

PENDULUM ACTIVITY DIRECTIONS

To complete the teacher demonstration of the pendulum activity you must have the following materials: a length of yarn or twine 18" long, a large paper clip, a penny, and a stopwatch or watch with a second hand. For the student pendulum activity you should also have extra lengths of yarn or twine, scissors and rulers or yardsticks.

1. Tie the large paper clip to one end of the 18" length of yarn or twine.
2. Place the penny in the paperclip so that it stays in place.
3. Holding the other end of the yarn in one hand, raise the penny and clip end up level with the other hand and release the penny and clip. Be careful to make sure that it does not have any interference as it swings. Hold the hand that is holding the end of the yarn very still so as not to add extra motion to the pendulum.
4. Using a stopwatch or a watch with a second hand, time the swinging motion for 15 seconds. Count the number of complete swings that the pendulum makes during that time. A complete swing is one full back and forth motion.
5. Repeat this procedure several more time.

On average a pendulum 18" long should produce 12 complete swings in 15 seconds.

Have students repeat the procedure and encourage them to change such variables as the length of the string, or the weight on the end of the pendulum and predict the results that they will get. Remind them to keep the time constant at 15 seconds.

Students will discover that the longer the string on the pendulum, the fewer complete swings will be completed in 15 seconds. The shorter the string is, the more complete swings will occur. Changing the amount of weight on the end of the pendulum will not affect the number of complete swings that it makes.

VEXING VARIABLE WORKSHEET

In an experiment, a VARIABLE is the factor that can be changed to see what will happen. Scientists work with two types of variables. They are the INDEPENDENT VARIABLE and the DEPENDENT VARIABLE. The independent variable is the one that is deliberately changed by the investigator. The dependent variable is a factor that might be affected as the result of the change. Remember, a good experiment must also have a CONTROL, which is a factor that does not change. It helps make sure the results are reliable.

For each experiment below, identify the independent variable, the dependent variable, and the control.

1. Groups of 6th, 7th and 8th grade students were given the same puzzle to work. They were timed to see how long it took each group to complete the puzzle.

Independent variable _____

Dependent variable _____

Control _____

2. A study was done to see if different composition of skateboard wheels affected the performance of the board. The same board, the same rider and the same course were used. Only the wheels were different.

Independent variable _____

Dependent variable _____

Controls _____

3. Groups of students were given different types of paper to construct paper airplanes. They all used the same pattern for their planes. The planes were tested to see which ones would fly the greatest distance.

Independent variable _____

Dependent variable _____

Control _____

4. An experiment was done to see which colored sand would heat up the most when placed in the sun. The sand samples were white, red, green, and black. All samples were the same amount, placed in identical containers, left in the sun the same amount of time, and the temperature was measured with the same thermometer.

Independent variable _____

Dependent variable _____

Controls _____

VEXING VARIABLES ANSWER KEY

1. Groups of 6th, 7th and 8th grade students were given the same puzzle to work. They were timed to see how long it took each group to complete the puzzle.

Independent variable STUDENTS

Dependent variable TIME IT TOOK TO COMPLETE THE PUZZLE

Control PUZZLE

2. A study was done to see if different composition of skateboard wheels affected the performance of the board. The same board, the same rider and the same course were used. Only the wheels were different.

Independent variable WHEELS

Dependent variable PERFORMANCE OF THE BOARD

Controls BOARD,RIDER,COURSE

3. Groups of students were given different types of paper to construct paper airplanes. They all used the same pattern for their planes. The planes were tested to see which ones would fly the greatest distance.

Independent variable PAPER

Dependent variable DISTANCE PLANE FLEW

Control SAME PATTERN

4. An experiment was done to see which colored sand would heat up the most when placed in the sun. The sand samples were white, red, green, and black. All samples were the same amount, placed in identical containers, left in the sun the same amount of time, and the temperature was measured with the same thermometer.

Independent variable DIFFERENT COLORED SAND SAMPLES

Dependent variable TEMPERATURE OF THE SAND

Controls SAME CONTAINERS, SAME TIME IN THE SUN, SAME

THERMOMETER

KEY CONCEPTS AND VOCABULARY LIST

VARIABLE - A changeable factor in an experiment.

INDEPENDENT VARIABLE - Sometimes called the manipulated variable, is the factor in an experiment that is deliberately changed.

DEPENDENT VARIABLE - Sometimes called the responding variable, is the factor or condition that might be affected as a result of the change.

CONTROL - A variable that does not change. The standard for comparison in an experiment.

EXAMPLE: A scientist wanted to see which brand of plant food would make tomato plants grow best. She used 9 of the same variety of tomato plants. All of the plants were the same size, grown in the same size containers, with the same type and amount of soil. The plants were exposed to the same amount of sunlight and darkness, the same temperature, and they were watered the same amount. The only difference was the type of plant food that they were given. Three plants were given no food at all, 3 were given Brand A food, and 3 were given Brand B food. The plants were measured on day 1, day 7, and day 14. The scientist was then able to determine that the plants fed Brand B had grown the most.

Independent variable - Plant Food

Dependent variable - Rate of growth

Controls - Same plants grown under the same conditions except for the plant food.

Discussion questions:

1. Why was it necessary to have more than one plant for each group? This allows you to determine the average rate of growth of the plants.
2. Why is it necessary to have a set of plants that received no plant food? These plants serve as a control group.
3. Why does a good experiment only test one variable at a time? This is the only way that you can be sure that you are making the correct assumptions as to the cause of a change in the outcome.

VARIABLE CHECKUP

Read through the following experiments and identify the INDEPENDENT and the DEPENDENT variables.

