Expanding Our Vocabulary for Evaluating Writing

Although different situations require that writing take different forms (i.e., resume versus lab report), certain factors are important to ALL writing situations. These factors— while general— can be adapted or explained in terms that are specific to each writing situation. Below is a list of eight communication factors that apply to writing situations. I encourage you to begin using this vocabulary to describe writing.

Content: Has the student included technical or scientific ***Content*** accurately and thoroughly? Does the student address accurate information such as definitions, formulas, theorems, explanations, or data?

Context: Has the student communicated in a way appropriate for the situation or ***Context*** in which the document /presentation/visual will be received? Have the requirements of the assignment been met?

Audience: Has the student addressed the ***Audience*** with appropriate language and technical content, vocabulary, level of knowledge, and register (informal or formal)?

Purpose: Has the student identified the ***Purpose*** of their communication, such as to inform, persuade, instruct, or demonstrate?

Support: Has the student included appropriate ***Support*** in the form of documentation, facts, statistics, formulas, illustrations, or evidence?

Design: Does the student use effective ***Design***, both for page design and for the integration of verbal explanations and visual illustrations? Does the student display neatness and cross-references at appropriate points?

Organization: Has the student ***Organized*** the communication into logical sections, paragraphs, topic sentences, and headings?

Expression: Has the student ***Expressed*** written work clearly, efficiently, and effectively, and has the student used correct grammar and mechanics?

Ways that Writing Factors Apply to Physics Lab Reports

Although evaluation sheets for lab reports may not exclusively address the eight factors mentioned above, many are implicitly included. For example, the worksheet used by Physics to assess lab reports includes words such as "clear and readable," "stated correctly," "section headings provided," "correct grammar and spelling," and "use of labels on graphs." I would consider each of these criteria that address communication.

(See Original Physics Evaluation Sheet on the next page)

SAMPLE COVER SHEET

PHYSICS ____ LABORATORY REPORT
LABORATORY I

Name and ID#: ______________________________

Date performed: ______________ Day/Time section meets: ______________

Lab Partners' Names: ______________________________

____

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Problem # and Title: ______________________________

Lab Instructor Initials: __________

Communication Factors

Grading Checklist	Points
LABORATORY JOURNAL:	
PREDICTIONS (individual predictions completed in journal before each lab session)	
LAB PROCEDURES (measurement plan recorded in journal, tables and graphs made in journal as data is collected, observations written in journal)	
PROBLEM REPORT:	
ORGANIZATION (clear and readable; correct grammar and spelling; section headings provided; physics stated correctly)	
DATA AND DATA TABLES (GROUP PREDICTIONS) (clear and readable; units and assigned uncertainties clearly stated)	
RESULTS (results clearly indicated; correct, logical, and well-organized calculations with uncertainties indicated; scales, labels and uncertainties on graphs; physics stated correctly)	
CONCLUSIONS (comparison to prediction & theory discussed with physics stated correctly ; possible sources of uncertainties identified; attention called to experimental problems)	
TOTAL(incorrect or missing statement of physics will result in a maximum of 60% of the total points achieved; incorrect grammar or spelling will result in a maximum of 70% of the total points achieved)	
BONUS POINTS FOR TEAMWORK (as specified by course policy)	

expression

content

expression and page design

expression

organization

support

content

* An "R" in the points column means to rewrite that section only and return it to your lab instructor within two days of the return of the report to you -- no exceptions.

Quality of Writing Defined: Moving Away from "Good" and "Bad"

It is not enough to recognize the general factors of communication. Graders must also be able to assess the ability of writers to communicate well. Communication involves a number of factors, resulting in a spectrum for evaluation. Below are listed the eight factors of writing and how each of these factors may be assessed according to the scale of "excellent," "average," and "poor" for a lab report.

