Name:

Science 9
M. Lam

Designing an Experiment

Block:

Read the “Designing an Experiment” document on the website.

1. Take notes on a separate piece of paper.
2. Record key definitions and the examples used in the reading on this page.

Key Term	Definition	Example
Experiment		
Hypothesis		
Variable		

Key Term	Definition	Example
Constant (Controlled Variable)		
Independent Variable		
Dependent Variable		
Control		

SCIENTIFIC METHOD

IDENTIFYING VARIABLES AND WRITING HYPOTHESIS NOTES AND PRACTICE

NOTES

1. Watch the video about scientific variables

2. Make notes below about the different types of variables

Independent Variable	Dependent Variable	Controlled Variables
Example from video:	Example from video:	Example from video:

3. Read the document "writing a testable hypothesis" on the website and make notes below:

What is a Hypothesis?	How is a Hypothesis written?

Practice

Write a hypothesis for each of the following problem statements. Identify the dependent and independent variables for each.

A. How does the amount of leaves on a tree affect how many birds will build nests in it?

Hypothesis: IF_____

THEN_____

BECAUSE_____

B. How does the acid level of a lake affect how many fish live there?

Hypothesis: IF_____

THEN_____

BECAUSE_____

C. How does the amount of milk you drink affect the strength of your bones?

Hypothesis: IF_____

THEN_____

BECAUSE_____

4. The strange case of BeriBeri

In 1887 a strange nerve disease attacked the people of the Dutch East Indies. The disease was beriberi. Symptoms of the disease included weakness and loss of appetite, and victims often dies of heart failure. Scientists thought the disease might be caused by bacteria. They injected chickens with bacteria from the blood of patients with beriberi. The injected chickens became sick. However, so did a group of chickens that were ***not*** injected with the bacteria.

One of the scientists, Dr Eljkman, noticed something: before the experiment, all the chickens had eaten whole-grain rice, but during the experiment, the chickens were fed polished rice. Dr Eljkman researched this interesting case and fourd that polished rice lacked thiamine, a vitamin necessary for good health.

A. State the Problem:

B. What is the original hypothesis? IF_____

THEN_____

BECAUSE_____

C. How was the hypothesis tested?

D. Should the hypothesis be supported or rejected based on the experiment?

E. What should the new hypothesis be and how would you test it?

Hypothesis: IF_____

THEN_____

BECAUSE_____

More Practice: Identifying Controls and Variables

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 stack of papers each group has made. Group A made 1.587 stacks and Group B made 2, 113 stacks of paper.

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 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.

Identify the:

1. Control group:
2. Independent variable:
3. Dependent variable:
4. What should Homer's conclusion be?

Bart believes that if mice eat food exposed to radiation they will become extra strong. He decides to perform an experiment by feeding 10 mice food that has been exposed to radiation for 10 seconds (Group A) and comparing these 10 mice to another 10 mice that ate food that had not been exposed (Group B). His test consisted of a heavy block of wood that blocked the mouse food. He found that 8/10 of the Group A mice were able to push the block away and 7/10 of the Group B mice were able to do the same.

Identify the:

1. Control group:
2. Independent variable:
3. Dependent variable:
4. What should Homer's conclusion be?

5. How could Homer's experiment be improved?

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

1. What is Krusty's hypothesis?

2. Control group:
3. Independent variable:
4. Dependent variable:
5. Explain whether the data supports Krusty's hypothesis.

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 50 customers (group A) eat his new breath mint after they finished eating a crabby patty. The other fifty (group B) also received a regular breath mint. Both groups were told that they were getting the breath mint that would cure their bad breath. Two hours after eating the crabby patties, 30 customers in group A and 10 customers in group B reported having better breath than they normally had after eating a crabby patty.

1. Which is 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 having fresher breath?

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 laundry soap she found at the Sail-Mart. SpongeBob made sure to wash one pair of pants in plain water and another pair in water thiwth the Clean-O detergent. After washing both pairs of pants a total of 3 times, the pants washed in the detergent did not appear to be any cleaner than the pants washed in plain water.

1. What was the problem SpongeBob wanted to investigate?

2. What is the Independent variable?
3. What is the Dependent variable?
4. What should SpongeBob's conclusion be?

Examples of flawed experimental designs

Identify the flaw(s) in each example.

Example 1: Does food colouring effect children's behaviour?

An experiment was set up to show what effect food colourings have on children. A group 20 of kids age 6-10 participated and was randomly put into two groups. One group would have a healthy food colour free afternoon snack (fruits and water) and the other group would have an afternoon snack full of food colourings (candy and soft drinks). They tested the children by getting them to do a drawing and some writing both before and after the food. The children with the food colour free food had very little change in their drawing/writing while those in the food colour group had a marked decrease in competency. In addition the kids in the food colour group were also described as bouncing off the walls.

Example 2: Do plants give off water vapour?

Forty bean plants, growing in pots, were covered one afternoon by individual glass containers and left in the laboratory overnight. Next morning, the inside of the lid of each container was found to be covered in droplets of a fluid which proved to be water.

Example 3: Is the supermarket's 'own brand' of washing powder as good as a nationally-advertised one?

Eric Triton bemoaned the fact that his wife Ariel insisted on washing his clothes with their local supermarket's own brand of powder. He was sure the well-known brand he saw performing miracles on television most evenings would do better. He therefore set out to prove as much.

Mr Triton decided to compare the effectiveness of the two products on what his wife called 'difficult' dirt: grass stains on white linen handkerchiefs. He bought 4kg of the well-known brand for 5.17 in their supermarket and noted that the same weight of the own-brand powder would have cost 4.47. He followed the instructions on the packets exactly, weighing out the same amount of powder and using their washing machine's programme for white linens. Mr Triton was aware of the need for an index of 'cleanliness' and therefore devised a subjective scale, ranging from 10 ('whiter than white') to 0 (the starting level of dirtiness).

Mr Triton's belief was substantially confirmed. He scored the handkerchief cleaned by the national brand an impressive 8, whereas the own-brand powder only managed 7. Triumphantly, he reported the outcome to his wife. Mrs Triton, however, was unimpressed. She pointed out to her husband that there were several flaws in his experiment and convinced him that the outcome was 'not proven'.

SCIENTIFIC METHOD

DESIGNING AND CONDUCTING EXPERIMENTS

1. Go to the following page: www.biologycorner.com/worksheets/scientific_method_plant_exp.html

2. Follow the instructions and answer the following questions:

A. **Write your hypothesis**
(should be in a complete sentence and describe what exactly is being tested. Use your "IF→THEN→BECAUSE" statement)

Dependent variable:

Independent variable:

B. Describe your control group and your experimental group with regards to what variables were used in each.

	Type of Flower	Type of Pot	Type of Soil	Detergent?
Control group				
Experimental group				

C. Create a data table to show your results. This table should include an average for your experimental and control group.

Control group			
Experimental group			

D. Explain why you need a control group.

E. Explain why an average is needed to compare your results.