1. You want to see if plants grow better when they are exposed to classical music. You take 4 identical plants, potted in the same containers, under the same conditions. The only difference is that 2 plants will be exposed to classical music as they grow. The others will grow exposed to no music. After 2 weeks you compare the grow rates.

Independent Variable _____

Dependent Variable _____

2. You want to see which brand of battery really does last longer. You place Brand A in a flashlight and turn it on. You record how long it takes for the battery to run out. Then you repeat the experiment with Brand B.

Independent Variable _____

Dependent Variable _____

3. You want to test and see if people choose food based on its color. You take several containers of plain cream cheese and mix them with food coloring so that you have one red sample, one blue one, one green one, and a plain white one. You spread plain saltine crackers with the different samples of cream cheese. Ask 10 different people to pick a cracker to eat. Record which color sample was picked the most.

Independent Variable _____

Dependent Variable _____

4. You want to see if the length of a pendulum affects the number of swings it will make in 15 seconds.

Independent Variable _____

Dependent Variable _____

5. Design Your Own Experiment

Write out a short description of an experiment. You may come up with one on your own or you may use one from your textbook or another source. State the Independent and Dependent variables of your experiment.

VARIABLE CHECKUP KEY

1. You want to see if plants grow better when they are exposed to classical music. You take 4 identical plants, potted in the same containers, under the same conditions. The only difference is that 2 plants will be exposed to classical music as they grow. The others will grow exposed to no music. After 2 weeks you compare the grow rates.

Independent Variable MUSIC

Dependent Variable GROWTH RATE

2. You want to see which brand of battery really does last longer. You place Brand A in a flashlight and turn it on. You record how long it takes for the battery to run out. Then you repeat the experiment with Brand B.

Independent Variable DIFFERENT BRANDS OF BATTERIES

Dependent Variable LENGTH OF TIME THE FLASHLIGHT WORKS

3. You want to test and see if people choose food based on its color. You take several containers of plain cream cheese and mix them with food coloring so that you have one red sample, one blue one, one green one, and a plain white one. You spread plain saltine crackers with the different samples of cream cheese. Ask 10 different people to pick a cracker to eat. Record which color sample was picked the most.

Independent Variable COLOR OF THE CREAM CHEESE

Dependent Variable THE SAMPLE COLOR PICKED MOST OFTEN

4. You want to see if the length of a pendulum affects the number of swings it will make in 15 seconds.

Independent Variable LENGTH OF STRING

Dependent Variable NUMBER OF SWINGS

5. Design Your Own Experiment

Write out a short description of an experiment. You may come up with one on your own or you may use one from your textbook or another source. State the Independent and Dependent variables of your experiment.

ANSWERS WILL VARY

VEXING VARIABLES CHECKUP

Name: _____

Teacher: _____

Date : _____

Title of Work: _____

	Criteria				Points
	1	2	3	4	
Student will be able to pick out the INDEPENDENT VARIABLE from 4 different experiments.	No Understanding or Knowledge . The response is characterized by the following: no response, completely incorrect response, or response conveys no understanding of the term as it relates to the activity.	Minimal Knowledge or Understanding. The INDEPENDENT VARIABLE was identified in 1 of 4 experiments.	Partial Knowledge and Understanding. The INDEPENDENT VARIABLE was identified correctly in 2 or 3 of the experiments.	Full Knowledge and Understanding. The response is characterized by the correct identification of the INDEPENDENT VARIABLE in all 4 experiments.	_____
Students will be able to pick out the DEPENDENT VARIABLE from 4 different experiments.	No Understanding or Knowledge . The response is characterized by the following: no response, completely incorrect response, or response conveys no understanding of the term as it relates to the activity.	Minimal Knowledge or Understanding. The DEPENDENT VARIABLE was identified in 1 of 4 experiments.	Partial Knowledge and Understanding. The DEPENDENT VARIABLE was identified correctly in 2 or 3 of the experiments.	Full Knowledge and Understanding. This response is characterized by the correct identification of the DEPENDENT VARIABLE in all 4 experiments.	_____
Students will write out a description of an experiment and identify the INDEPENDENT VARIABLE in the experiment.	No Knowledge or Understanding The response is characterized by one or more of the following: No response Completely incorrect response The response conveys no understanding of the idea or concept needed to answer the question.	Minimal Knowledge The response show that the student has some inkling of the knowledge or understanding of the term.	Partial Knowledge and Understanding This response is pretty good but isn't necessarily complete. The response is characterized by one or both of the following: partially correct answer, or Response conveys some but not complete understanding of the concept needed	Full Knowledge and Understanding This response is characterized by one or more of the following: Completely correct answer Response conveys full understanding of the term as it relates to the experiment. Response conveys full understanding of the idea or	_____

			to answer the question.	concept needed to answer the question.	
Students will write out a description of an experiment and identify the DEPENDENT VARIABLE in the experiment.	No Knowledge or Understanding The response is characterized by one or more of the following: No response A completely incorrect response Response conveys no understanding of the concept needed to answer the question.	Minimal Knowledge and Understanding This response shows that the student has some inkling of knowledge or understanding of the term.	Partial Knowledge and Understanding This response is pretty good, but is not necessarily complete. The response is characterized by one or both of the following: partially correct answer, or response conveys some but not complete understanding of the concept needed to answer the question.	Full knowledge and Understanding This response is characterized by one or more of the following: Completely correct answer. Response conveys full understanding of the term as it relates to the experiment. Response conveys full understanding of the concept needed to answer the question.	—
					—
				Total---->	—

Teacher Comments: