

Investigations With Mealworms: What Do They Prefer? Part 1: Wet or Dry?

You have observed mealworms and recorded facts you noticed about them. We have also begun to think about what new questions we would like to explore about them using investigation. Using your lab-report forms, you and your partner will follow the procedures for a controlled experiment to find out if mealworms prefer a wet or dry environment. For each trial, you should have a drawing that is labeled. You should also write your observations about what happened each time. We will use each team's data to compile class data.

Your conclusion and discussion should show what you learned from the data and tell if the results support or refute your hypothesis. Remember that all experiments with live animals should not harm the animals.

Investigations With Mealworms: What Do They Prefer? Part 1: Wet or Dry?

Suggested Grade Span

3–5

Task

You have observed mealworms and recorded facts you noticed about them. We have also begun to think about what new questions we would like to explore about them using investigation. Using your lab-report forms, you and your partner will follow the procedures for a controlled experiment to find out if mealworms prefer a wet or dry environment. For each trial, you should have a drawing that is labeled. You should also write your observations about what happened each time. We will use each team's data to compile class data.

Your conclusion and discussion should show what you learned from the data and tell if the results support or refute your hypothesis. Remember that all experiments with live animals should not harm the animals.

Big Ideas and Unifying Concepts

Cause and effect
Form and function
Interdependence
Systems

Life Science Concepts

Evolution, diversity and adaptations
Populations and ecosystems
Regulation and behavior
Reproduction and heredity
Structure and function

Mathematics Concepts

Data collection, organization and analysis
Graphs, tables and representations
Measurement
Probability

Exemplars

Time Required for Task

One or two 45 minute class sessions (after introductory lessons).

Context

These investigations with mealworms are part of a unit of study on animal behavior for our fourth graders. We begin the unit with students identifying classroom objects that are either living or nonliving and then identifying the six characteristics of living things in order to classify them. Prior to conducting investigations, students are given time to observe mealworms. They watch to see how they move and how they interact. Additionally, they learn how to handle them respectfully and safely. Students have also been introduced to our lab report form and have discussed how to conduct a controlled experiment. We provide the procedures and materials list for our fourth graders when they are first learning how to conduct an investigation. These early investigations provide models for later ones that students may generate.

What the Task Accomplishes

Students will use their science skills for observing mealworms in order to collect and record data. A model sentence is given to help students use a prediction, based on prior knowledge, to generate their hypotheses. After compiling class data tables, they will analyze data to draw conclusions, communicate findings and make connections to what they have already learned.

The lab report form includes indicators (written along the left side of the page) to help students understand what the performance expectations are for each part of the lab. Using the same form in grades four through eight also helps teachers to track students' growth over time. The small box with each indicator allows the teacher to check if evidence is provided.

How the Student Will Investigate

Students work in pairs or trios to conduct their investigations. Each individual records his/her own data and observations. Procedures and materials are provided, but students must review the information together and set up their controlled experiment with minimal help from the teacher. Students cut paper towels in two half circles, placing them in a petri dish. A drop of water is put on one side and the other is left dry. Two or three mealworms are placed in the center of the dish and timed for 30 seconds. (Teachers can either time for the entire class, or one student can be the timer for each team.) Observations are recorded and the next trial is conducted until three trials are completed.

Once all data are collected and recorded, the teacher compiles a table with class data (totals) before students write up their discussion, conclusions and reflections on what they learned. This sometimes generates discussions about why some data may be different from what most students found and possible sources of error during the investigations. Students end by writing a new testable question to explore.

Exemplars

Interdisciplinary Links and Extensions

Science

Students can conduct wet/dry investigations with other small animals or begin to list other possible testable questions for mealworms. (NOTE: Mealworms can detect odors, can sense light and have an innate turning response that helps them find their shelters again. They are attracted to dampness but can die in even small amounts of water. All of these facts could provide testable questions for students to explore.

Language Arts/Movement

Students could use their observations about how mealworms move to create acrostic poems, flip books, or poems using alliteration and/or onomatopoeia as literary devices.

Mathematics

Students could build simple mazes, timing how long it takes and finding averages for how long it takes mealworms to get through, finding averages and graphing the results.

Teaching Tips and Guiding Questions

Providing time for observing mealworms before conducting investigations is important in teaching students to understand mealworms' "normal" behavior, so students can recognize when the mealworms act differently. It is also essential to discuss the ethics of using live animals for science experiments.

