



Developed and Published
by

AIMS Education Foundation

This book contains materials developed by the AIMS Education Foundation. **AIMS** (Activities Integrating Mathematics and Science) began in 1981 with a grant from the National Science Foundation. The non-profit AIMS Education Foundation publishes hands-on instructional materials that build conceptual understanding. The foundation also sponsors a national program of professional development through which educators may gain expertise in teaching math and science.

Copyright © 2013 by the AIMS Education Foundation

All rights reserved. No part of this book or associated digital media may be reproduced or transmitted in any form or by any means—except as noted below.

- A person purchasing this AIMS publication is hereby granted permission to make unlimited copies of any portion of it (or the files on the accompanying disc), provided these copies will be used only in his or her own classroom. Sharing the materials or making copies for additional classrooms or schools or for other individuals is a violation of AIMS copyright.
- For a workshop or conference session, presenters may make one copy of any portion of a purchased activity for each participant, with a limit of five activities or up to one-third of a book, whichever is less.
- All copies must bear the AIMS Education Foundation copyright information.
- Modifications to AIMS pages (e.g., separating page elements for use on an interactive white board) are permitted only for use within the classroom for which the pages were purchased, or by presenters at conferences or workshops. Interactive white board files may not be uploaded to any third-party website or otherwise distributed. AIMS artwork and content may not be used on non-AIMS materials.

Digital distribution rights may be purchased for users who wish to place AIMS materials on secure servers for school- or district-wide use. Contact us or visit the AIMS website for complete details.

AIMS Education Foundation
1595 S. Chestnut Ave., Fresno, CA 93702-4706 • 888.733.2467 • aimsedu.org

Printed in the United States of America

Table of Contents

<i>Skills Chart</i>	<i>iv</i>
<i>Chinese Proverb</i>	<i>v</i>
Introduction	1
It's A Shoe In!	2
Unique U	4
On Your Own Two Feet	7
Creature Features	14
Super Sleuth	16
Mini Metric Olympics	19
Mini Metric Olympics II	30
Metric Scavenger Hunt	31
Cool It!	32
Hot Stuff	34
Corny Comparisons	37
Weight Watchers	39
Second Guessing	42
Chaotic Computing	44
It's Simply Marble-ous	51
Count and Crunch — "m & m's" [®] candies	55
What's in the Bag— "m & m's" [®] candies	58
Dealing with Data	61
Practically Pi	65
Just Drop It	68
Screen Test	71
Trial and Error Learning	74
Graph-FeeT-EE	79
The Penny Sort & Nickel Dates	83
Rubber Band Stretch	96
Rubber Band Shoot	99
It's Bean Fun!	101
The Big Banana Peel	105
Going Bananas	107
Sample Grids	115

Index to Skills

MATH SKILLS

Attributes	1, 3
Applying Formulas	34, 36
Averaging	13, 17, 19, 21, 26, 28, 37, 39
Calculator Usage	13
Counting	22, 34, 36
Decimal Computation	13, 19, 24
Equations	13, 14, 24, 26, 34, 36, 39
Estimating	9, 13, 14, 21, 22, 28, 30
Formula Usage	13, 14, 26, 34, 36, 39
Fractions	19
Frequency Tables	19, 33
Graphing	3, 10, 11, 17, 19, 21, 24, 26, 29, 30, 33, 34, 36, 39
Logic	2, 3, 5, 7, 37
Measuring Area	9
Measuring Length	9, 17, 24, 28, 30, 34, 36
Measuring Mass	9, 13, 34, 36, 39
Measuring Temperature	10, 11
Measuring Volume	9, 12
Patterns	34, 36
Percent	3, 13, 14, 19, 33, 39
Permutations	33
Predicting	9, 12, 13, 21
Probability	33, 37
Problem Solving	2, 5, 37
Ratios	12, 13, 14, 22, 37, 39
Rounding Decimals	19, 24
Sampling	22, 33, 37
Set Theory	1
Sorting	2, 5
Tabulating	21, 33
Timing	15, 29
Using Tables	5, 28
Venn Diagrams	1
Whole Number Computation	15, 17, 21

SCIENCE PROCESSES

Generalizing	10, 12, 26, 28, 34, 36, 37, 39
Hypothesizing	21, 33
Inferring	21, 33
Interpreting Data	10, 11, 17, 19, 21, 22, 24, 26, 28, 29, 30, 36, 39
Observing	1, 2, 3, 5, 7, 10, 11, 13, 19, 22, 28
Recording Data	All investigations
Variables	24, 26, 34, 36

Introduction

This book may be described as a sample of innovative activities that correlate to mathematics and science in a unique and exciting way. These highly motivating investigations invite students and teachers to explore, discover, and enjoy the many fascinating elements of our world. The investigations employ a wide variety of readily available and easily understood materials—from marbles to "m & m"® candies to old shoes and rubber balls.

