

# Discovering the Charge of an Electron Worksheet

## Data Table

Magnet Piece	Mass of BBs (g)	Sorted Mass (g)	Unique Masses (g)	Difference in Mass (g)
1				—
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15 (40-mm)				Avg.

## Post-Lab Analysis and Calculations

- Arrange the measured masses of BBs into the *Sorted Mass* column in *descending* order, starting with the largest recorded mass and ending with the smallest.
- Some of the masses in the *Sorted Mass* column may be the same or nearly the same (within a few hundredths of a gram of each other).
  - Average the masses that are nearly the same. For example, masses of 3.12, 3.11, and 3.10 grams would average to 3.11 g.
  - Record only the unique masses and the average masses of those that are nearly the same in the *Unique Masses* column of the data table. *Note:* This column will have fewer than 15 data points.
- Subtract each unique mass from the one just above it in the *Unique Masses* column and record each difference in the last column of the data table. Again, this *Difference in Mass* column will have fewer than 15 data points.
- Note the smallest value in the *Difference in Mass* column between any two samples of BBs. If several of the differences in mass are the same or nearly the same as the smallest difference, find the average smallest difference and record this value at the bottom of the last column. What does this difference represent?
- Using the average smallest difference in mass calculated above and the recorded mass for the BBs from the final 40-mm magnet piece, predict the number of BBs that were attached to the largest magnet. Record your prediction below.  
 Predicted number of BBs from largest magnet \_\_\_\_\_
- Count and record the number of BBs in the weighing dish from step 14 of the *Procedure*.  
 Actual number of BBs from largest magnet \_\_\_\_\_

## Post-Lab Questions *(Answer on a separate sheet of paper.)*

- How did the predicted number of BBs compare to the actual number from the largest magnet? What possible sources of error are in this procedure?
- One could easily determine the mass of a single BB by weighing it or by weighing a known number and dividing the total mass by the number of BBs weighed. Why couldn't Robert Millikan determine the charge of a single electron in a similar manner?
- The predicted number of BBs was checked with the actual number of BBs attached to the largest magnet. Millikan could not verify his results in the same way. Give examples of other scientific research that depends on supporting evidence without the ability to verify results in such a concrete way.