Some possible questions to guide investigations might include:

- How will you control the experiment to find out what mealworms prefer? What variables will remain the same? What variable will you measure?
- Is this a fair test?
- What is a stimulus? What is a response?
- What other science vocabulary will you use to explain what you learned?
- How will you be sure to treat the mealworms safely and carefully so that no harm comes to them?
- What do you already know about mealworms from your observations?
- What questions will your investigation answer?
- What is your prediction?
- Have you given the mealworms a CLEAR choice in this investigation?
- Did you conduct at least three trials?
- Did you note at least three details in your recorded observations?
- Did anything surprise you during the investigation?
- How can you explain different results found in the class data?

Exemplars

Concepts to be Assessed

(Unifying concepts/big ideas and science concepts to be assessed using the Science Exemplars Rubric under the criterion: Science Concepts and Related Content)

Life Science – Structure and Function; Reproduction and Heredity: Students understand that all organisms are living systems, that each distinct structure has a set function that serves the organism, and that species acquire their unique characteristics through biological adaptations. Students understand what to look for (size, shape, texture, structure, movement, etc.) when observing organisms and use prior knowledge to classify and compare living organisms. Students observe that each organism has different structures that serve different functions in growth, survival, and reproduction. Students understand the characteristics of mealworms by describing some of their needs, aspects of their immediate environments, some of their structures, and the effects of changes to their environment.

Scientific Method: Students use the terms *stimulus*, *response*, *controlled experiment*, and *variable* appropriately and are able to observe, explain, and describe cause-effect relationships with some justification, using data and prior knowledge when variables are controlled. (cause and effect)

Life Science – Regulation and Behavior: Students know that all organisms have basic needs – air, water, food. Animals depend on plants. Some eat plants and others eat animals that eat plants. They can survive only in an environment in which needs can be met. Different environments support different types of organisms.

Life Science – Evolution, Diversity and Adaptations: Students see that species acquire many of their unique characteristics including structures, behaviors, or physiology, through biological adaptation, that enhances survival and reproductive success.

Life Science – Populations and Ecosystems: Students identify some patterns of similarities and differences and recognize mealworms' interdependence with other living things. (systems and interdependence)

Mathematics: Students identify trends and patterns and represent and analyze data appropriately. Students explore probability and use tables to show how values of one variable are related (increase, decrease, etc.) to values of another. Numerical data and precise measurements are used in describing events, answering questions, providing evidence for scientific explanations and challenging misconceptions.

Exemplars

Skills to be Developed

(Science process skills to be assessed using the Science Exemplars Rubric under the criteria: Scientific Procedures and Reasoning Strategies, and Scientific Communication Using Data)

Scientific Method: Observing, predicting/hypothesizing, collecting and recording data, drawing conclusions, communicating findings, challenging misconceptions and raising new questions.

Other Science Standards and Concepts Addressed

Scientific Method: Students describe, predict, investigate and explain phenomena. Students control variables.

Scientific Theory: Students look for evidence that explains why things happen and modify explanations when new observations are made.

Life Science – Structure and Function; Reproduction and Heredity: Students describe and group animals by what they eat and where they live. Students understand that living things are found almost everywhere in the world and are interdependent and that each plant or animal has different structures that serve different functions in growth, survival and reproduction. Students understand the characteristics of organisms (needs, environments, structures and behaviors), see patterns of similarity and differences among living organisms, and recognize the interdependence of all systems that support life.

Life Science – Evolution, Diversity and Adaptations: Students understand that many characteristics of organisms are inherited from parents and that others are a result of interactions with the environment. Species acquire many of their unique characteristics through biological adaptation, which includes changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment. Organisms can only survive in environments that can meet their needs. Organisms have distinct structures that have developed to help them function and survive.

Life Science – Regulation and Behavior: Students understand that an organism's behavior evolves through adaptation to its environment. How a species moves, obtains food, reproduces and responds to danger are based on the species' evolutionary history.

Communication: Students use verbal and nonverbal skills to express themselves effectively.

Suggested Materials

Students are provided with scissors, paper towels (to be cut to fit the dishes), water, petri dishes, two to three mealworms, clock/timer with a second hand, and lab report forms for recording. Refer to the worksheets on pages 9–12.

Investigations With Mealworms: What Do They Prefer? Part 1: Wet or Dry?

