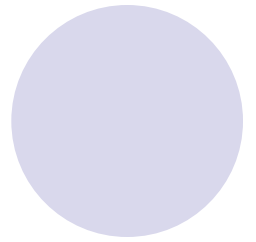
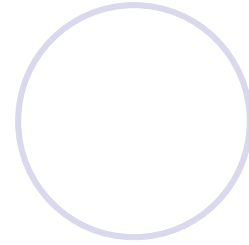
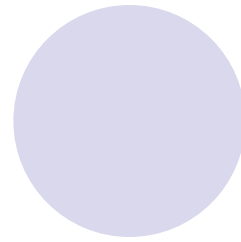
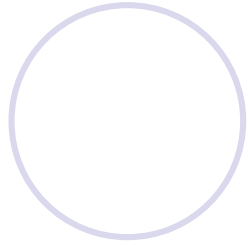
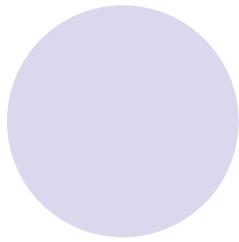


The Scientific Method



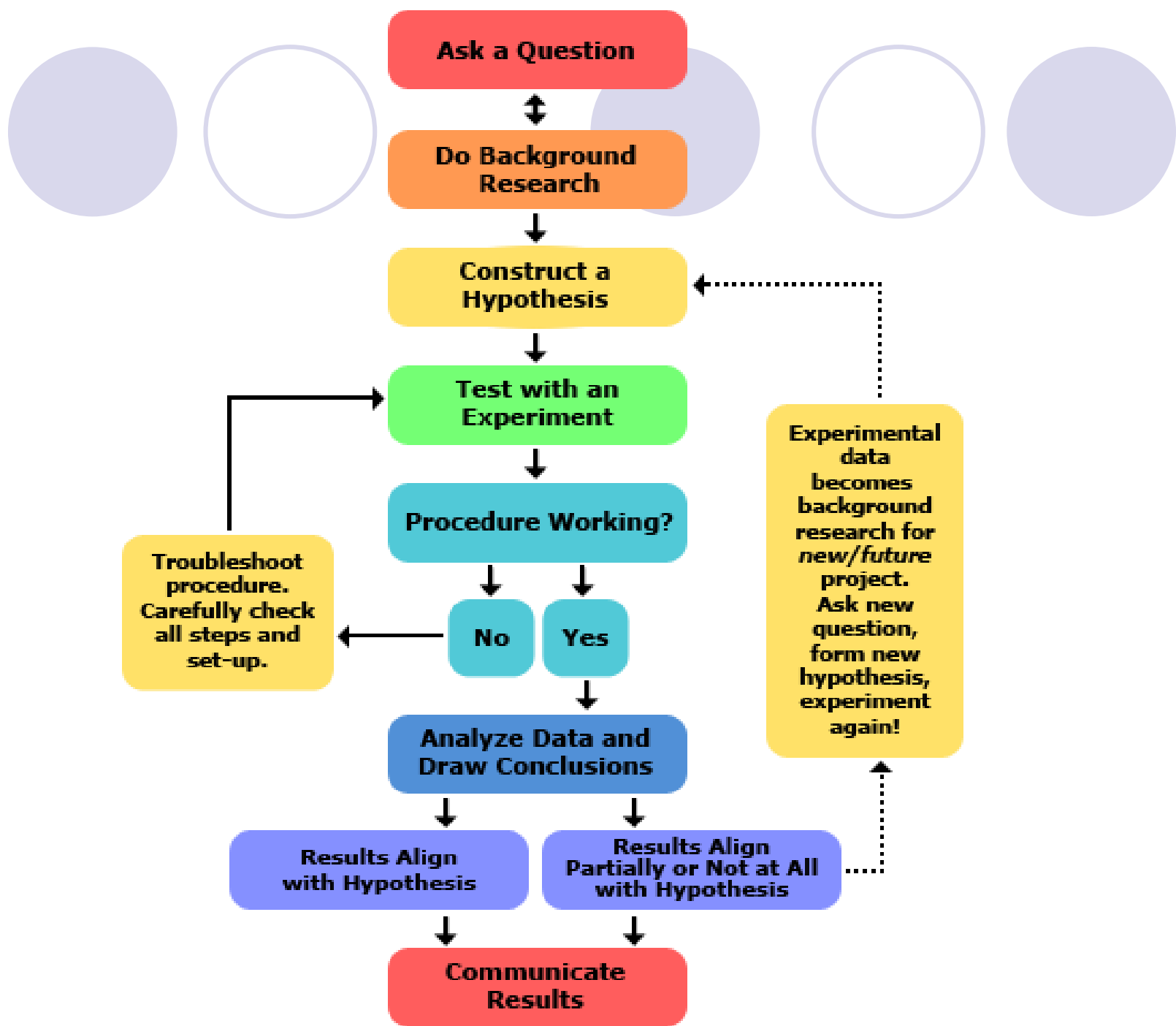
Science 8
Ms. Poonia



Discussion Question

- The Scientific Method was created by scientists from all over the world and is constantly changing. It is a series of steps followed to solve problems.





The Scientific Method

Series of steps that **scientists** use to answer **questions** and solve **problems**.

Steps may be used in a different **order**, **skipped**, or **repeated**.

Scientific Method Steps

1. Ask a Question
2. Form a Hypothesis
3. Test the Hypothesis (Procedure)
4. Analyze the Results
5. Draw the Conclusion



1. Ask a Question

1. Ask a **question** (how, what, when, who, which, why, or where) or find a **problem**.

Observations (using one's 5 senses) often lead to **questions** or **problems**.

Ex. Will adding **fertilizer** make a plant grow **taller**?

