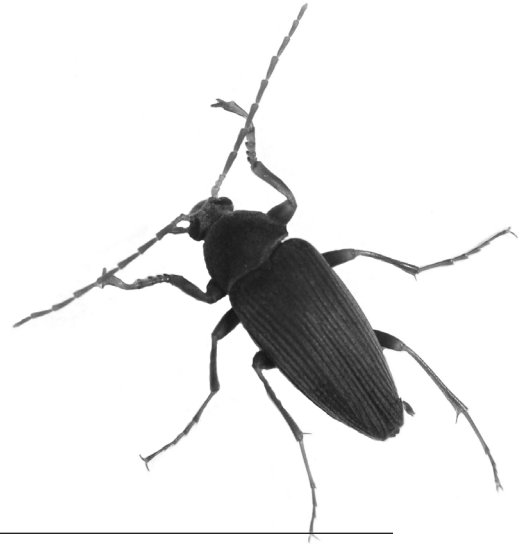


# Earth's Birthday Project

## AMAZING BUGS®



### Pre/Post Questions: **Beetle Races**

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#### Introduction

Pre/Post Questions are tools for guiding inquiry and assessing student learning. Students answer the questions before they do the activities in the Amazing Bugs kit (pre) and again after the activities are completed (post).

Students are not expected to score high points the first time they answer the questions. The Amazing Bugs activities will give them many chances to practice the skills needed to improve their answers in the second round.



#### Contents

Questions are presented on one-page, reproducible handouts. Each handout is followed by easy instructions, including quick prep and a rubric or answer key for grading. Use one or two questions, or all four—the more time you invest, the more students learn and the more opportunities you have for assessment.

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#### Scheduling, Time, Materials

Schedule the first round (pre) a few days in advance of the arrival of your live beetles. Plan on 20–25 minutes for each question in the first round (pre), and 15–20 minutes in the second round (post). The only materials you'll need are two copies of each question, and a pencil, for each student.

#### Standards and Benchmarks

The teacher's instruction for each question includes New Mexico science and/or math benchmarks.

**For more information: [earthsbirthday.org/nm](http://earthsbirthday.org/nm)**

OK to duplicate for use with students!

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## Measuring Beetle Speed

1. What would you do to measure how fast a beetle is crawling?

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2. If you had two beetles to compare, what would you do to discover which one crawled faster?

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## Question 1: Teacher Instruction

### Science Benchmark

- Scientific Thinking and Practice, Standard I, 5–8 Benchmark I – Use scientific methods to develop questions, design and conduct experiments using appropriate technologies, analyze and evaluate results, make predictions, and communicate findings.

### Teacher Prep

Make two copies of Beetle Races Handout Q 1 for each student—one for Pre, one for Post.

### Pre (First Round)

Instructions to students: (1) *Imagine that you are a scientist studying beetles. One of your specimens is crawling across your desk. You are interested in how fast it can crawl. What would*

*you do to measure its speed? Please think about the question and write your best answer on the handout. (2) In the second rectangle, describe how you would compare the speed of two beetles to discover which was crawling faster.*

Allow no more than 25 minutes to answer both questions.

### Post (Second Round)

Have students complete the handout again after they have done all the Amazing Bugs activities. Allow no more than 20 minutes.

### Grading

The total possible score is 6 points. Use the following rubric to grade student answers.

Score	Description
6	The answer to question 1 on the handout clearly describes two or more <b>steps</b> the student would take to measure speed in terms of <b>distance and time</b> . The answer to question 2 includes steps to discover which beetle is faster by comparing <b>distance and time</b> .
4	The answer to question 1 describes a way to measure that does not clearly refer to <i>both distance and time</i> . The answer to question 2 describes a comparison without clear reference to <i>both distance and time</i> . Or one answer is complete and the other is incomplete.
2	Neither answer is complete. Student mentions time and/or distance but does not describe steps for measuring them.
0	Neither answer mentions time or distance. Neither describes ways of measuring or comparing speeds.

## Beetle Speed

Anna and Rose wanted to measure how fast a darkling beetle would crawl over a distance of 20 centimeters. They made a race track that was 20 centimeters long, and they tried one beetle three times. They recorded the speeds for each trial on a data table like the one below. Then they wrote the speed in the form of a ratio.