Exemplars

Possible Solutions

A hypothesis showing a prediction about which side (wet/dry) will be chosen and a possible reason why (based on earlier observations) should be stated. Variables to be kept constant and the variable to be measured are stated. For each trial, there should be a drawing that is labeled (wet and dry sides; 1st, 2nd and 3rd trials; mealworms). Two or three mealworms are used in each trial. Students might provide a key for labels as well. Observations about what happened each time should include at least three details.

The class data table should be accurate and used to write a conclusion and discussion, including whether the results support or refute the hypothesis.

Task-Specific Assessment Notes

Novice

This student's solution is lacking in clarity and completeness, although the investigation is finished. The student attempts to draw from prior knowledge to develop a hypothesis. The student does not state clearly what will be measured or list all of the variables. The drawings of trials are not numbered or clearly labeled. Data are collected, but no observations are recorded. Only one mealworm is used, although procedures called for using two or three. The student's discussion does not summarize results, perhaps because of confusion in completing the data table. There is some evidence of understanding in that the student records an unexpected event ("they tried to get out"). The student attempts to write a testable question.

Apprentice

This student's solution is lacking in detail, although the task is completed. The student draws from prior knowledge to develop a hypothesis, but does not state clearly what will be measured or list all of the variables. The drawings of trials are not numbered but do have some labeling and show details. It appears that four mealworms are used in the trials. Data are collected and appear to be accurate. Observation comments seem appropriate and relevant, yet the explanation is incomplete, lacking the steps of the tests conducted. The student apparently reversed the data for the class data table, and the summary includes these numbers but does not say (in units) what is actually counted. The discussion does not refer back to the hypothesis or connect to any bigger idea beyond "mealworms like the wet." The student attempts to write a testable question, but it is not in question form.

Practitioner

This student's solution is complete. The hypothesis draws upon prior knowledge and variables are listed correctly. How the variable will be measured is clearly stated. An appropriate number of trials are conducted. The drawings are numbered to show each trial and are labeled. All data from the individual trials appear to be recorded accurately, and observations include three details. The student uses the class data table to state a conclusion that the hypothesis is refuted, calling it a "guess" rather than hypothesis. The student correctly uses the discussion to answer the question being tested and refers back to the hypothesis.

Exemplars

Expert

This student's solution is complete and detailed. The hypothesis states a cause-effect relationship and variables are correctly defined. The drawings are numbered to show each trial and are labeled. A key is provided for the symbol used for the mealworms. All data from the individual trials appear to be recorded accurately. Observations are stated in complete sentences and include three details. Conclusions are based on data and refer back to the student's hypothesis. A new testable question is raised, is written in question form and builds upon results from this investigation.

Exemplars

Worksheet

Scientist(s) _____ Date _____ Hr _____

Mealworms in Wet and Dry Experiment

Evaluation Criteria

testable

if, then construction

shows cause/effect relationship

Names variable to be tested (independent)

Names variable to be measured (dependent)

Identifies constants

Question: Do mealworms prefer wet or dry?
What I want to find out

Hypothesis (Prediction): If mealworms are given a choice of wet or dry then _____
What I think will happen

Reason: because _____
Why I think it will happen

Variables: Independent Variable: One I will change
How I will make sure it is a fair test _____

Dependent variable: How I will measure results (units) _____

Variables I will keep the same (constants):

Courtesy of Ann Arbor Public Schools, 2000

Exemplars

Worksheet (cont.)

- Writes own procedure
- Procedure is fair test
- tells all steps
- steps are in order
- someone else could do the experiment exactly

when appropriate

- quantities stated
- number of trials stated
- times specified
- all materials are listed
- metric units are given
- quantities given when needed
- drawing has enough detail to be understood
- significant parts of drawing are labeled
- sequence noted, when needed

Procedure:

What I will do.



Materials:

What I will need

Lab Set Up

1. Put 2 half circles of paper towel in each side of a petri dish.
2. Put a drop of water on one piece of paper towel.
3. Put 2 or 3 mealworms in the middle of the petri dish.
4. Time for 30 seconds.
5. Record the positions of the mealworms.
6. Repeat 2 more times.

- 1 plastic petri dish
- 1/2 circles of paper towel, cut to fit the petri dish.
- 2 or 3 live mealworms
- clock with second hand

Courtesy of Ann Arbor Public Schools, 2000

Exemplars

Worksheet (cont.)

	Data:	Trial	# of mealworms on wet	# of mealworms on dry
<input type="checkbox"/> units		1		
<input type="checkbox"/> accurate/ complete		2		
		3		
<input type="checkbox"/> totals or averages when needed		Totals		

- accurate
- at least 3
details
- complete
sentences
- relevant

- reader can
understand
what is
written

Observations:

Use words to describe what happened during the experiment. Give specific, relevant details. Avoid opinions, feelings, generalizations.

	Class Data:	Trial	Total # of mealworms on wet	Total # of mealworms on dry
<input type="checkbox"/> units		1		
<input type="checkbox"/> accurate/ complete		2		
		3		
<input type="checkbox"/> totals or averages when needed		Totals		

Courtesy of Ann Arbor Public Schools, 2000

Exemplars

Worksheet (cont.)

- accurate summary
- correct trend
- correct terms

Summary:

Use words to tell what the data says.
Then describe trends, patterns, etc.
Use scientific terms

(Using data) _____

- tells how evidence related to hypothesis
- answers question accurately

Conclusion

Tell if your hypothesis was or was not supported by the data.

Tell how your question was answered.

"My hypothesis was/was not supported by the data and showed that _____

- showed, stated what was learned
- refers to "Big Idea"
- science vocabulary accurate
- complete sentences

Big Idea:

What did you learn?

How is what you learned connected to the Big Idea you are studying in science?
CLUE:

- complete sentences
- sources of error

Reflection:

Explain anything that happened in the experiment that you did not expect.

Discuss some likely sources of error.

- testable question

Next testable question:

Courtesy of Ann Arbor Public Schools, 2000

Exemplars

Novice

Mealworms in Wet and Dry Experiment

Evaluation Criteria

testable

if, then construction

shows cause/effect relationship

Names variable to be tested (independent)

Names variable to be measured (dependent)

Identifies constants

Question:

Do mealworms prefer wet or dry?

What I want to find out

Hypothesis

(Prediction):

What I think will happen

If mealworms are given a choice of wet or dry

then I thin they like dry

Reason:

Why I think it will happen

because

the oat bran is dry

Variables:

How I will make sure it is a fair test

Independent Variable: One I will change dryness

Dependent variable: How I will measure results (units) _____

where they go

Variables I will keep the same (constants):

light, tempature

The student attempts to draw from prior knowledge to state a hypothesis.

S/he does not clearly state what will be measured.

Not all variables are listed.

Exemplars

Novice

- Writes own procedure
- Procedure is fair test
- tells all steps
- steps are in order
- someone else could do the experiment exactly

when appropriate

- quantities stated
- number of trials stated
- times specified
- all materials are listed
- metric units are given
- quantities given when needed
- drawing has enough detail to be understood
- significant parts of drawing are labeled
- sequence noted, when needed

Procedure:

What I will do.



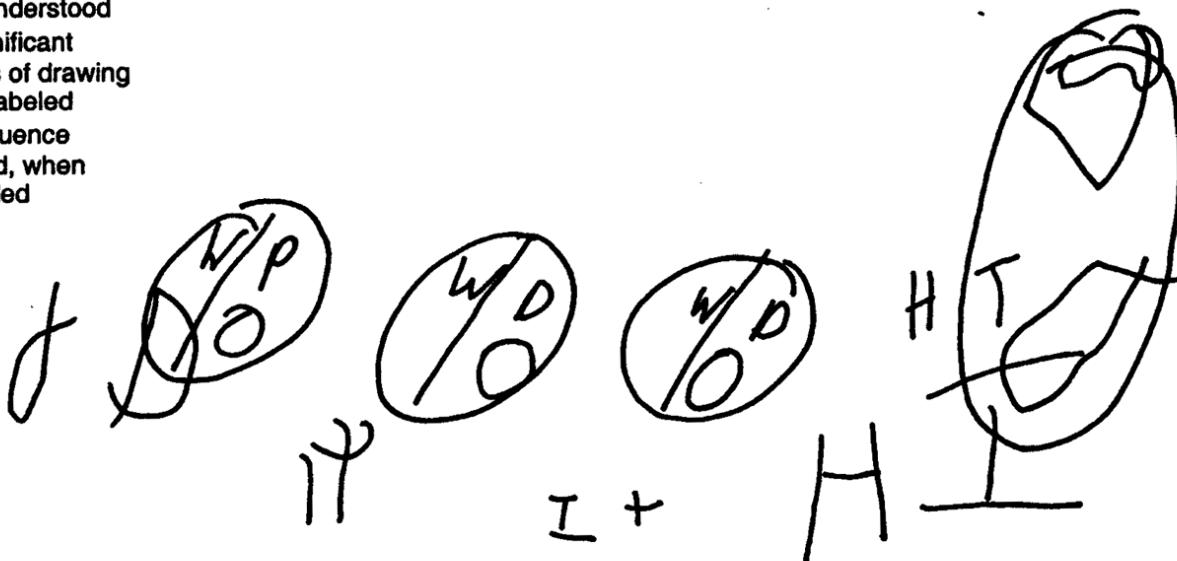
1. Put 2 half circles of paper towel in each side of a petri dish.
2. Put a drop of water on one piece of paper towel.
3. Put 2 or 3 mealworms in the middle of the petri dish.
4. Time for 30 seconds.
5. Record the positions of the mealworms.
6. Repeat 2 more times.