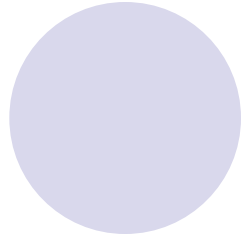
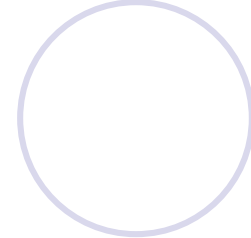
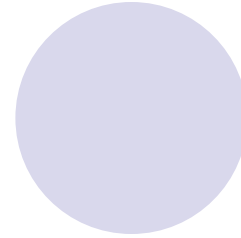
2. Form a Hypothesis

The hypothesis is a **statement**.

It can be a possible **explanation** or answer to a **question**. It must be **testable**.

Ex. **If** plants are **fertilized** more, **then** they will grow taller.

Think--Pair--Share



- Try to think of something that you've always wondered the answer to and try to word it as a hypothesis.
- Write your sentence on the whiteboard.

A decorative header consisting of five circles in a row. The first, third, and fifth circles are solid light purple. The second and fourth circles are hollow with a light purple outline.

A good hypothesis will allow
you to make a prediction

*"If _____ [I do this] _____, then
_____ [this] _____ will happen."*

3. Test the Hypothesis (Procedure)

A controlled experiment has a control group and an experimental group

The basic idea is to change only one factor - the variable.

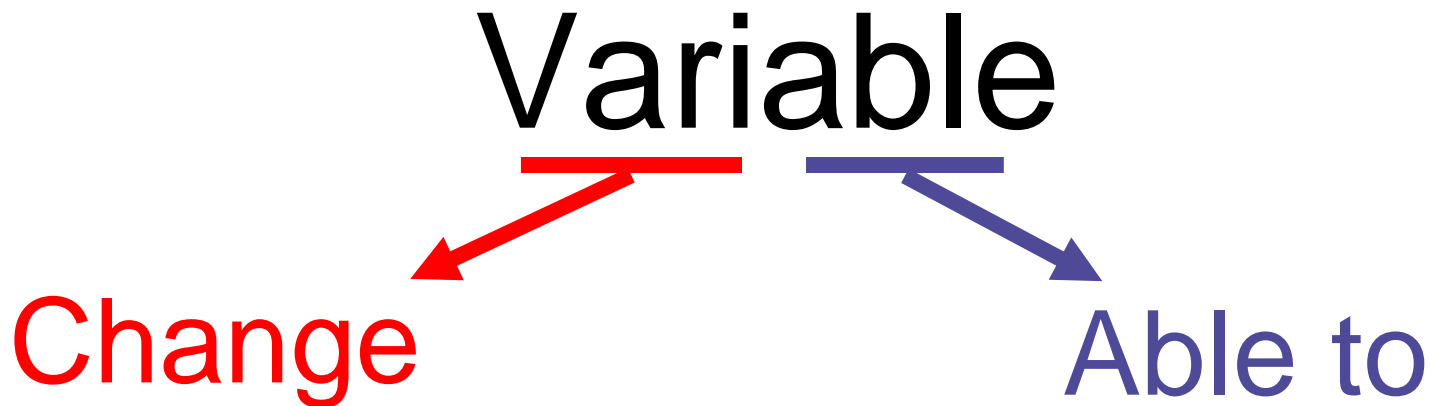


Every good **controlled**
experiment has these 3
things:

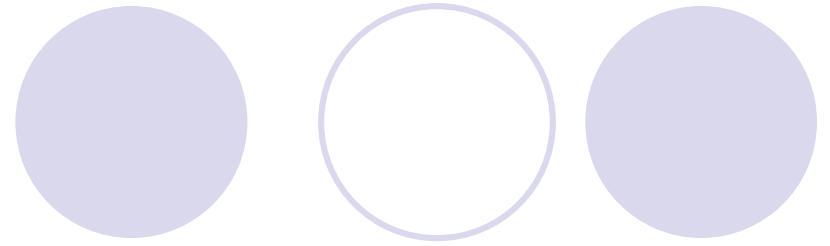
- Independent variable
- Dependent variable
- Control

Definitions

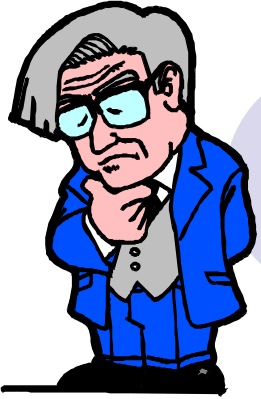
- **Variable**: A factor that can change in an experiment. Every experiment has two – one is the cause, the other is the effect.



Cause and Effect



- Does crushing a sugar cube effect the rate at which the sugar dissolves in the water?
- What is the cause and what is the effect?



Crushing the sugar cube is what we predict will be the *cause*.

- Crushing the sugar cube will effect how long it takes to dissolve.

The time it takes to dissolve is what we will see the *effect* on.

This is called the *Independent Variable*.

This is called the *Dependent Variable*.

Defintions continued



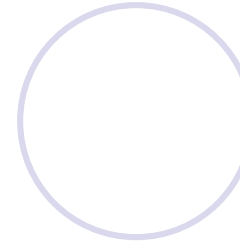
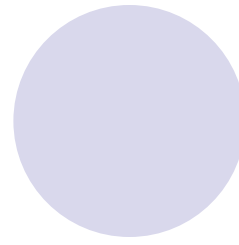
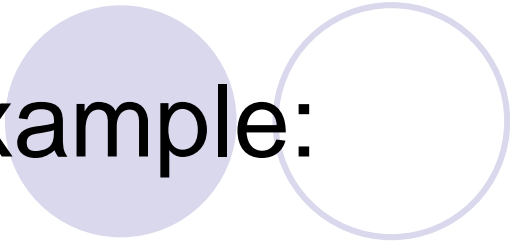
- **Variable**: A factor that can change in an experiment. Every experiment has two – one is the cause, the other is the effect.
- **Independent variable**: what you manipulate (cause to change or influence) in an experiment



Independent Variable

- This is what you **manipulate** to test your hypothesis
- There should only be **ONE** in an experiment

Example:



Larry was told that a certain muscle cream was the newest best thing on the market and claims to double a person's muscle power when used as part of a muscle-building workout.

