Chemistry Lab: M&Ms and the Mole

WHAT TO TURN IN: Hypothesis, Data Table, Calculations, Error Analysis, Conclusion, Questions

OBJECTIVES

- To determine how much of a mole of M&Ms can fit in our classroom
- To determine how many classrooms would be needed to hold an entire mole of M&Ms

MATERIALS

M&M candies (about 3 pounds), other round candies, marbles, or beads
Meter sticks
Scientific calculators
A cubic decimeter (1 dm^3 = 1 L) plastic cube

PROCEDURE on back

CALCULATIONS

Step 5: volume of the classroom
Step 6: number of M&Ms in 1 m^3
Step 7: number of M&Ms that would fill the classroom
Step 8: how much of a mole of M&Ms can fit in the classroom
Step 9: how many classrooms the size of ours would hold one mole of M&Ms

QUESTIONS

1) Does the answer you calculated for step 7 surprise you? Why or why not?
2) Does the answer you calculated for step 8 surprise you? Why or why not?
3) Why do you think M&Ms are a good choice for the "particles" in this lab?
4) How is DA (dimensional analysis) used in this lab?

DATA TABLE

STEP 3: Total M&Ms in 1 dm^3 = _____

STEP 4: **Length** = _____m **Width** = _____ m **Height** = _____m

STEP 5: Volume of the classroom: _____m^3

STEP 6: Number of M&Ms in a m^3 = _____

STEP 7: Number of M&Ms in one classroom = _____

STEP 8: Amount of moles in one classroom = _____

STEP 9: Number of classrooms needed to hold 1 mol M&Ms = _____

PROCEDURE

1) Write a hypothesis: How many moles of M&Ms do you think will fit in our classroom? If you think it is less than one mole, how much of a fraction of one mole will fit?
2) Carefully fill the plastic 1-dm^3 cube with M&Ms.
3) A few students will count the number of M&Ms in one dm^3. Record this number in the data table. It is the same for everyone in the class.
4) A few students will measure the length, width, and height of our classroom (in meters) with the meter sticks. Record in data table.
5) Calculate the volume of the classroom: (L x W x H) in m^3. Record in data table.
6) Calculate the number of M&Ms in 1 m^3, using the number of M&Ms from step 3. Record your answer in the data table.

$$\frac{\textbf{\# M\&Ms}}{\textbf{1 } \cancel{\textbf{dm}^3}} \times \frac{1000\ \cancel{dm^3}}{1\ m^3} = \frac{\text{\# of M\&Ms}}{1\ m^3}$$

ANSWER FROM STEP 3

7) Calculate the number of M&Ms that would fill the classroom, using the number of M&Ms from your answer in step 6 and the volume of the room from step 5. Record your answer in the data table.

$$\frac{\textbf{\# M\&Ms}}{\textbf{1 } \cancel{\textbf{m}^3}} \times \frac{\textbf{\# } \cancel{\textbf{m}^3}}{\textbf{1 classroom}} = \frac{\text{\# of M\&Ms}}{1\ \text{classroom}}$$

ANSWER FROM STEP 6 ***ANSWER FROM STEP 5***

8) Calculate how much of a mole of M&Ms can fit in our classroom, using your answer from step 7. (This time, the "representative particle" used is M&Ms.) You should get a *very* small number. Record your answer in the data table.

$$\frac{\textbf{\# } \cancel{\textbf{M\&Ms}}}{\textbf{1 classroom}} \times \frac{1\ \text{mol}}{6.02 \times 10^{23}\ \cancel{M\&Ms}} = \frac{\text{\# mol}}{1\ \text{classroom}}$$

ANSWER FROM STEP 7

9) Calculate how many classrooms the size of ours would be needed to hold one mole of M&Ms. Use the *reciprocal* or *inverse* of the answer from step 7. You should get a *very* large number. Record your answer in the data table.

$$\frac{\textbf{1 classroom}}{\textbf{\# } \cancel{\textbf{M\&Ms}}} \times \frac{6.02 \times 10^{23}\ \cancel{M\&Ms}}{1\ \text{mol}} = \frac{\text{\# classrooms}}{1\ \text{mol}}$$

RECIPROCAL OF ANSWER FROM STEP 7