Materials:

What I will need

- 1 plastic petri dish
- 1/2 circles of paper towel, cut to fit the petri dish.
- 2 or 3 live mealworms
- clock with second hand

Lab Set Up



The drawings are not clearly labeled.

Exemplars

Novice

- all materials listed
- metric units given
- quantities given when needed
- drawing has enough detail to be understood
- significant parts of drawing are labeled
- sequence noted, when needed

Materials:
What I will need

- 1 plastic petri dish
- 10 cm x 10 cm dark construction paper
- 2 or 3 live mealworms
- clock with second hand

Lab Set Up

The trials are not numbered.

	Data:	Trial	# of mealworms on wet	# of mealworms on dry
<input type="checkbox"/> units		1	NO	1
<input type="checkbox"/> accurate/complete		2	NO	1
		3	NO	1
<input type="checkbox"/> totals or averages when needed		Totals	NONE	3

- accurate
- at least 3 details
- complete sentences
- relevant
- reader can understand what is written

Observations:
Use words to describe what happened during the experiment. Give specific, relevant details. Avoid opinions, feelings, generalizations.

Data is collected, however no observations are recorded.

The student only used 1 mealworm, although procedures call for using 2 or 3.

	Class Data:	Trial	Total # of mealworms on wet	Total # of mealworms on dry
<input type="checkbox"/> units		1	24 16	16 10
<input type="checkbox"/> accurate/complete		2	27 14	14 14
		3	22 15	15 22
<input type="checkbox"/> averages or totals when needed		Totals	67 (45)	45 (67)

Exemplars

Novice

- accurate summary
- correct trend
- correct terms

Summary:

(Using data) _____
 Use words to tell what the data says. Then describe trends, patterns, etc. Use scientific terms

meat worms
 like dry more

- tells how evidence related to hypothesis
- answers question accurately

Conclusion

"My hypothesis was/was not supported by the data and showed that _____
 Tell if your hypothesis was or was not supported by the data.

Tell how your question was answered.

in one mealworm
 like (dry)

- showed, stated what was learned
- refers to "Big Idea"
- science vocabulary accurate
- complete sentences

Big Idea:

What did you learn?

How is what you learned connected to the Big Idea you are studying in science? CLUE: _____

they tried to get out

The student reported something unexpected.

- complete sentences
- sources of error

Reflection:

Explain anything that happened in the experiment that you did not expect.

Discuss some likely sources of error.

- testable question

Next testable question:

what food they like

The discussion does not summarize results because of the confusion in completing the data table.

S/he provides a question, but it is not in a testable form.

Exemplars

Apprentice

Mealworms in Wet and Dry Experiment

Evaluation Criteria

testable

if, then construction

shows cause/effect relationship

Names variable to be tested (independent)

Names variable to be measured (dependent)

Identifies constants

Question:

Do mealworms prefer wet or dry?

What I want to find out

Hypothesis

If mealworms are given a choice of wet or dry

(Prediction):

then I think it will be wet

What I think will happen

Reason:

because

Why I think it will happen

they eat apples and it have moister

Variables:

Independent Variable: One I will change

How I will make sure it is a fair test

if it like's wet or dry

Dependent variable: How I will measure results (units) if they'll

go to wet or dry

Variables I will keep the same (constants):

the same in viorment and there temperture

The student does not state the variables clearly.

S/he does not state a complete list of constants.

S/he does not state what will be measured or counted.

The apprentice draws upon prior knowledge to support the hypothesis.