Interested in this product, he buys the special muscle cream and recruits Patrick and SpongeBob to help him with an experiment. Larry develops a special marshmallow weight-lifting program for Patrick and SpongeBob.

He meets with them once every day for a period of 2 weeks and keeps track of their results. Before each session Patrick's arms and back are lathered in the muscle cream, while Sponge Bob's arms and back are lathered with the regular lotion.

What is the independent variable?

- Larry is wondering how different lotions will affect how much Spongebob and Patrick can lift.
- He changes (manipulates) the type of lotion that each person gets.
- Therefore, the independent variable in this example is the LOTION he puts on each.

Defintions continued



- **Variable**: A factor that can change in an experiment. Every experiment has two – one is the cause, the other is the effect.
- **Independent variable**: what you manipulate (cause to change) in an experiment
- **Dependent variable**: what happens in an experiment because of the **independent** variable.

Dependent Variable



- Happens because of your independent variable
- It's how you determine if your hypothesis was true or not

Example



Larry was told that a certain muscle cream was the newest best thing on the market and claims to double a person's muscle power when used as part of a muscle-building workout.

Interested in this product, he buys the special muscle cream and recruits Patrick and SpongeBob to help him with an experiment. Larry develops a special marshmallow weight-lifting program for Patrick and SpongeBob.

He meets with them once every day for a period of 2 weeks and keeps track of their results. Before each session Patrick's arms and back are lathered in the muscle cream, while Sponge Bob's arms and back are lathered with the regular lotion.

What is the dependent variable in this experiment?

- Since Larry is looking to see if the cream has an effect on how much someone can lift, the **dependent variable** is THE NUMBER OF MARSHMALLOWS THAT CAN BE LIFTED by Spongebob and Patrick
- The number of marshmallows each one can lift *depends* on the type of lotion they got (independent variable)

Definitions continued

- **Independent variable**: what you manipulate (cause to change) in an experiment
- **Dependent variable**: what happens in an experiment because of the independent variable.
- **Control**: what you keep the same. So it doesn't interfere with your independent variable! (You use this in an experiment to compare to what you do change.)

Control

- The control is used to compare!
- In an experiment, you should always have something that you don't change so that you can compare what you do change!

Example



Larry was told that a certain muscle cream was the newest best thing on the market and claims to double a person's muscle power when used as part of a muscle-building workout.

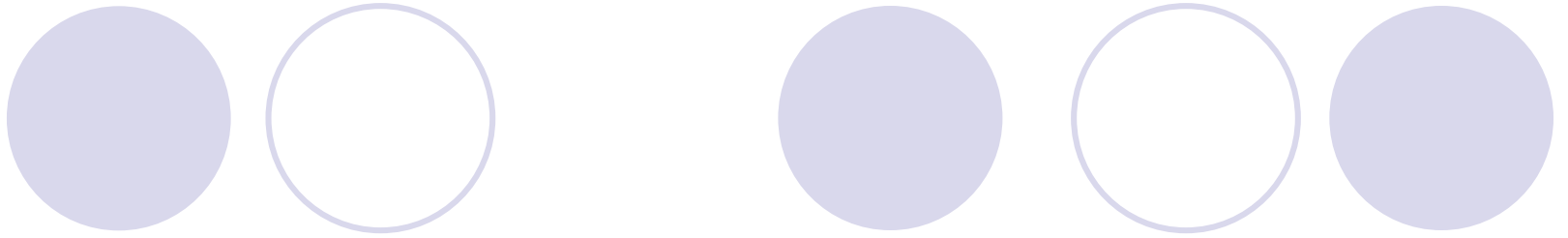
Interested in this product, he buys the special muscle cream and recruits Patrick and SpongeBob to help him with an experiment. Larry develops a special marshmallow weight-lifting program for Patrick and SpongeBob.

He meets with them once every day for a period of 2 weeks and keeps track of their results. Before each session Patrick's arms and back are lathered in the muscle cream, while Sponge Bob's arms and back are lathered with the regular lotion.

What is the control?

The title is centered at the top of the slide. It is flanked by five circles: a solid light purple circle on the far left, a hollow light purple circle, a solid light purple circle, a hollow light purple circle, and a solid light purple circle on the far right.

- In this experiment, what did Larry use to compare the muscle cream (the type of lotion that he changed) to?
- He used a regular type of lotion, one without any special properties, on Sponge Bob to compare his results.
- Larry could have also not put any cream on Sponge Bob to see if the cream that he put on Patrick differed.



When a **controlled** experiment
isn't **possible**...

Test your hypothesis with
more **observations** or by
conducting **research**.

HYPOTHESIS FORMULA

IF

+

Constants

(Things that will NOT change)

+

Independent Variable

(one thing that will change)

