Name: Period: Date:

BOUNCING BALL CHALLENGE

Making predictions in Physics

Preparation

1. Observations

Your observations	Observations from other classmates

2. Challenge

Each group will get the following equipment:

- A ball
- One meter stick

Your challenge is to

- Develop procedures for an activity that will provide you with data to predict how high the ball will bounce if you drop it from 150 cm, and how high it will bounce if dropped from 250 cm.
- Use your procedures to collect your data.
- Use your data to make your prediction.
- Drop the ball from 150 cm and 250 cm and determine how accurate your prediction was.

3. Procedure: First draft

Work with your group to develop procedures that will provide you with data to make your predictions.

4. Notes on our class discussion of procedures

5. Data collection variables

In each experiment, scientists try to recognize all the potential variables (things we can measure). Variables come in three types:

- **Independent** variables. Scientists identify the variable they will be directly changing.
- **Dependent** variables. When we change the independent variable, we then measure the results of a different variable.
- **Controlled** variables: These are variables we try to ensure that they don't change between trials.

Identify the variables in our activity:

Independent variable (abbreviation IV)	Controlled variables
Dependent variable (abbreviation DV)	

6. Final group procedures

Write out your complete procedures below.

Running the activity

7. Controlled variables

Record features of all your controlled variables in the space below. Use the last two rows for any other variables you recognize you are controlling.

Ball	
Surface	
Ball dropper	
Bounce height viewer	
Data recorder	
Where you measured from on the ball (top, bottom, or middle)	

8. Data collection

Write the names of your variables in the tip row (write on top of the light gray labels). Record the units in the top row labels in parentheses instead of next to each number. In this case: (cm)

IV: Independent variable	DV: Dependent variable			
	Average	Trial 1	Trial 2	Trial 3

9. Notes from data collection

Record any notes below about difficulties or irregularities that you noticed during running the activity.

10. Calculate the average for your DV values

In the gray column, record your average DV values (add all three trials, then divide by three).

Remember the **horizontal axis** is the one that goes sideways, like the **horizon**.

11. Plotting your data on a graph

Use the graph paper from **Page 6** to plot your data.

11.A. Labeling the graph

11.A.a. Label the x axis (horizontal) with the **name and units** of your independent variable (your IV).

11.A.b. Labe the y axis (vertical) with the **name and units** of your dependent variable (your DV).

11.A.c. Above the graph, write a **title** that explains what is on the graph (something like "Bouncing tennis ball" with your group members' names and class period).

11.B. **Plotting your data**. For each row in your data table:

11.B.a. Find the number for your IV (drop height) on the horizontal axis. Place a ruler or straightedge up from that number. Next, find the number for the DV (bounce height) on the vertical axis. Move your pencil from that number to the right until it reaches your ruler and place a dot there.

11.C. Next, **draw a 'best fit' line**:

11.C.a. Use a clear ruler to line up as best you can with all the data dots you just made in **Step 11.B.**

11.C.b. Your ruler may not go through all your dots—but try your best to match them. If the line does not go through all the dots, try to have them showing up randomly above and below the line.

11.C.c. Once your ruler is lined up as best you can with the dots, draw a line that extends the entire length of the graph.

12. Identifying mathematical values from your graph.

12.A. Steepness

12.A.a. Look at your line. How would you explain to others how steep your line is?

12.A.b. We call the steepness of the line the *slope* of the line. In math, you probably calculated it as "*rise over run*" (do you remember that???). In science we do the same thing, but we won't be checking the difference between random points on the graph, but rather we'll focus on the line. The longer the line we use, the more accurate our calculation will be.

12.A.c. Find the point where your best-fit line crosses the vertical axis. Record the value of the vertical axis in the table below.

12.A.d. Find the point where your line crosses the 200 cm line. Record the vertical axis in the table below.

When the best fit line crosses the bounce height of zero cm, the vertical value is:	cm
When the best fit line crosses the bounce height of 200 cm, the vertical value is:	cm

13. Preparing to share your data with the class

Using values in the table you just completed, calculate your slope in the space below.

$$\frac{\text{Rise (how much did your bounce height change?):}}{\text{Run (how much did your drop height change?):}} =$$

Create a whiteboard to share your data with the rest of the class.

Your group whiteboard should include the following information:

- A sketch of your graph (should take up about half of your whiteboard).
    - Label your axes with variable name and units, and put numbers at every 50 cm.
    - Place a dot where your line crosses the vertical axis, and another where it crosses the 200 cm line, then draw a line between these. Now add all your other dots **about** where they are on the graph: Focus on if they are above or below your line.
- Do not include your data table: Your graph will be a visual representation of all these numbers!