	Excellent	**Average**	**Poor**
Addresses Content accurately and thoroughly	Includes accurate and complete technical information, including formulas, explanations, theorems, and data.	Includes accurate technical information, but has missed some important information.	Does not include accurate or complete information.
Writes to the appropriate Context or situation of assignment	Meets the requirements of the assignment; includes proper format and sections that assignment requires	Adequately meets requirements of the assignment; does not always display proper format.	Does not meet the requirements of the assignment as specified in the assignment sheet.
Addresses audience appropriately	Writes appropriately for the intended audience, including proper terms or vocabulary, explanations of concepts, formal register	Indicates audience but does not always include proper terms, concepts, or register (perhaps is too informal)	Does not recognize audience at all; does not include proper terms, concepts, or register to effectively address audience.
Indicates clear purpose for writing	Indicates purpose of the report (to solve a problem, to instruct, to explain, to demonstrate, etc.) in the beginning of the report.	Purpose of the lab report is not clearly indicated by the writer, or is indicated incorrectly.	Purpose of the lab report is not indicated at all. No effort has been made to indicate purpose of writing.
Organizes writing well	Includes complete, yet concise, paragraphs; includes strong topic sentences that indicate focus of paragraph or section; includes strong forecasting statements; includes appropriate headings and subheadings; demonstrates coherence throughout report.	Includes adequate overall format; does not display concise paragraphs or topic sentences; does not include all appropriate headings and subheadings; paragraphs do not cohere very clearly.	Does not use appropriate headings or subheadings; does not apply conciseness to paragraphs; paragraphs do not logically connect; topic sentences are not effective.
Includes adequate support (documentation and illustrations)	Includes illustrations or visual figures necessary for the report. Refers to appropriate readings, theories, and relevant background information; includes proper citation formats; includes relevant charts, graphs, or tables;	Refers to appropriate readings and background information, but does not use correct citation methods; includes tables, graphs, and charts, but does not include	Does not include necessary support in the form of citations, background information, tables, charts, graphs, labels, and cross-references.

	includes proper labeling and cross-references to figures, tables, charts, and graphs.	complete labeling or cross-references.	
Applies an appealing design	Report and figures are clear and legible. Visuals are balanced on the page with appropriate verbal explanations nearby. Report is neat; headings, subheadings, and titles have similar font and style to indicate hierarchy of information; sufficient white space allows for easy reading.	Report and figures are legible, but some areas are difficult to read. Figures and illustrations are not as neat as they could be. Headings and subheadings are indicated, but do not demonstrate hierarchy of information.	Report and figures are messy and difficult to read. Visuals and verbal explanations are not placed in a way convenient for the reader. Headings and subheadings are not clearly indicated.
Uses clear expression	Clear, readable prose. Uses complete sentences and proper subject-verb constructions. No spelling errors. Uses commas, periods, semi-colons, colons, punctuation marks, and dashes correctly. Uses correct abbreviations and capitalizations. Uses appropriate vocabulary and writes in a tone that clearly conveys ideas or concepts. Uses active voice to describe activities conducted by lab participants. Uses semi-formal tone.	Uses readable tone, but is not clear at all times. Includes occasional spelling errors. May occasionally misuse punctuation such as periods, commas, and colons. Does not use consistent tone or voice throughout the report.	Includes multiple spelling, grammar, or punctuation errors. Is difficult to read and understand due to misuse of language. Should be referred to a tutorial service (see Writing Support Network) for additional help.

Discussion of Sample Physics Report with Annotations Regarding Communication

Review the sample report included in the Physics coursepack.

What characteristics of writing does the report display well?

What characteristics are not displayed well?

Appendix F: Sample Laboratory Report

There is no set length for a problem report but experience shows the good reports are usually no more than three pages long. Graphs and photocopies of your lab journal make up additional pages. Complete reports will include the terminology and the mathematics relevant to the problem at hand. Your report should be a clear, concise, logical, and honest interpretation of your experience. You will be graded based on how well you demonstrate your understanding of the physics. Because technical communication is so important, neatness, and correct grammar and spelling are required and will be reflected on your grade.

‖ Note: As with Problem 1 of Lab 1, the double vertical bars indicate an explanation of that part of the report. These comments are not part of the actual report.

Statement of the problem

— Also indication of purpose (reason for writing)

‖ In a complete sentence or two, state the problem you are trying to solve. List the equipment you will use and the reasons for selecting such equipment.