+

THEN

+

Dependent Variable

**(The thing being measured in
the experiment)**

+

Prediction

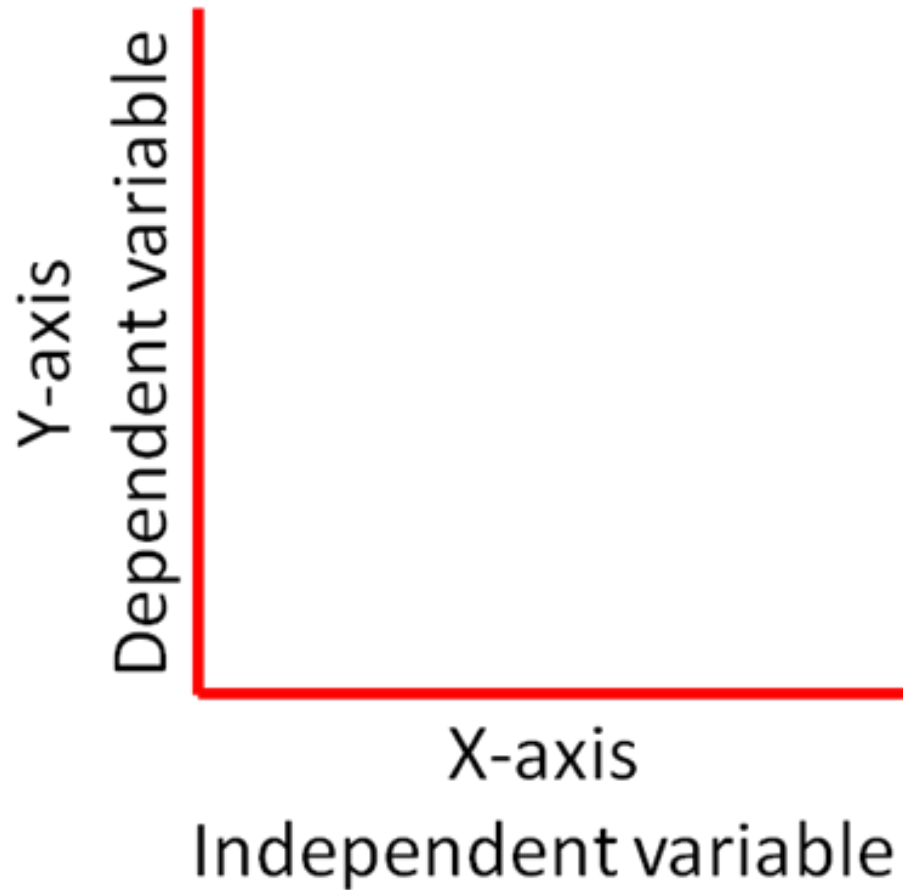
4. Analyze the Results

Collect and record **data** - information acquired by **experimentation**.

Calculations, tables, and **graphs** are used.

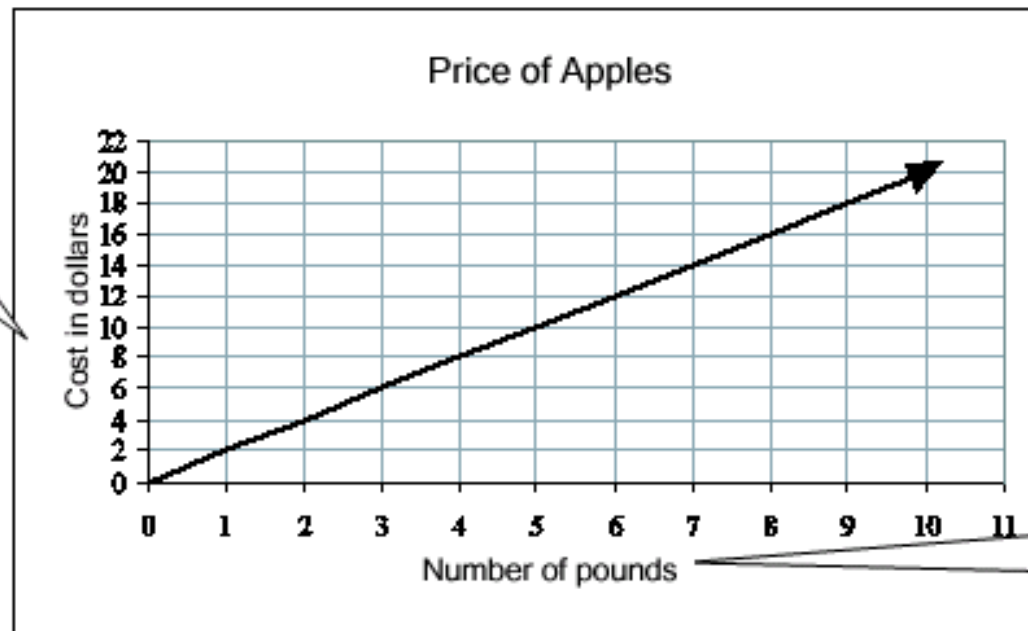
The plant with the **fertilizer** grew 1.5 cm taller in 1 **week**.

Independent Variable vs Dependent Variable



Independent Variable vs Dependent Variable Continued

Dependent variable – The cost of the apples **depends** on the number of pounds of apples purchased.



Independent variable – the number of pounds purchased.

5. Draw the Conclusions

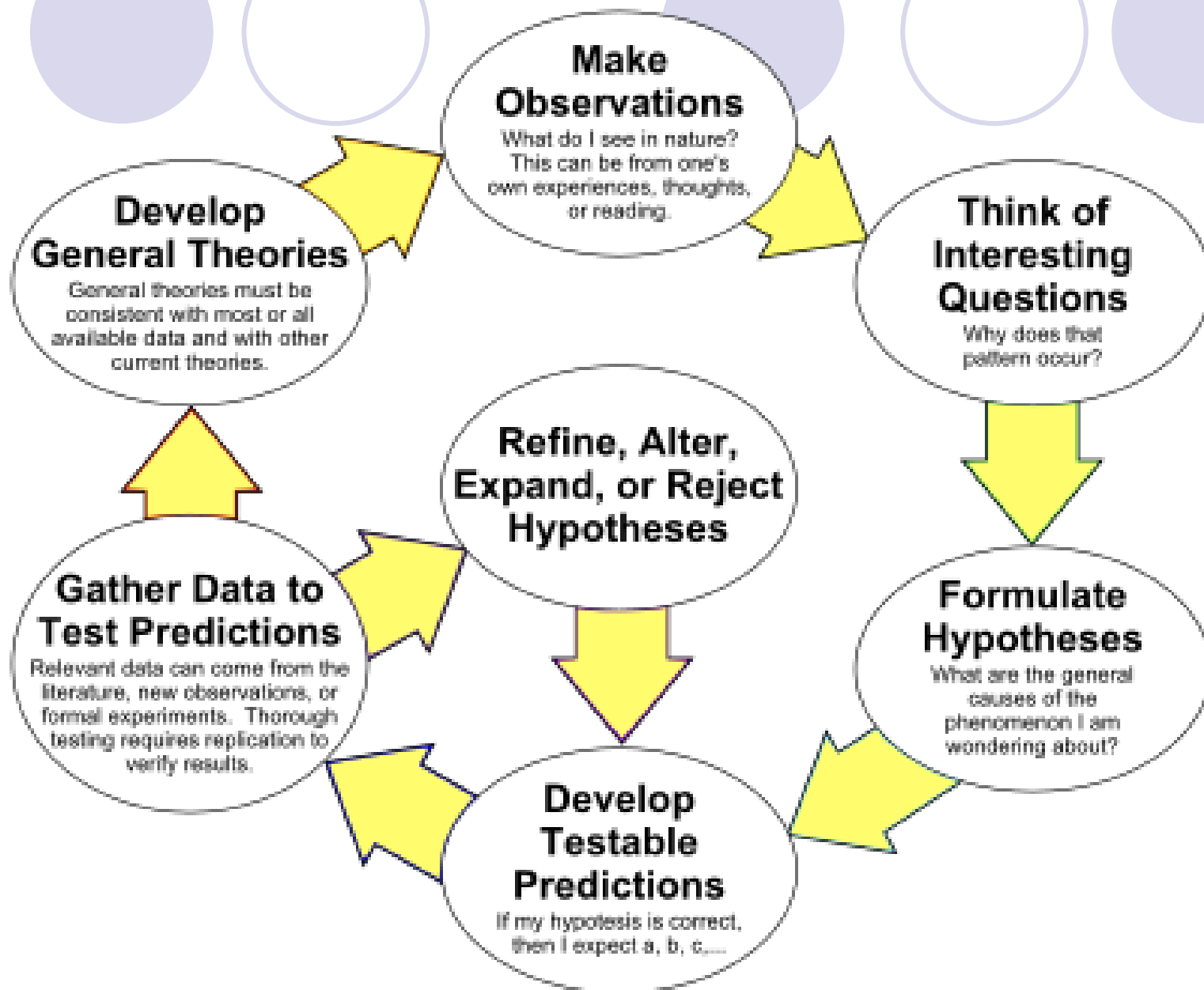
Did your **results** support your **hypothesis** or not?

