

Toxicology Experiment: Seed Bioassay

Seeds are living organisms that may be harmed by chemicals. You will find out if a chemical is **toxic** to a seed. This is an experiment to see if a chemical delays or prevents seeds from germinating (sprouting). You will find out the **dose** of chemical (how much chemical) prevents seeds from germinating. To do this, you will test the effects of several dilutions of a chemical.

Tasks:

- 1) Prepare bags
- 2) Prepare solutions
- 3) Wet napkins with solutions
- 4) Place seeds on napkins
- 5) Clean up

A team should split up and **one person prepares the bags** while one or **two people start making solutions**. Everyone should help place seeds on napkins and clean up.

1) Prepare Bags:

Materials:

8 bags (zip locking sandwich or freezer bags) and 8 white paper napkins

Marker

At least 10 inches of masking tape

The label for each dose that you test should include the Chemical name, bag number, solution strength (percentage or %), and date. Write out labels on masking tape. The bag number and solution strengths (%) that you will test are:

#8 – 100%

#7 – 50%

#6 – 25%

#5 – 12.5%

#4 – 6.25%

#3 – 3.125%

#2 – 1.56%

#1 – Control

Sample label:

Chemical A

#8 – 100%

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Place napkins in the bags and make sure that the bag will seal (turn down edges of napkins if necessary). At this time, leave the bag open.

2) Prepare Solutions:

These will be **serial dilutions**, which means each solution will be used to prepare the next, more dilute solution. Note that:

100% means full strength chemical from the bottle

50% dilution means 1 tablespoon of the 100% solution plus 1 tablespoon of water

25% dilution means 1 tablespoon of the 50% solution plus 1 tablespoon of water

12.5% dilution means 1 tablespoon of the 25% solution plus 1 tablespoon of water
and so forth

A 0% chemical solution means that only water is used, no chemical. This is called the **control**. You need to end up with a volume of 1 Tablespoon of each dilution for the experiment.

Materials

8 cups

marker

Tablespoon measure

Chemical of your choice (example, window cleaner, plant fertilizer, mouthwash)

Step one: Mark the cups with the numbers 1, 2, 3, 4, 5, 6, and 7. Fill the first cup with water. Cup 1 is for the control (no chemical added) and the 100% solution will come right from the bottle or jar of chemical solution (see the bag labeling instructions).

Step two: Use the Tablespoon measure to place **1 (one) Tablespoon** of water into each of the cups (2-7). Do this **first** so that you do not contaminate your cup and spoon.

Step three: Use the Tablespoon to measure 1 Tablespoon of chemical into cup # 7. This is now a 50% dilution. Swirl the mixture and stir it with the measuring spoon.

Step four: Use the Tablespoon to transfer 1 Tablespoon of the mixture from cup #7 into cup #6. Swirl the mixture and stir it with the measuring spoon.

- The result is a 25% dilution in cup #6
- You have 1 Tablespoon of solution left in cup #7 for the experiment.

Step five: Continue to transfer 1 Tablespoon of the solution into the next cup in the series. Stop when you add the Tablespoon of solution to cup #2 (1.56% dilution)

Step six: You will have 1 Tablespoon solution in cups 7, 6, 5, 4, and 3. There will be **two (2) Tablespoons** of solution in cup #2. You only need one for the experiment so remove one Tablespoon and discard it into an empty cup or bucket.

3) Wet napkins with Solution:

- Line up the labeled bags containing napkins next to the cups, matching the %.
- Add 1 Tablespoon of full strength chemical to the bag labeled #8 – 100%.

- Add the contents of each of the other cups to the matching bag.
- Make sure that all of the solution is absorbed by the napkin (pour out excess).

4) Place Seeds on Napkins:

Materials

Seeds

Bags with solution

- Count out ten seeds for each bag.
- Place seeds on the napkin of each bag. Use an even pattern that will make it easy to look closely at individual seeds.
- Close the bag securely; gently smooth out any air bubbles.

5) Clean up:

- Empty contents of all cups into a bucket or sink.
- Stack cups and give to instructors.
- Seal up bag of seeds and put them back where you got them.
- Wipe up any spilled water or solution with paper towels and throw towels in the waste basket.

Review:

The strength or concentration of each of the solutions is the **dose**. Over three days the seeds will germinate (sprout). Germination is the **response**.

The Toxicologist thinks that the chemical may have an effect on the ability of the seeds to germinate. The Toxicologist wants to know what concentration (dose) of chemical will prevent seeds from germinating. This is the **toxic dose**.

The **Control** for the experiment is a set of seeds that are treated only with water (0% chemical). All other responses should be compared to the control. If none of the seeds in the control bag germinate, there may be something wrong with the experiment. What could be wrong?

If all of the seeds in all of the doses germinate, the chemical has no effect on seed germination. It could have other effects, but we know that it does not affect germination. It may be **nontoxic**.

If none of the seeds in the doses germinate, but the controls do germinate, what does that tell you about the toxicity of the chemical? What would a toxicologist do next to try to find the toxic dose?

Analysis of Seed Bioassay

Chemical _____

Date experiment was started: _____ Today's date: _____

Bag Number	Dose (% Concentration)	Total # of seeds	# of seeds germinated	# of seeds not germinated
1 (control)	0%	10		
2	1.56%	10		
3	3.125%	10		
4	6.25%	10		
5	12.5%	10		
6	25%	10		
7	50%	10		
8	100%	10		

Graph Results