Addresses purpose of report

The problem was to determine the dependence of the time of flight of a projectile on its initial horizontal velocity. We rolled an aluminum ball down a ramp and off the edge of a table starting from rest at two different positions along the ramp. Starting from the greater height up the ramp meant the ball had a larger horizontal velocity when it rolled along the table. Since the table was horizontal, that was the horizontal velocity when it entered the air. See Figure 1 from my lab journal for a picture of the set-up.

→ use of active voice: expression

strong forecasting statement

We made two movies with the video equipment provided, one for a fast rolling ball and one for a slower one. These movies were analyzed with LabVIEW™ to study the projectile's motion in the horizontal and vertical directions.

Prediction

← use of clear headings: organization

‖ Next comes your prediction. Notice that the physical reason for choosing the prediction is given. In this case there is a theoretical relationship between Δt and v_o. There is a reference to real life experience: the example of the bullets. Also, note that this prediction is wrong. The prediction does not need to be correct, it needs to be what you really thought before doing the lab; that is why it is called a prediction. The prediction is supposed to be a complete and reasonable attempt by your group to determine the outcome of the problem.

Our group predicted that the time the ball took to hit the ground once it left the table would be greater if the horizontal velocity were greater. We have observed that the faster a projectile goes initially, the longer its trajectory. Since the gravitational acceleration is constant, we reasoned that the ball would take more time to travel a larger distance.

Mathematically, we start from the definition of acceleration:

$$a = \frac{d}{dt}\left(\frac{dy}{dt}\right)$$

and integrate twice with respect to time to see how a change in time might be related to initial velocity. We found that:

$$y - y_o = v_o\Delta t + 0.5a\Delta t^2 \qquad (1)$$

With up being the positive y-axis, we know the acceleration is -g. We also know that v_o is the initial velocity, and $y_o - y$ is h, the height of the table. Solving for Δt one finds:

$$\Delta t = \frac{vo \pm \sqrt{(vo^2 + 2hg)}}{g} \qquad (2)$$

accuracy of content

Good Expression: use of complete sentences

Faced with a choice in sign, our group choose the solution with the positive sign, deciding that a possible negative value for elapsed time is nonsense. From equation (2), we deduced that if v_o increased, then the time of fall also increases. This coincided with our prediction that a projectile with fastest horizontal velocity would take the most time to fall to the ground. For a graph of our predicted time of flight versus initial horizontal velocity, see Graph A from the lab journal.

correct use + capitalization of name (expression)

LabVIEW™ generated graphs of x and y positions as functions of time. Our prediction for the vertical direction was equation (1). Since the ball only has one acceleration, we predicted that equation (1) would also be true for the horizontal motion:

$$x - x_o = v_o\Delta t + 0.5a\Delta t^2$$

The dotted lines on the printed graphs represent these predictions.

The Example of Two Bullets

Our TA asked us to compare a bullet fired horizontally from a gun to a bullet dropped vertically. Our group decided the bullet which is fired horizontally will take longer to hit the ground than the one that is simply dropped from the same height.

Data and results

> This section describes your experimental method, the data that you collected, any problems in gathering the data, and any crucial decisions you made. Your actual results should show you if your prediction was correct or not.

Excellent organization

To ensure the ball's velocity is completely horizontal, we attached a flat plank at the end of the ramp. The ball rolls down the ramp and then goes onto the horizontal plank. After going a distance (75 cm) along the plank, the ball leaves the edge of the table and enters projectile motion.

Good paragraph structure

We measured the time of flight by simply counting the number of video frames that the ball was in the air. The time between frames is 1/30 of a second since this is the rate a video camera takes data. This also corresponds to the time scale on the LabVIEW™ graphs. We decided to compare the times of flight between a ball with a fast initial velocity and one with a slow initial velocity. To get a fast velocity we started the ball at the top of the ramp. A slower velocity was achieved by starting the ball almost at the bottom of the ramp.

Strong topic sentences

logical order of paragraphs (chronological)

During the time the ball is in the air, the horizontal velocity is a constant as shown by the velocity in the x-direction graphs for slow and fast rolling balls. From these graphs, the slowest velocity we used was 1.30 m/s, and the fastest was 2.51 m/s.