The twenty-five investigations presented here are sequenced from simple to complex according to these science processes:

- A. Observing and Classifying
- B. Measuring
- D. Estimating, Predicting, and Hypothesizing
- D. Controlling Variables
- E. Gathering and Recording Data
- F. Interpreting Data
- G. Applying and Generalizing

While the experiences are ordered in this manner, be encouraged to select any of the activities to supplement your own curriculum

It is the sincere desire of the writing team that these curricular materials will encourage and challenge teachers and students in the endeavor to integrate math and science.

Weight Watchers

I. Topic Area

Estimating and measuring mass.

II. Introductory Statement

Weight Watchers is an activity that requires students to estimate and measure mass.

III. Math Skills

- Measuring
- Estimating
- Computing Ratio and Percent (optional)
- Using Calculators (optional)
- Averaging

Science Processes

- Observing
- Measuring
- Predicting and Estimating
- Recording Data

IV. Materials (per group)

Golf ball
 Marble
 Wooden block that weighs less than, but is larger than the golf ball
 Tennis ball
 Ping Pong ball
 Clay ball
 Equal arm balance with Metric mass set
 Student Worksheet

V. Key Question

"Can you order the objects from heaviest to lightest using only visual clues?"

VI. Background Information

The difference between the estimated mass and the actual mass, divided by the actual mass, multiplied by 100 equals the percent of error.

$$\frac{\text{difference}}{\text{actual mass}} \times 100 = \% \text{ of error}$$

Examples:

Item	Estimated Mass in Grams	Actual Mass in Grams	Percent of Error
Golf Ball	20	35	43%
Marble	15	10	50%

Golf Ball

Actual mass	35
Estimated mass	-20
Absolute difference	15

Actual mass	35	<u>.428</u>	Rounded off equals .43
		15.000	
		140	
		100	.43 × 100 = 43%
		70	
		300	
		280	
		20	

Marble

Estimated mass	15
Actual mass	-10
	5

Actual mass	10	<u>.50</u>	.50 × 100 = 50%
		5.00	
		50	

VII. Management Suggestions

This activity can be done in small groups or in a whole group activity. The activity can be done in one 45 minute class period.

VIII. Procedure

Collect all the necessary materials mentioned in the Materials Section IV. Give each student a copy of the worksheet. Place the objects where all the students can see them. Go through the worksheet step by step with the students. It might be helpful to make an overhead transparency of the worksheet and explain to the students before you begin what they will be doing.

IX. What the Students Will Do

- The students will order the objects from the heaviest to the lightest visually and record their guess.
- The students will estimate the mass of each object.
- The students can work in small groups and weigh the objects while the rest of the class watches.
- All the students will record the actual mass in grams.
- Students will find and record the difference between the actual mass and estimated mass.

Students may stop at this point. If the teacher feels that students are capable, the teacher may have the students continue to fill in the chart. This is a good opportunity to have students use calculators.

Optional

- Have students find their average error. A small prize could be awarded to the student with the lowest average error.
- Have students find the ratio.
- Have students convert the ratio to a decimal.
- Have students compute the percent of error.

X. Discussion

- Is there a way the estimations can be checked for accuracy?
- Can you estimate the mass of the objects in grams and then find the actual mass in grams?
- Discuss with the students what their rationale for ordering the items from heaviest to lightest was.

XI. Extension

Provide each student with a chart that has all the items left out. Let the students choose 6 items of which they would like to estimate the mass and then continue on with the mathematical calculations.

Weight Watchers

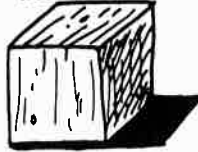
Golf Ball



Marble



Wooden Block



Tennis Ball



Ping Pong Ball



Clay Ball









1. Look at the 6 items. List them in order from heaviest to lightest : 1. _____
2. _____

2. Next estimate their mass (grams). 3. _____

3. Weigh to find their actual mass. 4. _____

4. Determine the error of your guess. 5. _____

5. Compute the percent of error. 6. _____

Item	Estimated Mass in Grams	Actual Mass in Grams	Error (Difference)	Ratio $\frac{\text{Difference}}{\text{Actual}}$	Decimal $\text{Diff.} \div \text{Actual}$	Percent of Error $\frac{\text{Decimal} \times 100}{\text{Decimal} \times 100}$
Golf Ball 						
Marble 						
Wooden Block 						
Tennis Ball 						
Ping Pong Ball 						
Clay Ball 						
Average Error				Average Percent of Error		

Weight Watchers

Sketch →
the
6 objects



1. LOOK AT 6 ITEMS. LIST THEM IN ORDER FROM HEAVIEST TO LIGHTEST.



2. NOW ESTIMATE THEIR MASS (GRAMS).
3. WEIGH AND FIND THEIR ACTUAL MASS.
4. DETERMINE THE ERROR OF YOUR GUESS.
5. FIND THE RATIO.
6. COMPUTE THE PER CENT OF ERROR.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

ITEM	ESTIMATED MASS IN GRAMS	ACTUAL MASS IN GRAMS	ERROR (DIFFERENCE)	RATIO: $\frac{\text{DIFFERENCE}}{\text{ACTUAL}}$	DECIMAL DIFF. \div ACTUAL	PERCENT OF ERROR DECIMAL \times 100
AVERAGE ERROR				AVERAGE PER CENT OF ERROR		