

Name: _____ Date: _____ Team: _____

There Will Be Drugs Worksheet

Scenario: You have invented a new miracle drug for the treatment and prevention of a harmful disease. The easiest way for patients to take the drug at home to protect themselves is orally. However, the drug cannot be released immediately because they would die of toxic doses. *Your challenge:* Design an encapsulation coating that prevents the drug from being released upon immediate placement into an aqueous environment. Before a company will purchase your drug design, you must prove to them that the encapsulation works by demonstrating it with a large-scale model. They want to see you demonstrate control over the drug's initial release time and duration time.

For the large-scale model, use only simple household materials and ignore biocompatibility at this stage. Use a colorful flavored drink powder to represent the miracle drug that needs to be placed inside the fully built shell before closure. After building your encapsulation prototype, test it by anchoring it underwater and measuring the drug release initial time and duration time. Revise and retest your design as needed.

Design constraints: Initial drug release at _____ minutes and lasting for _____ minutes.

1. Begin by assessing the available materials and supplies. Brainstorm ideas for how to cover the shell and make the materials adhere by making a list of your encapsulation ideas.

2. Sketch some of your design ideas on extra paper or on the back of this sheet. Choose one design that your group agrees to construct; draw it below and make a list of all the needed materials and how you will use them. ***Have the teacher check your design plan before you start to build.***

Teacher initials

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3. Test your design prototype by securing it underwater. Use a timer to measure how long it takes for the drug powder to initially release—or if it even releases at all. You will know it has released when you see colored water. Then keep timing to measure the full length of the release.

Time when Kool-Aid® released:	
Time when Kool-Aid® release ended:	
Duration of release:	

4. From what you learned during the testing, what are the pros and cons of your design?
5. Redesign your encapsulation prototype to improve the original design. Draw below your revised design, indicating where and which materials and supplies will be used.

6. Fabricate your revised design.

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7. Test your revised design prototype the same way you tested the first one. Determine whether it works better or worse than your first design.

Time when Kool-Aid® released:	
Time when Kool-Aid® release ended:	
Duration of release:	

8. What are the pros and cons of your second design?

9. Think of improvements to your previous design by sketching them on extra paper or on the back of this sheet. Draw your revised plan below. Show that you can control the time when the drug (drink powder) is released by demonstrating that you can have a variety of times.

10. Fabricate your improved design.

11. Test your revised design prototype.

Time when Kool-Aid® released:	
Time when Kool-Aid® release ended:	
Duration of release:	

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12. What are the pros and cons of this design?

13. Try to improve your design one last time by sketching on extra paper or on the back of this sheet your design enhancement ideas. Draw your final revised plan below. Then build and test your new design.

Time when Kool-Aid[®] released:	
Time when Kool-Aid[®] release ended:	
Duration of release:	

14. **Summary Diagram of Design Changes and Improvements:** To conclude, make a diagram on paper or using PowerPoint[®] to show how your designs changed and/or improved by explaining your materials/methods along with the release times for each design.