- Convert the speeds (in Column C) to decimal numbers. Record the numbers in Column D. Then calculate the average speed.

**Distance: 20 cm**

A. Trial	B. Time (seconds)	C. Speed (distance/time)	D. Speed (decimal)
1	15	20/15	cm/sec
2	25	20/25	cm/sec
3	10	20/10	cm/sec
<b>Total Speed (decimal) <math>\div</math> 3 = Average Speed</b>			<b>cm/sec</b>

- Anna and Rose say that their beetle is fast and could win a race against any other darkling beetle in their classroom. Briefly describe two ways they could test to see if they are right.

**A.**

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**B.**

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## Question 2: Teacher Instruction

### Science Benchmark

- Scientific Thinking and Practice, Standard I, 5–8 Benchmark 1 – Use scientific methods to develop questions, design and conduct experiments using appropriate technologies, analyze and evaluate results, make predictions, and communicate findings.

### Math Benchmarks

- Number and Operations 2 – Understand the meaning of operations and how they relate to one another.
- Number and Operations 3 – Compute fluently and make reasonable estimates.
- Algebra 3 – Use mathematical models to represent and understand quantitative relationships.
- Data Analysis 1 – Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
- Data Analysis 2 – Select and use appropriate statistical methods to analyze data.

### Teacher Prep

Make two copies of Beetle Races Handout Q 2 for each student—one for Pre, one for Post.

### Pre (First Round)

Instructions to students: *Read the handout.* [You may wish to read together as a class to make sure that everyone understands the questions.] *Convert the speeds in Column C on the table to decimal numbers and write the numbers in Column D. Calculate the average speed and write it in the box next to the equation. Then go to the next question. Briefly*

*describe two ways that Anna and Rose can test to see if their darkling beetle could out-race any other beetle in the classroom.*

Suggest that students round their answers to 2 decimal places. Allow no more than 25 minutes total for 1 and 2.

### Post (Second Round)

Have students complete the handout again, after they have done the Amazing Bugs activities. Allow no more than 20 minutes.

### Grading

The total possible score is 6 points, one for each of six correct answers.

### Answer Key for Question 1 (four answers)

Trial	Speed
1	1.33
2	0.80
3	2.00
<b>Average Speed</b>	1.38 cm/sec

**Suggested Answers for Question 2 (two answers):** Anna and Rose could a) race beetles two at a time on one track to see which crossed the finish line first, then continue to race the winners against each other until they had one grand winner; b) race beetles one at a time on one track and compare times; c) race beetles on different tracks of the same length and compare times; d) race beetles on different tracks of different lengths, calculate speed using a common unit (for example, cm/sec), and compare speeds. (Students may have more imaginative suggestions that you will have to judge based on what, in your opinion, would give a good result.)

## Speed Comparison

Students at Salazar Elementary School raced six darkling beetles. They ran each beetle three times down a short track and three times down a long track. Then they calculated **the average speeds for each beetle** and wrote them on a table like the one below.

Beetle	Average Speed (cm/sec) Short Track	Average Speed (cm/sec) Long Track
1	1.58	2.00
2	2.30	2.15
3	1.34	1.45
4	1.19	1.18
5	2.29	2.35
6	1.47	1.40
<b>Total</b>		
<b>Average</b>		

1. On the table, add up the **total speeds** and calculate the **average** speed for both tracks.
2. Did the beetles run faster on the short track or the long track?  
 Short Track       Long Track
3. Why was it important to use the **same unit of measurement** for each beetle on both tracks?

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## Question 3: Teacher Instruction

### Science Benchmark

- Scientific Thinking and Practice, Standard I, 5–8 Benchmark I – Use scientific methods to develop questions, design and conduct experiments using appropriate technologies, analyze and evaluate results, make predictions, and communicate findings.

### Math Benchmarks

- Number and Operations 2 – Understand the meaning of operations and how they relate to one another.
- Number and Operations 3 – Compute fluently and make reasonable estimates.
- Algebra 3 – Use mathematical models to represent and understand quantitative relationships.
- Data Analysis 1 – Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
- Data Analysis 2 – Select and use appropriate statistical methods to analyze data.

