Design Experiments and Control Variables

Name_____ Date_____

Key Vocabulary

controlled dependent design experiment independent variable

Part I: Design Experiments

Directions: Three students are each going to do a science experiment. Read the variables that each student plans to use. Then briefly explain how the student could design a science experiment using those variables.

1. **Stacy's experiment**

   Independent variable: type of food placed on sheet of paper (such as chips, cookies, and cheese)

   Dependent variable: size of grease stain left on paper by each food

   Controlled variables: type of paper used; amount of time each object is left on paper; location of testing; how to measure size of each stain

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2. Javi's experiment

Independent variable: distance that flashlight is held away from object

Dependent variable: length of shadow made by object

Controlled variables: type of flashlight used; type of object used; surface on which shadow will appear; amount of light allowed into testing room; angle of flashlight

3. Tina's experiment

Independent variable: type of material water will flow through (soil, pebbles, or sand)

Dependent variable: volume of water that drains through each material into the tray

Controlled variables: size of cups and tray; level of material in cups; amount of time to let water drain through each material before measuring volume of water

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Part II: Control Variables

Directions: Two students each did a science experiment. They had trouble drawing conclusions. Read the description of each experiment. Then explain how you would help each student control the variables.

1. **Lawrence's experiment**

   Lawrence wanted to know whether tomato plants grow better with plain water or with sugary water. He gave one tomato plant 50 mL of plain water every day and gave the other tomato plant 100 mL of sugary water every day. After one week, the plant with sugary water was taller, but Lawrence still wasn't sure which type of water was better for tomato plants. How would you help Lawrence control the variables better?

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2. **Kira's experiment**

   Kira wanted to know whether a person's heart rate is fastest after riding a bike, playing basketball, or jogging. She asked Marty to ride a bike for 10 minutes, Gerda to play basketball for 10 minutes, and Carmen to jog for 10 minutes. After the 10 minutes passed, she measured Marty's pulse for one minute, then Gerda's, and then Carmen's. But Kira still wasn't sure which type of exercise makes a person's heart beat the fastest. How would you help Kira control the variables better?

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Design Experiments and Control Variables Answer Sheet

Part I: Design Experiments

Responses will vary but should accurately incorporate all variables provided on the student sheets. Examples are provided.

1. **Stacy's experiment:** Stacy could choose four kinds of fatty foods and place them each on white construction paper for 30 minutes. Then she could use a ruler to measure the widest part of the grease stain for each food and compare the results.
2. **Javi's experiment:** Javi could choose one object, such as a textbook, and stand it up on a desk. He could turn off the lights in the room and shine a flashlight on the book from 1 foot, 2 feet, and 3 feet away, but always from the same angle. Then he could measure the shadow length on the desk each time.
3. **Tina's experiment:** Tina could choose three identical paper cups and poke a similar hole in the bottom of each cup. She could fill each cup to the same level with a different material—soil, sand, or pebbles. Then she could pour 1 cup of water into one cup at a time and hold it over the tray for one minute. Finally, she could measure the amount of water that drained into the tray from each cup.

Part II: Control Variables

Responses will vary but should effectively resolve one or more problems with controlling variables in each experiment. Examples are provided.

1. **Lawrence's experiment:** Lawrence should have given each plant the same amount of each type of water. Otherwise, he can't be sure whether it was the type or the amount of water that made one plant grow more than the other.
2. **Kira's experiment:** Kira should have had each person try each activity. Otherwise, she can't be sure whether the pulse rates changed because of the person or the kind of activity. She also should have come up with a way to measure each person's pulse right after completing the activity, or else the person she measured last would have had more time to rest than the first or second person.