Do you need more **information**?

The **fertilizer** made the plant grow **taller**.

Communicate your results so they be **verified** and **repeated**.

The Scientific Method as an Ongoing Process



SpongeBob Assignment

The Bikini Bottom gang loves science class and wanted to do a little research. Read the description for each experiment and use your knowledge of the scientific method to answer the questions.

Read the paragraph carefully to yourself. Read the questions and discuss the answer with your shoulder partner.



1. FLOWER POWER

SpongeBob loves to garden and wants to grow lots of pink flowers for his pal Sandy. He bought a special Flower Power fertilizer to see if it will help plants produce more flowers. He plants two plants of the same size in separate containers with the same amount of potting soil. He places one plant in a sunny window and waters it every day with fertilized water. He places the other plant on a shelf in a closet and waters it with plain water every other day.

What did SpongeBob do wrong in this experiment? Explain.

What should SpongeBob do to test the effectiveness of Flower Power fertilizer? Write an experiment.



2. SUPER SNAILS

Gary is not the smartest snail in Bikini Bottom and believes he can improve his brain power by eating Super Snail Snacks. In order to test this hypothesis, he recruits SpongeBob and several snail friends to help him with the experiment. The snails ate one snack with each meal every day for three weeks. SpongeBob created a test and gave it to the snails before they started eating the snacks as well as after three weeks.

Based on the data provided, do the Super Snail Snacks work? Explain your answer.

Test Results		
Snail	Before	After
Gary	64%	80%
Larry	78%	78%
Barry	82%	84%
Terry	72%	70%



3. BUBBLE TIME

Patrick loves bubble gum and would like to be able to blow bigger bubbles than anyone else in Bikini Bottom. To prepare for the Bikini Bottom Big Bubble Contest, he bought five different brands of bubble gum and needs your help to find the brand that creates the biggest bubbles.

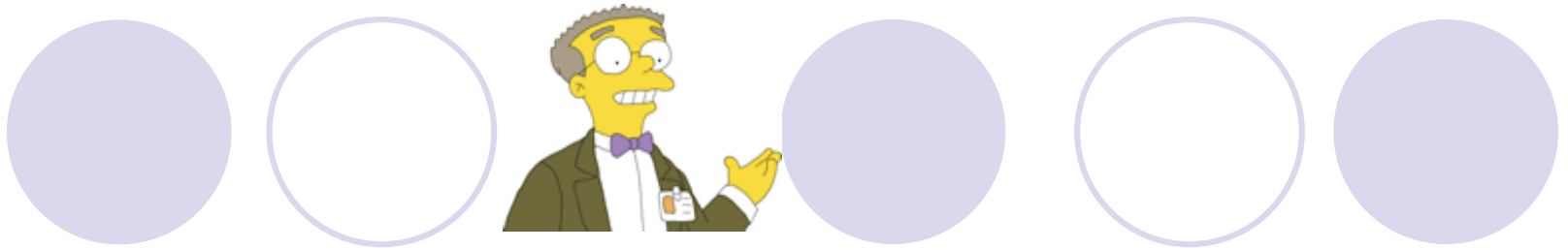
Write an experiment to test the bubble power of the bubble gum brands and help Patrick win the contest.



SIMPSONS - Identifying controls, variables (independent & dependent) conclusions and improving experiments.

In your Science Journal, Answer the Simpson Questions. Compare your findings with your shoulder partner.





Smithers thinks that a special juice will increase the productivity of workers. He creates two groups of 50 workers each and assigns each group the same task (in this case, they're supposed to staple a set of papers). Group A is given the special juice to drink while they work. Group B is not given the special juice. After an hour, Smithers counts how many stacks of papers each group has made. Group A made 1,587 stacks, Group B made 2,113 stacks.

Identify the:

1. Control Group
2. Independent Variable
3. Dependent Variable
4. What should Smithers' conclusion be?
5. How could this experiment be improved?



Homer notices that his shower is covered in a strange green slime. His friend Barney tells him that coconut juice will get rid of the green slime. Homer decides to check this out by spraying half of the shower with coconut juice. He sprays the other half of the shower with water. After 3 days of "treatment" there is no change in the appearance of the green slime on either side of the shower.