Exemplars

Apprentice

- Writes own procedure
- Procedure is fair test
- tells all steps
- steps are in order
- someone else could do the experiment exactly

- when appropriate
- quantities stated
 - number of trials stated
 - times specified
 - all materials are listed
 - metric units are given
 - quantities given when needed
 - drawing has enough detail to be understood
 - significant parts of drawing are labeled
 - sequence noted, when needed

Procedure:

What I will do.



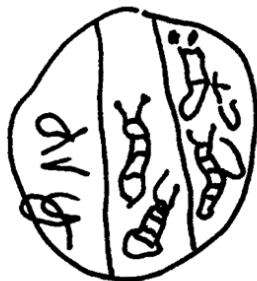
1. Put 2 half circles of paper towel in each side of a petri dish.
2. Put a drop of water on one piece of paper towel.
3. Put 2 or 3 mealworms in the middle of the petri dish.
4. Time for 30 seconds.
5. Record the positions of the mealworms.
6. Repeat 2 more times.

Materials:

What I will need

- 1 plastic petri dish
- 1/2 circles of paper towel, cut to fit the petri dish.
- 2 or 3 live mealworms
- clock with second hand

Lab Set Up



The drawing contains some labels, but they are incomplete.

There is no key or indication of the trials.

Exemplars

Apprentice

	Data:	Trial	# of mealworms on wet	# of mealworms on dry
<input type="checkbox"/> units		1	2	2
<input type="checkbox"/> accurate/ complete		2	2	2
		3	2	2
<input type="checkbox"/> totals or averages when needed		Totals	6	6

- accurate
- at least 3 details
- complete sentences
- relevant

Observations:

Use words to describe what happened during the experiment. Give specific, relevant details. Avoid opinions, feelings, generalizations.

- reader can understand what is written

one was under the paper towel and one on top, slow took 30 seconds to decide

	Class Data:	Trial	Total # of mealworms on wet	Total # of mealworms on dry
<input type="checkbox"/> units		1	24	16
<input type="checkbox"/> accurate/ complete		2	21	14
		3	22	15
<input type="checkbox"/> totals or averages when needed		Totals	67	45

The data appears to be accurate.

The comments are accurate and relevant.

The numbers are accurate, but this does not say what is being counted.

Exemplars

Apprentice

- accurate summary
- correct trend
- correct terms

Summary:

Use words to tell what the data says. Then describe trends, patterns, etc. Use scientific terms

(Using data)

There were 67 on wet and 45 on dry

The explanation is incomplete, lacking the steps of the tests conducted.

- tells how evidence related to hypothesis
- answers question accurately

Conclusion

Tell if your hypothesis was or was not supported by the data.

"My hypothesis was/was not supported by the data and showed that

mealworms like the wet

Tell how your question was answered.

Lack of complete sentences make the reflection hard to understand.

- showed, stated what was learned
- refers to "Big Idea"
- science vocabulary accurate
- complete sentences

Big Idea:

What did you learn?

I learned that mealworms like moistness.

How is what you learned connected to the Big Idea you are studying in science? CLUE:

- complete sentences
- sources of error

Reflection:

Explain anything that happened in the experiment that you did not expect.

One of them the wet. What would it really pick?

Discuss some likely sources of error.

- testable question

Next testable question:

hot and wet

Hot and wet is not written as a testable question.

The explanation does not show a cause-effect relationship or any connection to a bigger idea.

Exemplars

Practitioner

Mealworms in Wet and Dry Experiment

Evaluation Criteria

testable

if, then construction

shows cause/effect relationship

Names variable to be tested (independent)

Names variable to be measured (dependent)

Identifies constants

Question: Do mealworms prefer wet or dry?
What I want to find out

Hypothesis (Prediction): If mealworms are given a choice of wet or dry then They will choose wet
What I think will happen

Reason: because They like going under the meal and its wet there.
Why I think it will happen

Variables: Independent Variable: One I will change
How I will make sure it is a fair test wet - dry

Dependent variable: How I will measure results (units) is how many mealworms are on the wet or dry side each time.

Variables I will keep the same (constants):
temperature wet paper towel
light mealworms
time moisture

The student draws upon prior knowledge to support the hypothesis.

The variables are correct, and the constants are listed. (Light may be based on prior knowledge.)

