

Design a Delayed-Release Tablet

Student worksheet

Name: _____

Date: _____

Directions: Complete each section as described.

1. Introduction

Below, describe in your own words what a delayed-release drug is.

2. Material Testing and Selection

- a. Investigate the material properties of the plastic materials (polymers) based on the tests listed in the table below.

Material Property	Test
Color	Judge by appearance.
Transparency	Judge by appearance.
Tear strength	Try to tear the material: How easy or difficult is it to tear?
Water solubility	Put the material in a cup full of cold tap water: Does it dissolve? If yes, how fast does it dissolve?
Scratch resistance	Scratch the material with your fingernails: Does it leave a mark on the material? How easy or difficult is it to scratch?

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a. Record your observations in the following table.

Material	Color	Transparency	Tear strength	Water solubility	Scratch resistance
			☐ easy to tear ☐ in between ☐ difficult to tear	☐ insoluble ☐ soluble Time until dissolved: _____	☐ easy to scratch ☐ in between ☐ difficult to scratch
			☐ easy to tear ☐ in between ☐ difficult to tear	☐ insoluble ☐ soluble Time until dissolved: _____	☐ easy to scratch ☐ in between ☐ difficult to scratch
			☐ easy to tear ☐ in between ☐ difficult to tear	☐ insoluble ☐ soluble Time until dissolved: _____	☐ easy to scratch ☐ in between ☐ difficult to scratch
			☐ easy to tear ☐ in between ☐ difficult to tear	☐ insoluble ☐ soluble Time until dissolved: _____	☐ easy to scratch ☐ in between ☐ difficult to scratch
			☐ easy to tear ☐ in between ☐ difficult to tear	☐ insoluble ☐ soluble Time until dissolved: _____	☐ easy to scratch ☐ in between ☐ difficult to scratch
			☐ easy to tear ☐ in between ☐ difficult to tear	☐ insoluble ☐ soluble Time until dissolved: _____	☐ easy to scratch ☐ in between ☐ difficult to scratch
			☐ easy to tear ☐ in between ☐ difficult to tear	☐ insoluble ☐ soluble Time until dissolved: _____	☐ easy to scratch ☐ in between ☐ difficult to scratch

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- b. Based on your observations and results, which material(s) would you use to build your delayed-release tablet?

3. Tablet Design and Build

Based on your previous test results, come up with your own idea for a delayed-release tablet design. Your design has to meet the following design criteria:

- Use one bath tablet of each color (yellow, red, and blue) to make the pill. The bath tablets cannot be modified in any way.
- The final tablet has to be a single unit (made out of the three different color tablets) and needs to be fully enclosed.
- When submerged in water, your tablet has to release each one of the colors at a specific target time. The target times are given in the table below.

Yellow		Red		Blue	
m:ss	seconds	m:ss	seconds	m:ss	seconds
0:30	30	1:30	90	3:00	180

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- b. Draw a picture of your tablet design below. Label the main parts and materials of your design.
- b. Talk to your group and agree on a single tablet design that you will build. This can be a combination of two or more design ideas. Draw a picture of your design below. Label the main parts and materials of the design.
- c. Start making your first tablet prototype. When making your tablet:
- Keep your hands and your workspace dry.
 - Keep all water-soluble materials in the plastic bag.
 - Remember that you have several options when sealing the pills: a heat bag sealer, water-soluble tape, or “gluing” layers together with water.

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4. Tablet Testing

- Fill a plastic cup with cold tap water and drop your tablet into the water for testing. Discard the water in the sink afterward and rinse your cup.
- The time of color release is defined as the first moment at which you can see the color leaking out of the tablet wrapping and into the surrounding water (if the tablets start dissolving inside the wrapping it does NOT count, yet). Make sure you also check the water surface if your tablet is floating. Any tiny bit of color release counts!
- When testing your color release times, start your timer once the tablet hits the water surface.
- Record your observations and measured color release times below. You can calculate your tablet score using the scoring information below.

Test #	Design Description	Release time yellow	Release time red	Release time blue	Calculated tablet score
1					
2					
3					
4					
5					

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5. Tablet Score Calculation

- Points will depend on how close each color was released to its target time.
- Your team will start with a total score of 700 points.**
- The absolute value of the difference from the target time for each color is subtracted from your score. An example calculation for one tablet is shown in the table below.

Yellow	Red	Blue
Yellow releases at 0:40 (40 s). Target time – actual time: $30\text{ s} - 40\text{ s} = -10$. This means that 10 points are subtracted from your score.	Red releases at 0:10 (10 s). Target time – actual time: $90\text{ s} - 10\text{ s} = 80$. This means that 80 points are subtracted from your score.	Blue releases at 4:00 (240 s). Target time – actual time: $180\text{ s} - 240\text{ s} = -60$. This means that 60 points are subtracted from your score.
Total tablet score: $700 - 10 - 80 - 60 = 550$ points		

- Each color that is not released within the 5-minute (300 s) competition timeframe results in a 225-point subtraction. Another example calculation is shown in the table below.

Yellow	Red	Blue
Yellow releases at 0:30 (30 s). Target time – actual time: $30\text{ s} - 30\text{ s} = 0$. This means that 0 points are subtracted from your score.	Red releases at 4:30 (270 s). Target time – actual time: $90\text{ s} - 270\text{ s} = -180$. This means that 180 points are subtracted from your score.	Blue does not release within 5 min. This means that 225 points are subtracted from your score.
Total tablet score: $700 - 0 - 180 - 225 = 295$ points		

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6. Reflection

Think about how your tablet performed. List below what you would try next to improve the design and why.