

What is Inside the Mystery Boxes?

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Course: Honors Biology Period 7

NOTE: LIST THE INFORMATION SHOWN ABOVE. PROVIDE THE EXACT TITLE OF THE LAB AS SHOWN ON THE LAB HANDOUT. MAKE SURE TO CORRECTLY SPELL THE NAME(S) OF YOUR LAB PARTNER(S). STAPLE THE LAB REPORT RUBRIC TO THE FRONT OF THE LAB REPORT BEFORE SUBMITTING IT FOR A GRADE.

THE LAB REPORT MUST BE ORGANIZED BY HAVING THE SECTION HEADINGS SHOWN ON THE FOLLOWING PAGES.

INTRODUCTION:

In this investigation, students will learn about qualitative observations, quantitative observations, and inferences. A qualitative observation is something that a scientist can observe using his or her senses and takes the form of a description. A quantitative observation is similar, but must include a number. An inference is something that the scientist believes to be true based on the qualitative and quantitative observations, but cannot be directly observed. The purpose of this lab is to correctly identify the contents of 10 mystery boxes without opening them. Students are allowed to shake, tap, or otherwise touch the boxes, but are strictly prohibited from looking inside.

NOTE: THE INTRODUCTION SHOULD BE APPROXIMATELY 5-8 SENTENCES LONG. INCLUDE RELEVANT BACKGROUND INFORMATION, INCLUDING DEFINITIONS OF IMPORTANT TERMS, SO THAT THE READER CAN UNDERSTAND THE LAB REPORT. STATE THE PURPOSE OF THE LAB, BUT NOT THE RESULTS. DO NOT WRITE THE PROCEDURE IN THE INTRODUCTION.

HYPOTHESIS:

If I am given 10 mystery boxes, then I will correctly identify the contents of 7 of them.

NOTE: IN BIOLOGY, THE HYPOTHESIS WILL USUALLY BE WRITTEN IN “IF, THEN” FORMAT. THE WORDING FOR THE HYPOTHESIS WILL BE PROVIDED TO STUDENTS AT THE BEGINNING OF THE LAB.

EXPERIMENTAL DESIGN:

- The independent variable for this investigation is _____.
- The dependent variable for this investigation is _____.
- The control group for this investigation is _____.

NOTE: WRITE THIS SECTION OF YOUR LAB REPORT EXACTLY AS IT IS SHOWN ABOVE. FOR SOME LABS, THERE WILL BE NO INDEPENDENT VARIABLE, DEPENDENT VARIABLE, AND/OR CONTROL GROUP. IF A COMPONENT DOES NOT APPLY TO A LAB, WRITE “N/A” OR “NONE”.

THE INDEPENDENT VARIABLE IS THE CHANGEABLE FACTOR IN THE EXPERIMENT. THE DEPENDENT VARIABLE IS THE FACTOR THAT CHANGES AS A RESULT OF THE INDEPENDENT VARIABLE. THINK OF THE INDEPENDENT VARIABLE AS THE “CAUSE” AND THE DEPENDENT VARIABLE AS THE “EFFECT”. ON A GRAPH, THE INDEPENDENT VARIABLE IS FOUND ON THE X-AXIS AND THE DEPENDENT VARIABLE IS FOUND ON THE Y-AXIS.

THE CONTROL GROUP IS THE PART OF THE EXPERIMENT THAT IS NOT ALTERED BY THE INDEPENDENT VARIABLE AND IS USED FOR COMPARISON.

MATERIALS:

1. 10 mystery boxes
2. timer

NOTE: WRITE ALL OF THE MATERIALS IN A NUMBERED LIST, ONE PER LINE.

DO NOT INCLUDE BASIC CLASSROOM SUPPLIES LIKE PEN OR PENCIL, NOTEBOOK PAPER, OR LAB HANDOUT UNLESS SPECIFICALLY INSTRUCTED BY YOUR TEACHER.

PROCEDURE:

1. Each lab team will receive 1 mystery box.
2. The lab teams will have 2 minutes to make a list of observations for each mystery box. The lab teams will also make at least one prediction as to the contents of the mystery box. The observations and predictions will be recorded on notebook paper.
3. After two minutes, the teacher will announce that it is time to pass the boxes to the next group.
4. Repeat steps 3 and 4 for each of the 10 mystery boxes.
5. The teacher will share the contents of the mystery boxes with the class.