### Teacher Prep

Make two copies of Beetle Races Q 3 for each student—one for Pre, one for Post.

### Pre (First Round)

Instructions to students: *Read the handout.* [You may wish to read together as a class to make sure that everyone understands the questions.] *Then (1) complete the table: add*

*up the speeds in both columns and write them in the spaces on the “Total” line. Calculate the averages for both columns (short track and long track) and write them in the spaces on the “Average” line. Round your answers to **two decimal places**. (2) On which track did the beetles run faster, short or long? Fill in the circle next to the correct answer. (3) Write a short answer to question 3.*

Allow no more than 20 minutes.

### Post (Second Round)

Have students complete the handout again after they have done the Amazing Bugs activities. Allow no more than 15 minutes.

### Grading

The total possible score is 6 points, one for each of six correct answers.

Answer Key, Questions 1 and 2		
	Short Track	Long Track
<b>Total</b>	10.17 cm/sec	10.53 cm/sec
<b>Average Speed</b>	1.70 cm/sec	1.76 cm/sec
<b>The beetles ran faster on the long track.</b>		

**Question 3:** It was important to use the same unit of measurement because **it allowed us to compare speeds on tracks with different lengths** [this is the only possible correct answer].

## Beetle Race

Marcos and Sally made two long race tracks to race two darling beetles, Flash Master and Prize Racer. Each beetle ran down one of the tracks three times. The tracks were two different lengths.

- On each table convert the speeds (in Column C) to decimal numbers. Record the numbers in Column D. Then calculate the average speed.

### Flash Master

**Distance: 30 cm**

A. Trial	B. Time (seconds)	C. Speed (distance/time)	D. Speed (decimal)
1	15	30/15	cm/sec
2	17	30/17	cm/sec
3	10	30/10	cm/sec
<b>Flash Master Average Speed</b>			<b>cm/sec</b>

### Prize Racer

**Distance: 40 cm**

A. Trial	B. Time (seconds)	C. Speed (distance/time)	D. Speed (decimal)
1	20	40/20	cm/sec
2	15	40/15	cm/sec
3	10	40/13	cm/sec
<b>Prize Racer Average Speed</b>			<b>cm/sec</b>

- Which beetle's average was faster? \_\_\_\_\_

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## Question 4: Teacher Instruction

### Science Benchmark

- Scientific Thinking and Practice, Standard I, 5–8 Benchmark I – Use scientific methods to develop questions, design and conduct experiments using appropriate technologies, analyze and evaluate results, make predictions, and communicate findings.

### Math Benchmarks

- Number and Operations 2 – Understand the meaning of operations and how they relate to one another.
- Number and Operations 3 – Compute fluently and make reasonable estimates.
- Algebra 3 – Use mathematical models to represent and understand quantitative relationships.
- Data Analysis 1 – Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
- Data Analysis 2 – Select and use appropriate statistical methods to analyze data.

### Teacher Prep

Make two copies of Beetle Races Handout Q 4 for each student—one for Pre, one for Post.

### Pre (First Round)

Instructions to students: *Read the handout.*  
[You may wish to read together as a class to make sure that everyone understands the questions.] *First, complete both tables.*

*Convert the speeds in Column C on both tables to decimal numbers and write the numbers in Column D. Calculate the average speeds and write them in the box next to the equation. Then go to question 2. Which of the two beetles' speeds was faster? Write its name in the box.*

Allow about 25 minutes for 1 and 2.

### Post (Second Round)

Have students complete the handout again, after they have done the Amazing Bugs activities. Allow no more than 20 minutes.

### Grading

The maximum possible score is 9 points, one for each of nine correct answers. **Key:**

Trial	Flash Master	Prize Racer
1	2.00 cm/sec	2.00 cm/sec
2	1.76 cm/sec	2.67 cm/sec
3	3.00 cm/sec	3.08 cm/sec
<b>Average Speed</b>	2.25 cm/sec	2.58 cm/sec

**Prize Racer** had the faster average.