For the following information, be sure to write large enough that people can see it from 5-10 feet away.

- A description of your ball.
- Where you measured on your ball (top, bottom, middle).
- How steep your graph is (the number for your slope).
- Where your best-fit line crosses the vertical axis (approximate it to the nearest 2 cm).
- Any other details you think are important (but don't crowd too much on the graph).

14. Discussion notes

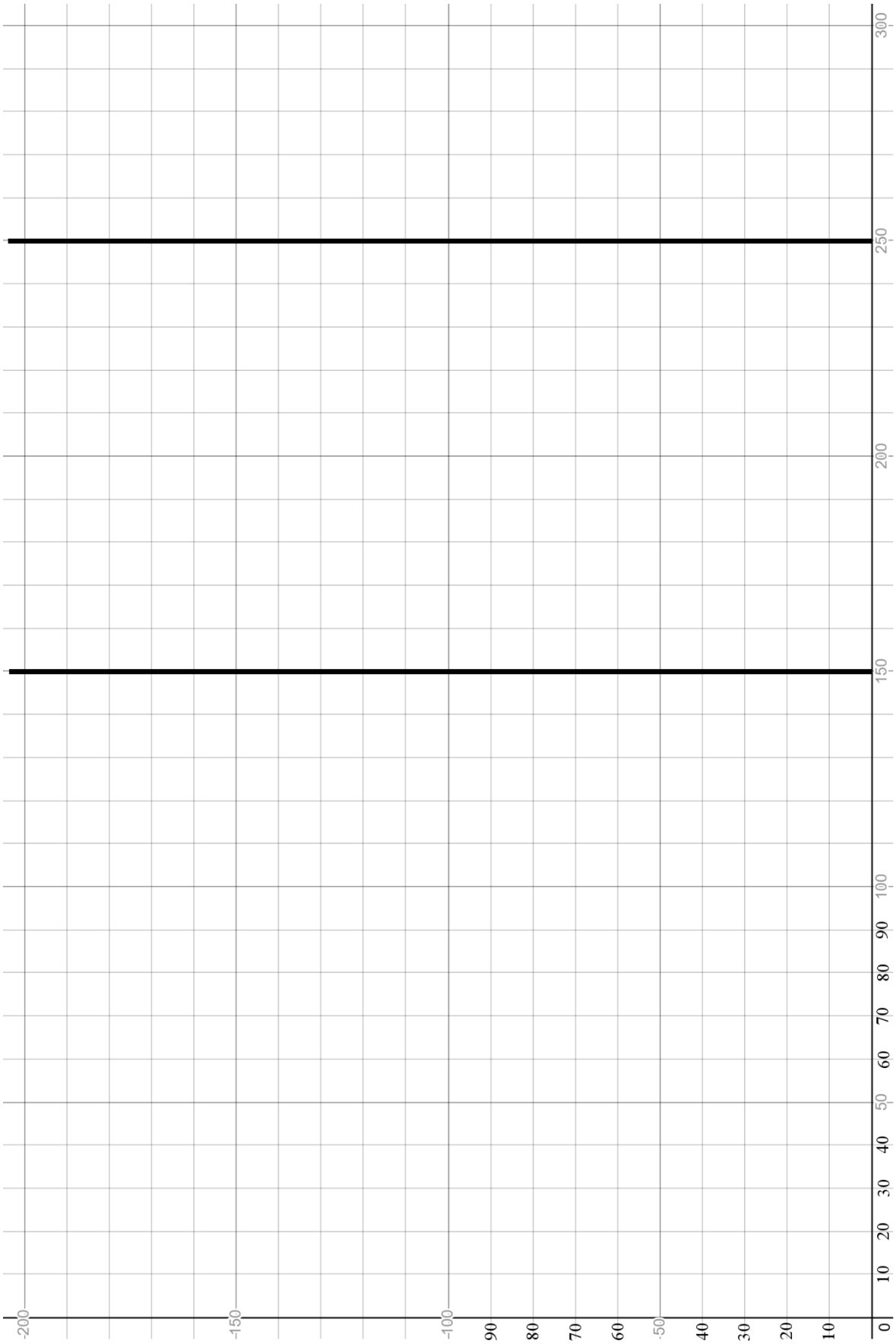
Record notes from our whiteboard meeting discussion below.

15. Predictions

Look at your graph, and record your predictions below:

When we drop our ball from 150 cm, we predict it will bounce _____ cm high.

When we drop the ball from 250 cm, we predict it will bounce _____ cm high.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