After making four measurements of the time of flight for these two situations, we could not see any correspondence between time of flight and initial horizontal velocity. (See table 1 from lab journal) As a final check, we measured the time of flight for a ball that was started approximately halfway up the ramp and found it was similar to the times of flight for both the fast and the slow horizontal velocities. (See table 2 from lab journal)

Good support: cross references to tables

> A discussion of uncertainty should follow all measurements. No measurement is exact. Uncertainty must be included to indicate the reliability of your data.

Most of the uncertainty in recording time of flight comes from deciding the time for the first data point when the ball is in the air and the last data point before it hits the ground. We estimated that we could be off by one frame which is 1/30 of a second. To get a better estimate of this uncertainty, we repeated each measurement four times. The average deviation served as our experimental uncertainty. (See Table 1 from lab journal) This uncertainty

content: uncertainty clearly stated

matches our estimate of how well we could determine the first and the last frame of the projectile trajectory.

Conclusions

> This section summarizes your results. In the most concise manner possible, it answers the original question of the lab.

Our graph indicates that the time of flight is independent of the ball's initial horizontal velocity. (See lab journal, Graph A) We conclude that there is no relationship between these two quantities.

Content: results clearly indicated

> A good conclusion will always compare actual results with the predictions. If your prediction was incorrect, then you must discuss where your reasoning went wrong. If your prediction was correct, then you should review your reasoning and discuss how this lab served to confirm your knowledge of the basic physical concepts.

Our prediction is contradicted by this independence between time of flight and initial horizontal velocity. We thought that the ball would take longer to fall to the floor if it had a greater initial horizontal velocity. After some discussion, we determined the error in our prediction. We did not understand that the vertical motion is completely independent of the horizontal motion. Thus, in the vertical direction the equation

$$y - y_o = v_o\Delta t + 0.5a\Delta t^2$$

means that the v_o is the only the y-component of initial velocity. Since the ball rolls horizontally at the start of its flight, v_o in this equation equals zero.

The correct equation for the time of flight, with no initial vertical component of velocity, is actually:

$$y - y_o = 0.5a\Delta t^2$$

In this equation, there is no relationship between time of flight and initial horizontal velocity.

Content: clearly distinguishes results from predictions

Furthermore, the graphs we generated with LabVIEW™ showed us that velocity in the y-direction did not change when the initial horizontal velocity changed. Velocity in the y-direction is always approximately zero at the beginning of the trajectory. It is not exactly zero because of the difficulty our camera had determining the position when the projectile motion begins. We observed that the y-velocity changed at the same rate (slope of v_y plots, graphs 1 and 2) regardless of the horizontal velocity. In other words, the acceleration in the y-direction is constant, a fact that confirms the independence of vertical and horizontal motion.

