Class Question:

What variables affect the direction mealworms travel?
**VOCABULARY**

**Science:** The study of the material world using human reason. The scientific method is the way humans reason and apply logic to data to help gain knowledge of the world.

- **Observation:** A description using your five senses. This could include contents, mass, size, color, temperature, smell, texture …
- **Opinion:** Something you believe or feel. Not a fact or observation.
- **Inference:** A guess based on past experiences.
- **Testable Question:** A question for which an experiment can be designed to answer.
- **Non-Testable Question:** A question for which an experiment cannot be designed to answer. For example, questions involving things that cannot be measured/observed or things that are not well defined/opinions.
- **Experimental Set-Up:** The materials, changing variable, and controls that are needed for an experiment.
- **Experiment:** A test or trial to discover something unknown.
- **Procedure:** A set of steps to conduct an experiment.
- **Controls:** The variables that are not changed in an experiment.
- **Changing Variable (Independent Variable):** The variable that is purposely changed in an experiment.
- **Results/Data (Dependent Variable):** The measurements/observations of the experiment, which are influenced/determined by the changing variable.
- **Prediction:** What you expect to happen based off of previous measurements/observations.
- **Scientific Practices:** A series of activities that scientists participate in to both understand the world around them and to communicate their results with others. (The specific practice worked on in this module is identifying testable questions.)
- **Technique:** A method for a specific task.
- **Reproducibility:** The ability to duplicate data from one trial to the next.
- **Median:** The middle number of a given set of numbers listed in increasing order.
- **Maximum:** The largest value in a given set of numbers.
- **Minimum:** The smallest value in a given set of numbers.
- **Compartment:** A section of something.
- **Habitat:** The natural home or environment of an animal, or plant.
- **Mealworm:** A type of insect.
- **Species:** A specific type of animal.
- **Adapt:** The process by which a plant/animal, over many generations, becomes better fit to its environment.
- **Migration:** When animal move from one place to another during certain times of the year.
- **Extinction:** The dying out of a species.
SCIENTIFIC PRACTICES

Testable Questions

Circle TESTABLE if the question can be tested by science. Circle NOT TESTABLE if the question cannot be tested by science.

1. What is the length of a brown bear’s front paw? **Testable** **Not Testable**
2. Do bears like to swim? **Testable** **Not Testable**
3. Are black bears smarter than brown bears? **Testable** **Not Testable**
4. How many brown bears are at the Santa Barbara Zoo? **Testable** **Not Testable**
5. What type of bear is the most fearsome? **Testable** **Not Testable**
6. How much honey does Winnie the Pooh eat in 24 hours? **Testable** **Not Testable**
7. In one day, what is the total amount of berries that all brown bears eat? **Testable** **Not Testable**
8. Are polar bears fast? **Testable** **Not Testable**
9. Is putting panda bears on the endangered species list important? **Testable** **Not Testable**
10. Can a mother bear find her cub among 6 other cubs? **Testable** **Not Testable**
Experimental Considerations:

1. You will only have access to the materials on the materials page.
2. You will run an odd number of trials.
3. Each trial may take no longer than 5 minutes.
4. You will only get one pillbox in which you may do two trials at the same time.
5. No more than two versions of the changing variable can be used.
6. You may only have a food or a bedding, but not both. For example, if your changing variable is food type, your bedding type must be no bedding.
7. If you are changing the light amount and are using a bedding or a food, the bedding/food must be half-filled in all three compartments.

Changing Variable (Independent Variable): ____________________________

Discuss with your group how you think your changing variable will affect the direction mealworms travel.

QUESTION

Question our group will investigate:

• If we change the ____________________________,
  insert changing variable (independent variable)
  what will happen to the ____________________________,
  insert what you are measuring (dependent variable)
  ____________________________?

Fill out the materials page with your SciTrek volunteer before moving onto the experimental set-up.
EXPERIMENTAL SET-UP

Changing Variable: ______________________ / __________ and ____________

Controls (variables you will hold constant):
Determine the variables that you will hold constant and indicate the specific value you will use in all your trials (control/value, example: insect type/mealworm).

<table>
<thead>
<tr>
<th>Insect Type</th>
<th>Mealworm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Determine the values of your changing variable (example: food type) from the materials page and write the values (example: cookies) for what you will put in each compartment of the pillbox at the start of the experiment. Draw an “X” in any compartment that will not be used.

<table>
<thead>
<tr>
<th>Su</th>
<th>M</th>
<th>Tu</th>
<th>W</th>
<th>Th</th>
<th>F</th>
<th>Sa</th>
</tr>
</thead>
</table>

If your changing variable is not light amount
• The following days should have the same materials
  o Sunday and Thursday
  o Tuesday and Saturday

If your changing variable is light amount
• Sunday and Saturday will be dark
• Tuesday and Thursday will be light

Prediction:
I predict the ____________________________ changing variable
the mealworms will travel to is ____________________________ value of changing variable.
**TECHNIQUE**  
*Median*

When running multiple trials in an experiment it is necessary to find one number to represent all of the data. The middle number, also known as the median number, is sometimes used to represent all the data. To find the median, first place all of the numbers from each trial in increasing order, second circle the middle number.

<table>
<thead>
<tr>
<th>Bedding:</th>
<th><strong>Final Number of Mealworm:</strong> (In Increasing Order)</th>
<th><strong>Median:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>3, 2, 5</td>
<td></td>
</tr>
<tr>
<td>Rocks</td>
<td>3, 5, 2, 5, 4</td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td>15, 19, 17</td>
<td></td>
</tr>
<tr>
<td>Dirt</td>
<td>13, 10, 11, 17, 13</td>
<td></td>
</tr>
<tr>
<td>Wood Chips</td>
<td>12, 9, 10, 10, 11</td>
<td></td>
</tr>
</tbody>
</table>
PROCEDURE

1. ____________________________________________________________

2. ____________________________________________________________

3. ____________________________________________________________

4. ____________________________________________________________

5. ____________________________________________________________

6. ____________________________________________________________
RESULTS

Table

Fill out the chart for each of your compartments in your pillbox. For the variables that remain constant, write the value in compartment A and then draw an arrow through each box to indicate the variable is a control.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Compartment A (Su and Th)</th>
<th>Compartment B (M and F)</th>
<th>Compartment C (Tu and Sa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insect Type:</td>
<td>Mealworm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Type:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedding Type:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light Amount:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Container Type:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data</th>
<th>Compartment A</th>
<th>Compartment B</th>
<th>Compartment C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Measurements:</td>
<td>Number of Mealworms:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su(1)</td>
<td>M(1)</td>
<td>Tu(1)</td>
<td></td>
</tr>
<tr>
<td>Th(2)</td>
<td>F(2)</td>
<td>Sa(2)</td>
<td></td>
</tr>
<tr>
<td>Su(3)</td>
<td>M(3)</td>
<td>Tu(3)</td>
<td></td>
</tr>
<tr>
<td>Su(4)</td>
<td>M(4)</td>
<td>Tu(4)</td>
<td></td>
</tr>
<tr>
<td>Th(5)</td>
<td>F(5)</td>
<td>Sa(5)</td>
<td></td>
</tr>
<tr>
<td>Put 1-5 in Order:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The independent variable is the changing variable and the dependent variables are the final measurements.
My experiment shows ____________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
I acted like a scientist when__________________________________________________________

________________________________________________________________________
________________________________________________________________________