6. What was the initial observation?

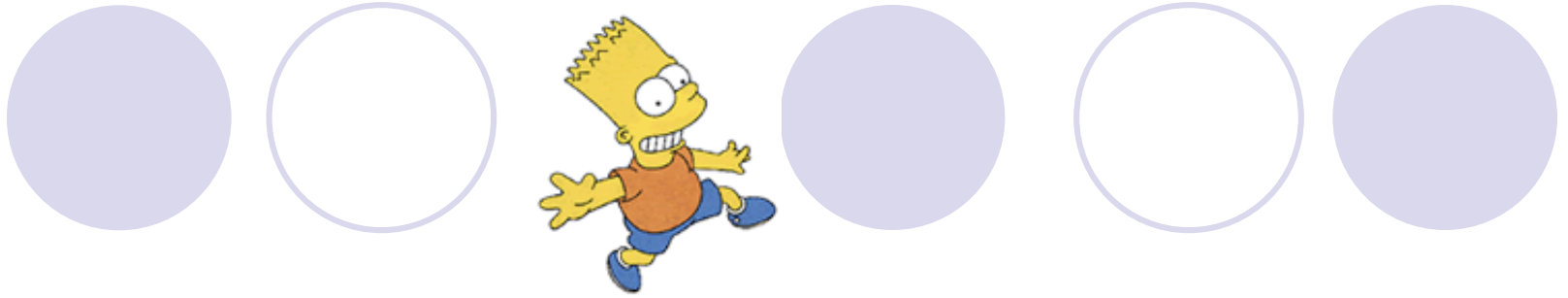
Identify the:

7. Control Group

8. Independent Variable

9. Dependent Variable

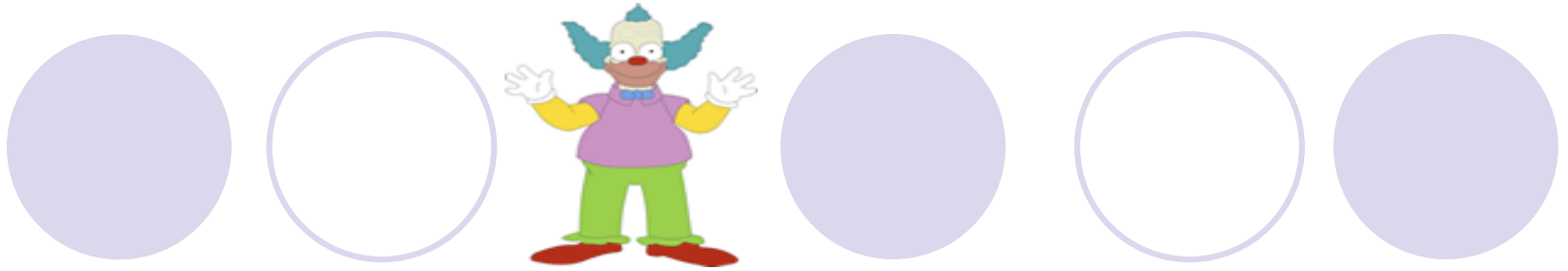
10. What should Homer's conclusion be?



Bart believes that mice exposed to microwaves will become extra strong (maybe he's been reading too much Radioactive Man). He decides to perform this experiment by placing 10 mice in a microwave for 10 seconds. He compared these 10 mice to another 10 mice that had not been exposed. His test consisted of a heavy block of wood that blocked the mouse food. he found that 8 out of 10 of the microwaved mice were able to push the block away. 7 out of 10 of the non-microwaved mice were able to do the same.

Identify the:

11. Control Group
12. Independent Variable
13. Dependent Variable
14. What should Bart's conclusion be?
15. How could Bart's experiment be improved?



Krusty was told that a certain itching powder was the newest best thing on the market, it even claims to cause 50% longer lasting itches. Interested in this product, he buys the itching powder and compares it to his usual product. One test subject (A) is sprinkled with the original itching powder, and another test subject (B) was sprinkled with the Experimental itching powder. Subject A reported having itches for 30 minutes. Subject B reported to have itches for 45 minutes.

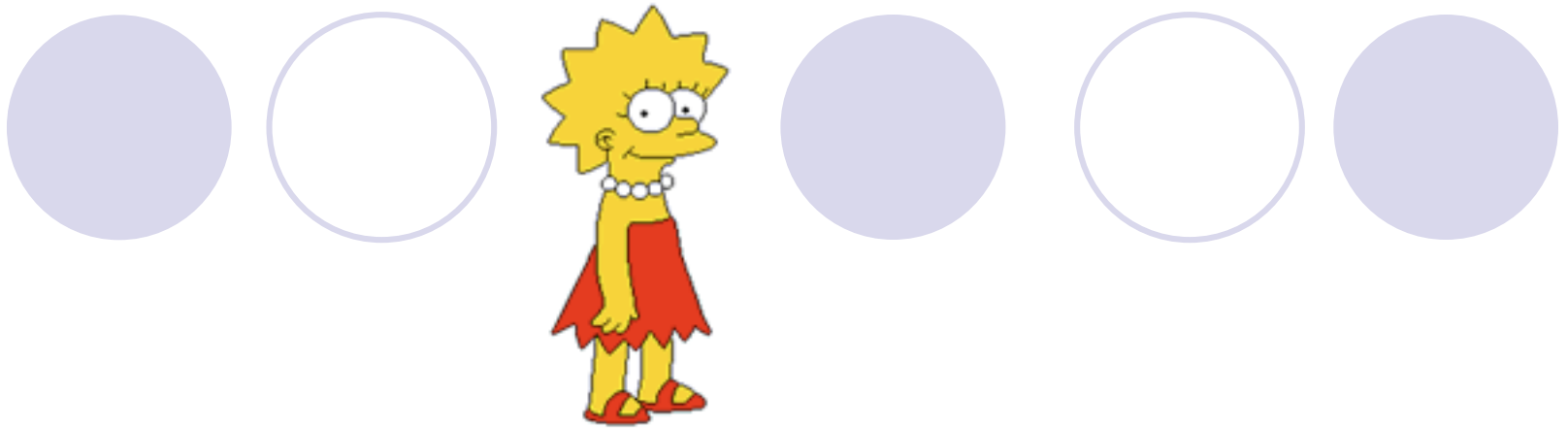
Identify the:

16. Control Group

17. Independent Variable

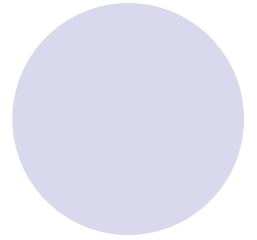
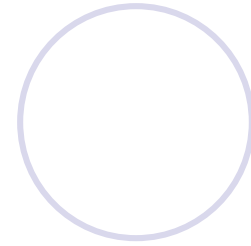
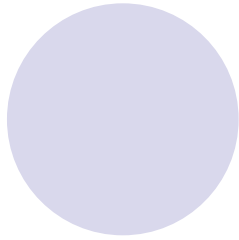
18. Dependent Variable

19. Explain whether the data supports the advertisements claims about its product.



Lisa is working on a science project. Her task is to answer the question: "Does Rogooti (which is a commercial hair product) affect the speed of hair growth". Her family is willing to volunteer for the experiment.

20. Describe how Lisa would perform this experiment. Identify the control group, and the independent and dependent variables in your description



SPONGE BOB

Scientific Method

Controls and Variables - Part 1

1. PATTY POWER

Mr. Krabbs wants to make Bikini Bottoms a nicer place to live. He has created a new sauce that he thinks will reduce the production of body gas associated with eating crabby patties from the Krusty Krab. He recruits 100 customers with a history of gas problems. He has 50 of them (Group A) eat crabby patties with the new sauce. The other 50 (Group B) eat crabby patties with sauce that looks just like new sauce but is really just mixture of mayonnaise and food coloring. Both groups were told that they were getting the sauce that would reduce gas production. Two hours after eating the crabby patties, 30 customers in group A reported having fewer gas problems and 8 customers in group B reported having fewer gas problems.

Which people are in the control group?

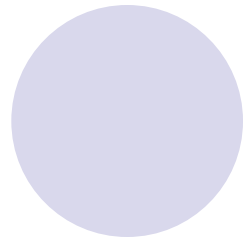
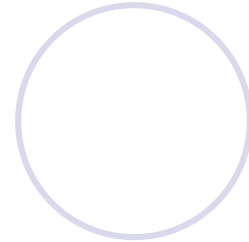
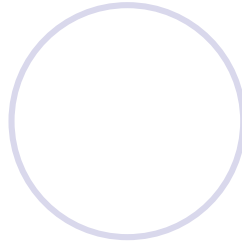
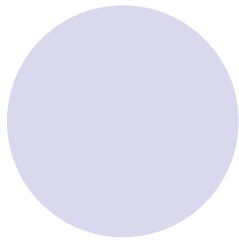
What is the independent variable?

What is the dependent variable?

What should Mr. Krabbs' conclusion be?

Why do you think 8 people in group B reported feeling better?





2 - SLIMOTOSIS

Sponge Bob notices that his pal Gary is suffering from slimotosis, which occurs when the shell develops a nasty slime and gives off a horrible odor. His friend Patrick tells him that rubbing seaweed on the shell is the perfect cure, while Sandy says that drinking Dr. Kelp will be a better cure. Sponge Bob decides to test this cure by rubbing Gary with seaweed for 1 week and having him drink Dr. Kelp. After a week of treatment, the slime is gone and Gary's shell smells better.

What was the initial observation?

What is the independent variable?

What is the dependent variable?

What should Sponge Bob's conclusion be?

3. MARSHMALLOW MUSCLES



Larry was told that a certain muscle cream was the newest best thing on the market and claims to double a person's muscle power when used as part of a muscle-building workout. Interested in this product, he buys the special muscle cream and recruits Patrick and SpongeBob to help him with an experiment. Larry develops a special marshmallow weight-lifting program for Patrick and SpongeBob.

He meets with them once every day for a period of 2 weeks and keeps track of their results. Before each session Patrick's arms and back are lathered in the muscle cream, while Sponge Bob's arms and back are lathered with the regular lotion.

Which person is in the control group?

What is the independent variable?

What is the dependent variable?

What should Larry's conclusion be?

Time	Patrick	SpongeBob
Initial amount	18	5
After 1 week	24	9
After 2 weeks	33	17

4: MICROWAVE MIRACLE



Patrick believes that fish that eat food exposed to microwaves will become smarter and would be able to swim through a maze faster. He decides to perform an experiment by placing fish food in a microwave for 20 seconds. He has the fish swim through a maze and records the time it takes for each one to make it to the end. He feeds the special food to 10 fish and gives regular food to 10 others. After 1 week, he has the fish swim through the maze again and records the times for each.

What was Patrick's hypothesis?

Which fish are in the control group?

What is the independent variable?

What is the dependent variable?

Special Food Group
(Time in minutes/seconds)

Fish	Before	After
1	1:06	1:00
2	1:54	1:20
3	2:04	1:57
4	2:15	2:20
5	1:27	1:20
6	1:45	1:40
7	1:00	1:15
8	1:28	1:26
9	1:09	1:00
10	2:00	1:43

Regular Food Group
(Time in minutes/seconds)

Fish	Before	After
1	1:09	1:08
2	1:45	1:30
3	2:00	2:05
4	1:30	1:23
5	1:28	1:24
6	2:09	2:00
7	1:25	1:19
8	1:00	1:15
9	2:04	1:57
10	1:34	1:30

Look at the results in the charts. What should Patrick's conclusion be?