NOTE: COPY THE PROCEDURE EXACTLY AS IT WAS PERFORMED. INCLUDE ANY MODIFICATIONS TO THE PROCEDURE THAT WAS DISTRIBUTED IN CLASS.

DO NOT WRITE THINGS LIKE: THE TEACHER WILL ASSIGN LAB PARTNERS, ANSWER THE POST-LAB QUESTIONS WITH YOUR PARTNER, ETC.

RESULTS:

Data Table #1: Observations and Predictions of 10 Mystery Boxes

Box	3 Observations (Quantitative and Qualitative)	Predictions	Actual Contents	Correct?
1	-heavy when lifted -makes a loud noise when tilted -seems hard or dense	glue stick	bottle of glucose	NO
2	-seem to be a lot of objects -most likely hard objects -sounds like pencils or crayons	crayons	21½ crayons	½
3	-shakes like a ball -seems hard or dense -seems like it is small (1-2 inches)	rock or mineral	halite	½
4	-seem to be a few objects -makes a loud noise when shaken -most likely hard objects	4 pieces of candy	5 cough drops	NO
5	-the box cannot fully close -seems to be squishy -seems to be full of air	sponge	balloon	NO
6	-makes a loud “thump” when tilted -seems to be heavy -seems like it is 2-3 inches long	glass jar	scorpion in a jar	½
7	-seems like a few small objects -seems like they are light-weight -makes a slight noise when shaken	3 thumbtacks	4 paper clips	NO
8	-seems like nothing is in the box -object barely moves when shaken -makes almost no sound when shaken	small piece of paper	sheet of paper	YES
9	-seems like 2 objects -makes a loud noise when shaken -the noise sounds like marbles	2 marbles	2 marbles	YES
10	-seems to be a number of objects -sounds like pennies when shaken -objects seem to be very small	10 pennies	14 pennies	½

NOTE: RECORD ALL OF THE DATA, INCLUDING PICTURES, DIAGRAMS, DESCRIPTIONS, AND QUANTITATIVE OBSERVATIONS, IN THE FORM OF TABLES WITH BOXES AROUND THEM. ALL DATA TABLES MUST HAVE A CLEAR AND SPECIFIC TITLE USING THE FORMAT AS SHOWN ABOVE.

DO NOT EXPLAIN YOUR DATA IN THE RESULTS SECTION. ALL OF THE EXPLANATIONS WILL BE WRITTEN IN THE DISCUSSION SECTION.

DISCUSSION:

In this lab, we recorded three types of data: qualitative observations, quantitative observations, and inferences. Both types of observations are shown in Data Table #1. A qualitative observation is a description. For example, the phrases “heavy when lifted” or “seems hard or dense” are qualitative observations. A quantitative observation is one that includes some sort of number. For example, the phrases “seems like it is 2-3 inches long” or “seems like 2 objects” are quantitative observations. An inference is something you determine to be true based on logic. Inferences are also shown in Data table #1. For example, the phrases “objects seem to be very small” and “makes almost no sound when shaken” are examples of inferences.

As shown in Data Table #1, I correctly identified the contents of 4 out of the 10 boxes. There were two instances in which I was very accurate. For example, I was 100% accurate at identifying boxes 8 and 9. I was also correct in identifying the contents of boxes 2 and 10, but I did not accurately predict the right number of objects. For boxes 3 and 6, I was close enough to be considered half correct, but I lacked sufficient detail. For example, I knew that box 6 contained a jar, but had no idea that it had a scorpion inside. I based my prediction on the fact that I heard a loud “thump” when I tilted the box. Also, I predicted that box 3 would contain a rock or mineral, but I did not state that it was halite. I don’t think that it would be possible for me to identify it as halite without opening the box.

Although my hypothesis was not correct, I was very close to being correct. For my hypothesis, I predicted “If I am given 10 mystery boxes, then I will correctly identify the contents of 7 of them.” In reality, I correctly predicted the contents of 4 boxes as shown in Data Table #1.

The biggest problem with this lab is that I was limited in my observations without being able to touch the objects. For example, mystery box 8 barely made a sound. At one point, my partner and I thought it was empty. It turns out that the paper got stuck to the side of the box. There was also a problem with box 5 for some students. My partner and I observed box 5 on the first day, but some of our classmates observed it on the second day. Since the balloon had deflated in between the two days, they did not record observations like “the box cannot fully close” or seems to be squishy” as shown in Data Table #1.