TIE TO STANDARDS

1. From the class experiments, write 2 factors you would expect to find in a mealworm’s ideal habitat.

   a. ____________________________  b. ____________________________

2. What would happen if the climate changed where the mealworms lived?

   a. __________________________________________________________

3. Overall, what are the three things that species can do when the environment changes?

   a. ____________  b. ____________  c. ____________
4. PANDA
   a. What were the environmental changes that caused the panda’s habitat to decrease?
      __________________________________________________________

   b. What type of changes were these? POSITIVE NEGATIVE

   c. What was the response of the pandas to this environmental change? ______

   d. Can this response occur within a panda’s lifetime? YES NO

5. LOCUST
   a. What was the environmental change that caused the locust’s habitat to increase?
      __________________________________________________________

   b. What type of changes were these? POSITIVE NEGATIVE

   c. What was the response of the locusts to this environmental change? ______

   d. Can this response occur within a locust’s lifetime? YES NO

6. a. What is it called when animals only move temporarily to another location?
       __________________________________________________________

   b. What is an example of an animal that does this? ______________

   c. What are possible reasons animals may do this? __________________
       ___________________________ ___________________________

   d. What is the response of migrating animals to environmental changes? ______

   e. Can this response occur within an animal’s lifetime? YES NO
7. CAMEL
   a. What does burning fat provide for an animal? ________________
   b. This can be used by the animal as a substitution for ________________ and ________________.
   c. Would it be a problem if a camel stored fat all over its body? YES NO
   d. What is stored in a camel’s hump? ________________________________
   e. What was the response of the camels to the environmental conditions? ______
   f. Can this response occur within a camel’s lifetime? YES NO

8. GIRAFFE
   a. List two other animals that live in this environment. ________________________________ and ________________________________
   b. What do the animals listed above eat? ________________________________
   c. Is there competition for this food source? YES NO
   d. What other type of food might giraffes eat? ________________________________
   e. What was the response of the giraffes to the environmental conditions? ______
   f. Can this response occur within a giraffe’s lifetime? YES NO
9. SABER-TOOTHED CAT

a. What adaptation did the saber-toothed cat have to live in its environment? ________________________________

b. What did they eat? ________________________________

c. What kept the saber-toothed cat from catching smaller prey? _________________

d. What was the response of the saber-toothed cats to environmental changes? ____________________________________________________________

e. Could this response occur within a saber-toothed cat’s lifetime? YES NO

10. LITTLE SWAN ISLAND HUTIA

a. Where did the hutia live? ________________________________

b. The two environmental changes to the island were: ________________________________ and ________________________________

c. Adaptations take ________________________________ and must occur over many ________________________________ of a species.

d. Are large or small habitat ranges beneficial for survival of species? LARGE SMALL

e. What was the response of the hutias to environmental changes? _________________

f. Could this response occur within a hutia’s lifetime? YES NO

11. 

a. What is it called when an entire species dies off? ________________________________

b. Does this usually occur over one generation? YES NO
EXTRA PRACTICE

Questions

Circle TESTABLE if the question can be tested by science. Circle NOT TESTABLE if the question cannot be tested by science. If the question is NOT TESTABLE change (revise) the question to be something that is testable.

1. How many hours does a giraffe sleep in a day? Testable Not Testable

Revision: ____________________________________________?

2. How fast can Wonder Woman run? Testable Not Testable

Revision: ____________________________________________?

3. Is learning how to write in cursive valuable? Testable Not Testable

Revision: ____________________________________________?

4. What is the total number of cups of coffee that people in the United States drink in one week? Testable Not Testable

Revision: ____________________________________________?

5. Is soap easy to pour? Testable Not Testable

Revision: ____________________________________________?

6. What species of animal has the thickest fur? Testable Not Testable

Revision: ____________________________________________?

7. Do ants like sugar? Testable Not Testable

Revision: ____________________________________________?
WORD SEARCH

Adapt
Bedding
Compartment
Extinction
Food

Habitat
Light
Mealworm
Median
Migration

Move
Observation
Reproducibility
Species
Testable Question
SciTrek is an educational outreach program that is dedicated to allowing 2nd-12th grade students to experience scientific practices first hand. SciTrek partners with local teachers to present student-centered inquiry-based modules that not only emphasize the process of science but also specific grade level NGSS performance expectations. Each module allows students to design, carry out, and present their experiments and findings.

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