SPONGE BOB

Scientific Method

Controls and Variables - Part 2

KRUSTY KRABS BREATH MINTS

Mr. Krabs created a secret ingredient for a breath mint that he thinks will "cure" the bad breath people get from eating crabby patties at the Krusty Krab. He asked 100 customers with a history of bad breath to try his new breath mint. He had fifty customers (Group A) eat a breath mint after they finished eating a crabby patty. The other fifty (Group B) also received a breath mint after they finished the sandwich, however, it was just a regular breath mint and did not have the secret ingredient. Both groups were told that they were getting the breath mint that would cure their bad breath. Two hours after eating the crabby patties, thirty customers in Group A and ten customers in Group B reported having better breath than they normally had after eating crabby patties.

1. Which people are in the control group?
2. What is the independent variable?
3. What is the dependent variable?
4. What should Mr. Krabs' conclusion be?
5. Why do you think 10 people in group B reported fresher breath?



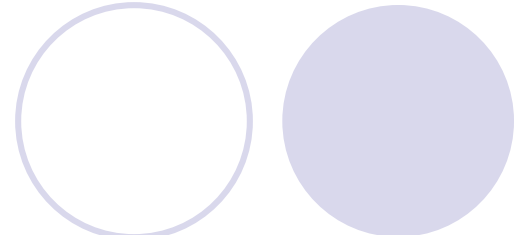


SPONGEBOB CLEAN PANTS



SpongeBob noticed that his favorite pants were not as clean as they used to be. His friend Sandy told him that he should try using Clean-O detergent, a new brand of laundry soap she found at Sail-Mart. SpongeBob made sure to wash one pair of pants in plain water and another pair in water with the Clean-O detergent. After washing both pairs of pants a total of three times, the pants washed in the Clean-O detergent did not appear to be any cleaner than the pants washed in plain water.

6. What was the problem SpongeBob wanted to investigate?
7. What is the independent variable?
8. What is the dependent variable?
9. What should Sponge Bob's conclusion be?



SQUIDWARD'S SYMPHONY

Squidward loves playing his clarinet and believes it attracts more jellyfish than any other instrument he has played. In order to test his hypothesis, Squidward played a song on his clarinet for a total of 5 minutes and counted the number of jellyfish he saw in his front yard. He played the song a total of 3 times on his clarinet and repeated the experiment using a flute and a guitar. He also recorded the number of jellyfish he observed when he was not playing an instrument. The results are shown in the chart.

10. What is the independent variable?
11. What is the dependent variable?
12. What should Squidward's conclusion be?
13. Are the results reliable? Why or why not?

Number of Jellyfish/Instrument

Trial	No Music	Clarinet	Flute	Guitar
1	5	15	5	12
2	3	10	8	18
3	2	12	9	7

SUPER BUBBLES

Patrick and SpongeBob love to blow bubbles! Patrick found some Super Bubble Soap at Sail-Mart. The ads claim that Super Bubble Soap will produce bubbles that are twice as big as bubbles made with regular bubble soap. Patrick and SpongeBob made up two samples of bubble solution. One sample was made with 5 oz. of Super Bubble Soap and 5 oz. of water, while the other was made with the same amount of water and 5 oz. of regular bubble soap. Patrick and SpongeBob used their favorite bubble wands to blow 10 different bubbles and did their best to measure the diameter of each one. The results are shown in the chart.



14. What did the Super Bubble ads claim?

15. What is the independent variable?

16. What is the dependent variable?

17. Look at the results in the chart.

a. Calculate the average diameter for each bubble solution.

Super Bubble = _____ cm Regular Soap = _____ cm

b. What should their conclusion be?

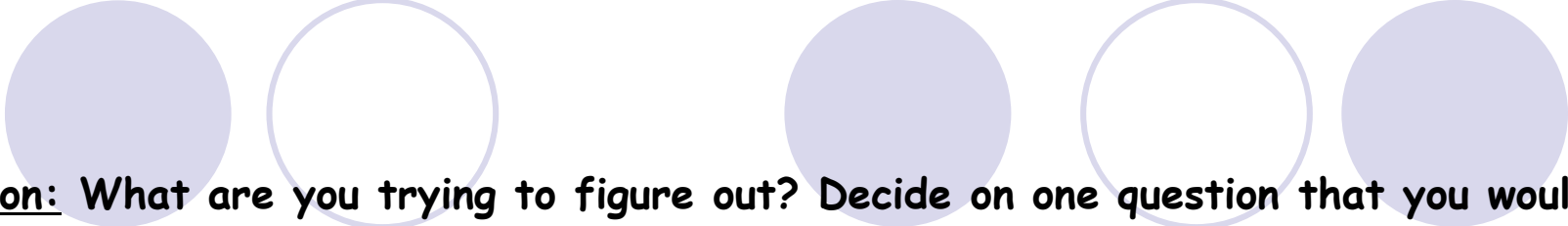
18. Are the results reliable? Why or why not?

Bubbles
(Diameter in centimeters)

Bubble	Super Bubble	Regular Soap
1	15	10
2	10	5
3	12	16
4	18	14
5	22	11
6	13	12
7	16	11
8	18	15
9	15	15
10	12	6

Guiding your inquiry

- Brainstorm the potential variables involved with pendulum lab and then come up the means to go about testing the impacts upon the period of the pendulum swing
- What factors determine the swing rate of the pendulum?
- Identify and test the
- factors that might affect the swing rate of a pendulum.
- You will test each factor (variable) separately, while
- controlling the other factors



Question: What are you trying to figure out? Decide on one question that you would like to find out about your pendulum swings.

Hypothesis: Remember to write your hypothesis in the correct Hypothesis formula. (IF + constants + independent variable + THEN +Dependent Variable + Prediction).

Control: What are keeping the same in this experiment?

Independent Variable: What are you testing in this experiment?

Dependent Variable: What do you think will be the result of your experiment?

Procedure/Method: Be sure to write detailed, step-by-step procedures to your experiment.

Observations and Data: Be sure to have tables and graphs in this section.

Analysis: What did you learn from your data?

Conclusions: Draw conclusions from your observations, data and analysis of your data. Was your hypothesis correct? What could you do differently in another experiment?



Lab Report Write-Up Outline

- Title
- Introduction
- Procedure
- Results
- Discussions/Conclusion