Exemplars

Practitioner

- Writes own procedure
- Procedure is fair test
- tells all steps
- steps are in order
- someone else could do the experiment exactly

when appropriate

- quantities stated
- number of trials stated
- times specified
- all materials are listed
- metric units are given
- quantities given when needed
- drawing has enough detail to be understood
- significant parts of drawing are labeled
- sequence noted, when needed

Procedure:

What I will do.



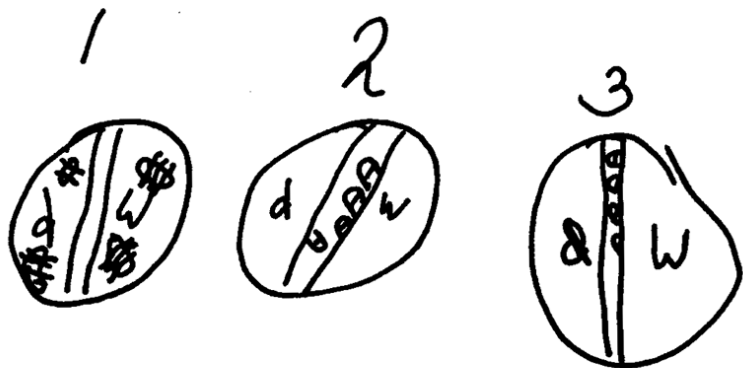
1. Put 2 half circles of paper towel in each side of a petri dish.
2. Put a drop of water on one piece of paper towel.
3. Put 2 or 3 mealworms in the middle of the petri dish.
4. Time for 30 seconds.
5. Record the positions of the mealworms.
6. Repeat 2 more times.

Materials:

What I will need

- 1 plastic petri dish
- 1/2 circles of paper towel, cut to fit the petri dish.
- 2 or 3 live mealworms
- clock with second hand

Lab Set Up



The student numbers the trials and records an accurate drawing and data.

Exemplars

Practitioner

	Data:	Trial	# of mealworms on wet	# of mealworms on dry
<input type="checkbox"/> units		1	2	2
<input type="checkbox"/> accurate/ complete		2	3	1
		3	4	0
<input type="checkbox"/> totals or averages when needed		Totals	9	3

- accurate
- at least 3 details
- complete sentences
- relevant

Observations:

Use words to describe what happened during the experiment. Give specific, relevant details. Avoid opinions, feelings, generalizations.

- reader can understand what is written

They would stay in the middle, when go wet or dry on the first trial they stayed on top in the other 2, they crawled under the paper

S/he states what was observed, including 3 details, but makes a misdirection on the experiment.

	Class Data:	Trial	Total # of mealworms on wet	Total # of mealworms on dry
<input type="checkbox"/> units		1	111 2	111 111 111
<input type="checkbox"/> accurate/ complete		2	111 2	111 111
		3	111 111 3	111 111 0
<input type="checkbox"/> totals or averages when needed		Totals	18	40

Exemplars

Practitioner

- accurate summary
- correct trend
- correct terms

Summary:

Use words to tell what the data says.
Then describe trends, patterns, etc.
Use scientific terms

(Using data) there was 40 dry and 8 wet

- tells how evidence related to hypothesis
- answers question accurately

Conclusion

Tell if your hypothesis was or was not supported by the data.

Tell how your question was answered.

"My hypothesis was/was not supported by the data and showed that

My guess was supported because I guessed dry.

- showed, stated what was learned
- refers to "Big Idea"
- science vocabulary accurate
- complete sentences

Big Idea:

What did you learn?

How is what you learned connected to the Big Idea you are studying in science?
CLUE:

The thing I learned was that a carpenter's 'nest' of the mealworm is they like dry.

I thought that because they have dry food

- complete sentences
- sources of error

Reflection:

Explain anything that happened in the experiment that you did not expect.

Discuss some likely sources of error.

I was surprised are mostly liked water.

I think this because it was easier to get out over there

- testable question

Next testable question:

Whether they like hanes or not?

S/he provides a conclusion which answers the question and explains how the hypothesis was supported by data.

The practitioner uses the word "guess" instead of key vocabulary such as "hypothesis."

Exemplars

Expert

Mealworms in Wet and Dry Experiment

Evaluation Criteria

testable

if, then construction

shows cause/effect relationship

Names variable to be tested (independent)

Names variable to be measured (dependent)

Identifies constants

Question:

Do mealworms prefer wet or dry?