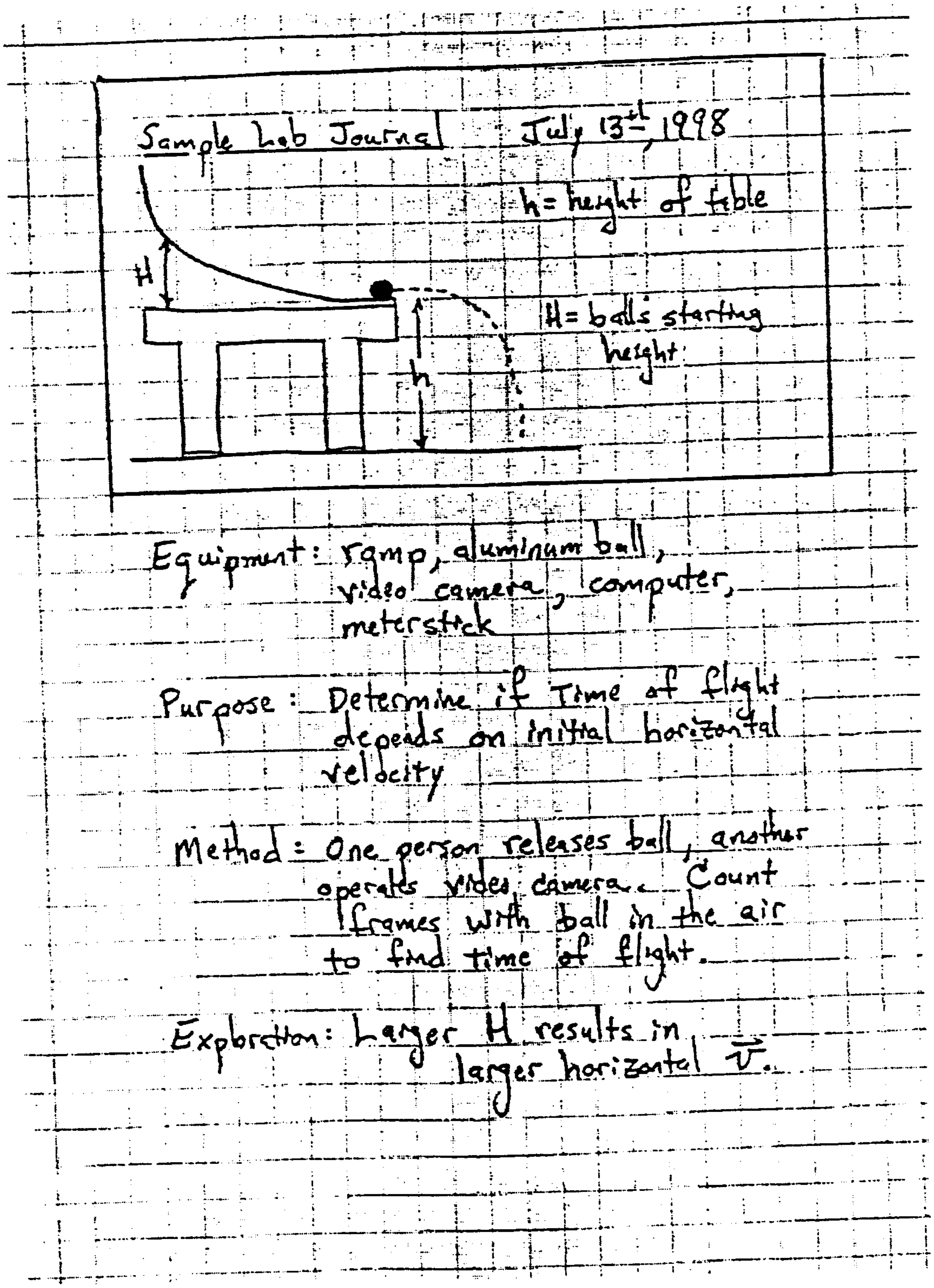
> After you have compared your predictions to your measured results, it is helpful to use an alternative measurement to check your theory with the actual data. This should be a short exercise demonstrating to yourself and to your TA that you understand the basic physics behind the problem. Most of the problems in lab are written to include alternative measurements. In this case, using the time of fall and the gravitational constant, you can calculate the height of the table.

Alternative Analysis

Since $y_0 - y = h$ and $a = -g$ we can check to see if our measured time of flight gives us the height of the table. From our graph, we see that the data overlap in a region of about 0.41 sec. With this as our time of flight, the height of the table is calculated to be 82.3 cm. Using a meter stick, we found the height of the table to be 80.25 cm. This helped convince us that our final reasoning was correct.

The example of the two bullets discussed in the Prediction section was interpreted incorrectly by our group. Actually, both bullets hit the ground at the same time. One bullet travels at a greater speed, but both have the same time of flight. Although this seems to violate "common sense" it is an example of the independence of the horizontal and vertical components of motion.

The following are pages photocopied from my lab journal:



Sample Lab Journal July 13th, 1998

Equipment: ramp, aluminum ball, video camera, computer, meterstick

Purpose: Determine if Time of flight depends on initial horizontal velocity

Method: One person releases ball, another operates video camera. Count frames with ball in the air to find time of flight.

Exploration: Larger H results in larger horizontal $\vec{v}$.

Design: Neatly written
Page design has adequate white space so it is easy to read
Organization: sections are clearly labeled
Support: proper labels are used

Grading Grid

	Satisfactory	Adequate	Poor
Addresses Content accurately and thoroughly			
Write to the appropriate Context or situation of assignment			
Addresses Audience appropriately			
Indicates clear Purpose for writing			
Organizes writing well			
Includes adequate Support (documentation and illustrations)			
Applies an appealing Design			
Uses clear Expression			

Comments:

Grade: ____________________