

Developing A Database

TIES 2002

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**This document is developed as partial
fulfillment of the TIES-2002 program by:
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Developing a Database Curriculum Unit Overview

Summary:

Developing a “database” is an important concept to learn since large amounts of information are sometimes necessary to collect, organize, manipulate, and retrieve. This can easily be accomplished with the Microsoft operating system through the Excel Spreadsheet and the Access Data Management software systems.

This module will incorporate skills in the areas of Physics, Mathematics, Software Usage, and Communication. This material is targeted for physics students in particular but could be modified for any level of high school students.

Students will put data into a spreadsheet and manipulate this data developing new resultant information utilizing basic physics equations. The resultant data will be graphed and interpreted. Students will then put this data into Access so that information can be set up in a relational database and recalled with queries unique to the problems given to the students.

From this resultant data students will be asked to determine maximum stress and strains for specific materials to be analyzed.

A final activity in this module will be to write a report summarizing their findings and interpreting their calculations and graphs. This will take the form of a consultants evaluation environmental conditions encountered.

NOTE: Since physics students have different levels of math and even the same level would have several different teachers, it is not possible to have this material taught in their math classes. Likewise, most of these students do not take computer courses at the same time it will be impossible to have collaborative efforts in these areas. As a result the specific, inter-curriculum subject material, will all be taught by the physics teacher.

Developing Database Summary Chart

The following is a summary of the unit including a brief summary of each Authentic Learning Task (ALT). This chart provides an overview of the tasks in each unit section and illustrates how they are related to each other. Results of ALT 1 & 2 will be utilized in ALT 3 where a report will be written by each student. The students will act as consultants to a parachute company and relate relevant information to them so a parachute can be properly designed given certain stresses and strains on a parachute.

Software Application	Physics	Mathematics & TI Calc.
ALT1-Excel Spreadsheet Setting up a spreadsheet with appropriate columns, entering data, applying equations to each column, graphing data.	ALT1-Kinematic and Force Applying kinematic equations for velocity, acceleration, drag force, and net force.	ALT1-Tools of Physics Doing equation solving and regression analyses using a spreadsheet program and TI calculators.
ALT2-Access Database Constructing a database and then entering data from Excel. Set up queries to retrieve appropriate data for subsequent science and math requirements.	ALT2-Determination of Application Questions From the Access Database calculated data will be retrieved and used to answer specific questions.	ALT2-Solving Application Questions Using Math Using the retrieved calculated data, other equations will be supplied to answer the specific questions

Transfer Activity:

Students will be asked to write a report whereby students will act as consultants to a parachute company and relating relevant information to them so they can properly design a parachute given certain stress and strains on the parachute. This not only provides a fourth area of curriculum to include in this module but will enable students to bring closure to the module and provide a means of understanding what they have accomplished. The chart below is a continuation of the chart above illustrating the flow of activity for this module.

Communication
ALT3-Report Writing Upon completion of all calculations and the answering all specific questions, a report will be written interpreting this information and putting into a meaningful format.

Section One: Software Application

ALT One: Microsoft Excel Spreadsheet

Summary

Activity #1:

Students will be given laptop computers and will be shown how to use Microsoft Excel Spreadsheet program.

- When given a short column of data students will be shown how to manipulate this data in successive columns by using simple operational equations.
- Students will also be shown how to graph the various relationships

Activity #2: Application of Activity #1

Students will be given data from a “sky diving free-fall lab” previously conducted. This data will be put into the Microsoft Excel Spreadsheet Program and calculations will be performed on each piece of data, for each column achieving the required calculations. Procedure will be similar to that of Activity #1.

This resultant manipulated data will be put into Access and will also be used for further stress and strain calculations.

Competencies

1. Demonstrate an ability to follow directions in using laptop computers and Excel Spreadsheet in particular.
2. Demonstrate an ability to put equations into Excel and achieve desired results
3. Be able to graph data
4. Be able to apply this knowledge to the given specific requirements of this model

Time

Activity #1: Estimated to be about ½ a period (about 45 minutes)

Activity #2: Estimated to be about 1-1/2 periods (about 2-1/4 hours)

Materials

- Set of laptop computers
- Chalk board and / or Overhead
- Set of data
- Equations used to manipulate data

Instructions

Activity #1:

1. Students will be each given a laptop computer.
2. Students will start up the Excel Spreadsheet program
3. Students will be given a small set of data on a worksheet
4. Students will be shown how to manipulate the data four times in four different columns
5. Students will be shown how to graph two of the columns to show relationships

Activity #2:

Students will be given instantaneous velocity values for skydiving data for every 0.25 seconds of free-fall. From this data students will set up columns to do the following:

1. Make a column next to the current column converting the English units into SI.
2. Make a Delta Velocity column.
3. Determine the Acceleration and label as a column.
4. Determine the Drag Force on the skydiver
5. Determine the net force on the skydiver who has a weight of 176 and label as a column.
6. Graph the Net Force vs. Time

*Note 1: Use TIME for the independent axis and FORCE for the dependent axis.

*Note 2: Make the proper titles and axis labels

Evaluation / Assessment of Students Competency

Students will be assessed by the teacher going to each student, checking each column's results, checking the graph on their laptops, and recording a grade in the grade book. Students can help each other but each student must perform all required work.

Closure

These two activities will enable students to be somewhat proficient in Excel Spreadsheet work. It should also lead them to a better understanding of kinematics, drag force, and net forces and how they vary during free-fall.