What I want to find out

Hypothesis

If mealworms are given a choice of wet or dry

(Prediction):

then they will choose dry

What I think will happen

Reason:

because

Why I think it will happen

they live in dry areas

Variables:

Independent Variable: One I will change

How I will make sure it is a fair test

wet or dry

Dependent variable: How I will measure results (units) is how many

mealworms are on wet or dry side per trial.

Variables I will keep the same (constants):

Some Mealworms, same petri dish, same paper towel pieces,

The expert states the hypothesis as a cause-effect relationship.

S/he states variables that will change and remain constant.

Exemplars

Expert

- Writes own procedure
- Procedure is fair test
- tells all steps
- steps are in order
- someone else could do the experiment exactly

when appropriate

- quantities stated
- number of trials stated
- times specified
- all materials are listed
- metric units are given
- quantities given when needed
- drawing has enough detail to be understood
- significant parts of drawing are labeled
- sequence noted, when needed

Procedure:

What I will do.



1. Put 2 half circles of paper towel in each side of a petri dish.
2. Put a drop of water on one piece of paper towel.
3. Put 2 or 3 mealworms in the middle of the petri dish.
4. Time for 30 seconds.
5. Record the positions of the mealworms.
6. Repeat 2 more times.

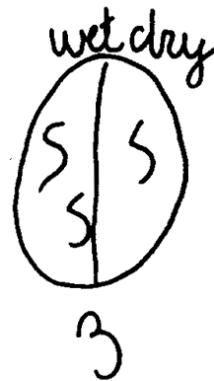
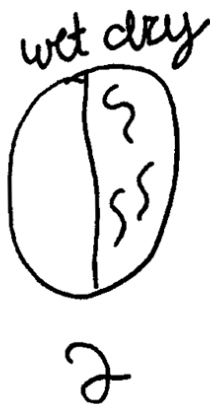
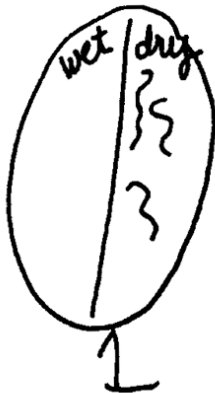
Materials:

What I will need

- 1 plastic petri dish
- 1/2 circles of paper towel, cut to fit the petri dish.
- 2 or 3 live mealworms
- clock with second hand

Lab Set Up

~ = mealworm



The drawing is clearly labeled.

Exemplars

Expert

	Data:	Trial	# of mealworms on wet	# of mealworms on dry
<input type="checkbox"/> units		1	0	3
<input type="checkbox"/> accurate/ complete		2	0	3
		3	2	1
<input type="checkbox"/> totals or averages when needed		Totals	2	7

- accurate
- at least 3 details
- complete sentences
- relevant
- reader can understand what is written

Observations:

Use words to describe what happened during the experiment. Give specific, relevant details. Avoid opinions, feelings, generalizations.

I observed that on our first and second test all

the mealworms were on the dry side. On the third test 2 mealworms were on the wet side and one was on the dry

	Class Data:	Trial	Total # of mealworms on wet	Total # of mealworms on dry
<input type="checkbox"/> units		1		
<input type="checkbox"/> accurate/ complete		2		
		3	 	
<input type="checkbox"/> totals or averages when needed		Totals	18	35

$$\begin{array}{r} 18 \\ 35 \\ \hline 53 \end{array}$$

Three accurate relevant details are given in complete sentences.

Exemplars

Expert

- accurate summary
- correct trend
- correct terms

Summary:

Use words to tell what the data says. Then describe trends, patterns, etc. Use scientific terms

(Using data) I think
the class chart show
39/53 mealworms like dry.

- tells how evidence related to hypothesis
- answers question accurately

Conclusion

Tell if your hypothesis was or was not supported by the data.

Tell how your question was answered.

"My hypothesis was/was not supported by the data and showed that

yes our class chart
shows mealworms
like dry and that's what
I guessed

The conclusion is based on the data.

- showed, stated what was learned
- refers to "Big Idea"
- science vocabulary accurate
- complete sentences

Big Idea:

What did you learn?

How is what you learned connected to the Big Idea you are studying in science? CLUE:

I learned that
though most mealworms
prefer dry, some prefer
wet.

- complete sentences
- sources of error

Reflection:

Explain anything that happened in the experiment that you did not expect.

Discuss some likely sources of error.

I didn't expect
the mealworms to crawl
under the paper towel.

- testable question

Next testable question:

Do beetles prefer
the same thing as
mealworms.