with aerogels?

Making them cheaply.

10. What is an emulsion? What is a common emulsion?

An emulsion is a mixture of two immiscible liquids. Common emulsions include mayonnaise, oil and vinegar salad dressing, Italian salad dressing, ice cream, milk, paint, margarine, lotion, face cream.

11. What is an emulsifying agent (emulsifier)?

A substance added to an emulsion to prevent it from separating back out.

12. What does it have to do with aerogels?

One way aerogels are made is my creating an emulsion and then employing solution exchange to get rid of the second compound leaving behind holes/air pockets in the dried gel.

13. Tell a specific time when you used each of the following in this project.
    Answers vary

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14. Posttest Only: Give **two** instances where you grew through this project in creativity, critical thinking (perseverance), collaboration, communication, or conflict resolution.

Answers vary