NOTE: THE DISCUSSION SHOWN ABOVE IS AN ABBREVIATED SAMPLE. THE LENGTH OF THE DISCUSSION SECTION VARIES FOR EACH LAB REPORT, BUT IS USUALLY ABOUT 2 PAGES LONG.

DESCRIBE ALL OF THE DATA THAT YOU COLLECTED DURING THE LAB. EXPLAIN ALL RELEVANT VOCABULARY TERMS AND CONCEPTS. CLEARLY SHOW HOW THEY RELATE TO YOUR DATA. DO NOT SIMPLY RESTATE ALL OF THE DATA FROM THE RESULTS SECTION IN PARAGRAPH FORM. INSTEAD, INTERPRET THE DATA AND USE YOUR RESULTS TO SUPPORT YOUR CLAIMS. TO PROPERLY REFERENCE YOUR RESULTS, CITE THE ACTUAL DATA AS WELL AS THE DATA TABLE BY NUMBER.

ANALYZE YOUR HYPOTHESIS USING CLAIM-EVIDENCE-REASONING. TO DO THIS, RESTATE THE HYPOTHESIS THAT YOU WROTE EARLIER IN THE LAB REPORT. STATE WHETHER IT WAS CORRECT, INCORRECT, OR PARTIALLY CORRECT. CITE DATA FROM YOUR LAB REPORT TO SUPPORT THIS CLAIM.

ANSWER ALL ASSIGNED POST-LAB QUESTIONS IN PARAGRAPH FORM. DO NOT WRITE THE QUESTIONS. INCORPORATE THE ANSWERS THROUGHOUT THE DISCUSSION SECTION WHERE THEY ARE MOST APPROPRIATE.

DESCRIBE ACTUAL OR POSSIBLE SOURCES OF ERROR DURING THE LAB. STUDENTS WILL NOT BE GIVEN CREDIT FOR GENERIC ANSWERS SUCH AS "NOT ENOUGH TIME" OR "I FELT RUSHED". THE SOURCES OF ERROR MUST INCLUDE AN EXPLANATION.

SCIENTIFIC WRITING IS SUPPOSED TO BE BORING AND A BIT REPETITIVE. YOU ARE NOT SUPPOSED TO MAKE IT EXCITING THE WAY YOU WOULD FOR A CREATIVE ESSAY. YOU ARE SUPPOSED TO DESCRIBE YOUR LAB AND PROVIDE JUSTIFICATION/REASONING FOR YOUR RESULTS.

CONCLUSION:

This lab introduced our class to qualitative observations, quantitative observations, and inferences. My partner and I used quantitative and qualitative observations to make an inference about the contents of the mystery boxes. We also learned that quantitative observations always include a number, whereas qualitative observations do not. In some instances, we identified the correct item but not the correct quantity. I would modify this lab by allowing students to touch the objects while being blindfolded. This would allow the students to record more detailed and accurate observations. It would also allow students to correctly predict the quantity of the items.

NOTE: SUMMARIZE THE MAIN POINTS FROM THE LAB REPORT BY DESCRIBING THE MOST IMPORTANT THINGS YOU LEARNED BY COMPLETING THIS LAB. DO NOT GO INTO ANY LENGTHY EXPLANATIONS BECAUSE THEY SHOULD HAVE ALREADY BEEN INCLUDED IN THE DISCUSSION SECTION. HIGHLIGHT THE MAIN IDEAS THAT THE READER SHOULD KNOW FROM READING THE LAB REPORT. DO NOT DISCUSS YOUR HYPOTHESIS IN THE CONCLUSION.

IN THE CONCLUSION, DISCUSS WHAT YOU LEARNED, NOT WHAT YOU LEARNED ABOUT. FOR THIS EXAMPLE, DON'T SAY THAT YOU LEARNED ABOUT QUALITATIVE AND QUANTITATIVE OBSERVATIONS. WRITE YOU ACTUALLY LEARNED, SUCH AS DEFINITIONS OR EXAMPLES OF QUALITATIVE AND QUANTITATIVE OBSERVATIONS.

FINALLY, STATE AT LEAST ONE WAY TO IMPROVE THE LAB AND PROVIDE A BRIEF EXPLANATION.

THE LENGTH OF THE CONCLUSION SECTION SHOULD BE ONE PARAGRAPH OF APPROXIMATELY 6-8 SENTENCES.