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| **Chemistry of Coatings**  **A scientific inquiry lesson: Scientific Method** |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lab Partner: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Objective** |
| The goal of this inquiry lab is to use your knowledge of the scientific method and engineering design matrix and design an experiment to determine the ideal epoxy to hardener ratio. Make sure you view the [rubric](https://docs.google.com/document/d/1jZzeuwSjmU7KmdUTUXq9FDieknSCVf_yy9dzBcPebe8/edit?usp=sharing) for how you will be graded in terms of the use of the scientific method. When the rubric splits, you will be graded with the red text. |

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| **Discover-Homework** |
| Think about it: “How are great discoveries made?” [Watch this video](https://sites.google.com/site/mrsdiazstudentresources/1-21-gigawatts)! Notice the process Doc Brown goes through to address the problem of how to send Marty back in time. Cite two pieces of evidence that Doc Brown and Marty used to figure out how to send him back to the future. |
| **Answer:** |

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| **Learn-Homework** |
| All scientists need to know about the Scientific Method and the importance of the steps for any experimental design. Engineers follow a similar process using the engineering design matrix. Compare and contrast the steps of the scientific method and engineering design process by clicking on the links below. Make sure to make AT LEAST two comparisons and two differences between the two.  [Overview of the Scientific Method](http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml#overviewofthescientificmethod) and [Overview of the Engineering Design Process](https://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml). |
| **Notes:** |

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| **Pre-Lab Questions**  To help answer these questions, see the attached links provided. |
| 1. Define a [polymer](https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm).   Link: [All about epoxy resins](https://www.thoughtco.com/what-is-epoxy-resin-820372)   1. How is an epoxy resin an example of a polymer? 2. List three industries/products where epoxy resins are used. 3. What is the most common epoxy: hardener ratio commonly used in epoxy resin systems?   [Scientific Method and Engineering Design](https://www.sciencebuddies.org/engineering-design-process/engineering-design-compare-scientific-method.shtml)   1. Identify whether the following prompts should use the scientific method or engineering design matrix:    1. Why are some tomato plants and tomatoes larger than others?    2. I need a better support frame for my tomato plants.    3. How can I capture the sun’s energy to heat water?    4. Is it possible to turn soil into energy with a microbial fuel cell?    5. How does changing the level of oxygen affect the exothermic oxidation of iron powder? |

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| **Purpose**  In one sentence state the purpose of this experiment. |
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| **Hypothesis**  Using an “if, then” statement, state a testable hypothesis. |
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| **Variables and Controls**  List all appropriate variables and controls that will used in this experimental design. |
| **Independent:**  **Dependent:**  **Controls:** |

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| **Procedure**  List the procedure in number/bullet format. |
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| **Data**  Come up with a data table to record all relevant measurements and information. Make sure to include all observations and units! |
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| **Conclusion**  State whether the hypothesis was accepted or rejected. Make sure to cite specific examples and supply potential sources of error. |
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| **Post-Lab Questions** |
| 1. Why do you think the hypothesis was accepted or rejected? 2. What is the ideal ratio between epoxy and hardener after conducting this experiment? 3. How would knowing what the engineering group tested be helpful in your design of the epoxy? (Use the class discussion to guide this answer) 4. Extension: What would you do next time you would design this beam? Be specific! |

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| **Extension: Redesign**  If given time and materials refine the experimental procedure using what you know now about the scientific method and engineering design to get the most cost effective beam with a close to ideal ratio! |
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