Teacher will make a transparency of the results and discuss the relationships and insights students should have gained.

Alt-1 / Software Applications /Activity #1 - Worksheet

Each student should copy the “Data” values into their spreadsheet. Then perform the 6 tasks described under the table. The table and graph on the following page is the proper result for this activity. When you finish Activity #1 then begin Activity #2.

Activity
#1

Data	Col. #1	Col. #2	Col. #3	Col. #4
------	---------	---------	---------	---------

26.47				
27.63				
28.97				
30.13				
31.47				
33.20				
34.35				
35.49				
36.04				
37.18				

Directions:

1. Column #1: Multiply Data column by 3.28 and place results in Col. #1
2. Column #2: Divide “Data” column by 6.98 and add 35.77 to it and place results in Col. #2
3. Column #3: Divide Col. #2 by Col. #1 and subtract 2.88 from that result and place in Col. #3
4. Column #4: Perform a “Delta” operation on the “Data” column (i.e. for each two consecutive numbers subtract the first from the second → 27.63-26.47, 28.97-27.63, etc.)
5. Make columns #1 → #4 to have 3 decimal values
6. Make a graph putting Col. #2 on the “X” axis and Col. #1 on the “Y” axis

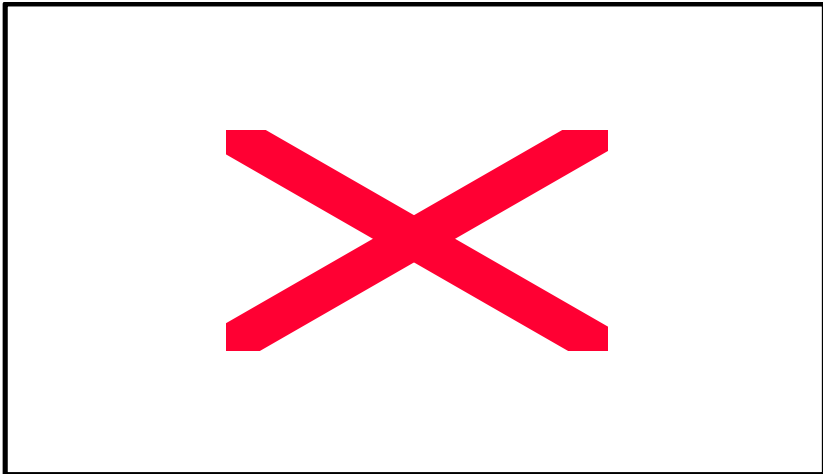
RESULTS OF ACTIVITY #1

The table below shows the expected results:

Activity #1

Data	Col. #1	Col. #2	Col. #3	Col. #4
26.47	86.820	39.562	-2.424	
27.63	90.610	39.728	-2.442	1.156
28.97	95.029	39.921	-2.460	1.347
30.13	98.810	40.086	-2.474	1.153
31.47	103.220	40.279	-2.490	1.344
33.20	108.905	40.527	-2.508	1.733
34.35	112.668	40.691	-2.519	1.147
35.49	116.413	40.855	-2.529	1.142
36.04	118.217	40.934	-2.534	0.550
37.18	121.934	41.096	-2.543	1.133

The graph below is the expected graph result for this activity:



Alt-1 / Software Applications / Activity #2 - Worksheet

Each student should copy the “Data” values into their spreadsheet and the column headings. Then perform the 10 tasks described under the table. The table and graph on the following page are the proper result for this activity.

Skydiving Lab Data

Time (s)	Altitude from grnd (m)	Altitude from S.L. (m)	Speed (km/h)	Speed (m/s)	Air Density (kg/m ³)	Accel. (m/s ²)	Net Drag F. (N)	Calculated Drag F. (N)	% Error Drag Net vs. Calc.	Net Force Down (N)
6.00	2937.71		110.59							
6.25	2925.09		114.65							
6.50	2912.48		119.41							
6.75	2896.46		126.92							
7.00	2880.47		135.11							
7.25	2864.50		142.59							
7.50	2848.56		148.65							
7.75	2831.51		156.08							
8.00	2816.76		162.13							
8.25	2802.03		166.08							
8.50	2785.06		171.37							
8.75	2768.12		176.64							
9.00	2750.08		182.58							
9.25	2732.08		189.90							
9.50	2715.24		195.13							
9.75	2697.30		201.02							
10.00	2680.51		205.53							
10.25	2661.52		211.36							
10.50	2644.80		215.15							
10.75	2624.76		221.62							
11.00	2605.88		227.41							
11.25	2587.04		231.80							
11.50	2569.33		235.51							
11.75	2551.66		239.21							
12.00	2535.13		241.55							

Directions:

1. Enter the given data into your Excel Spreadsheet Program and also set up the column headings
2. The given “Altitude” is for above the ground at the airfield. Convert that value into a standard altitude based upon Sea Level that is 243.8 feet below the airfield and place in the “Altitude S.L. column.
3. Convert the “Speed” given in km/hr into m/s and put into the appropriate column.
4. The “Density” value is a function of the altitude above sea level and was derived from tables or graphs. To arrive at an accurate value for each specific 0.25 second and corresponding altitude, a regression equation was established. The Math section of ALT-1 will deal with the details of arriving at this value. The quadratic equation used to arrive at the density value is the following for each 0.25 sec in terms of kg/m³:
 - $(4.195122E-9)*(S.L. Altitude)^2 + (1.189724)*(S.L. Altitude)^1 + 1.22639607$

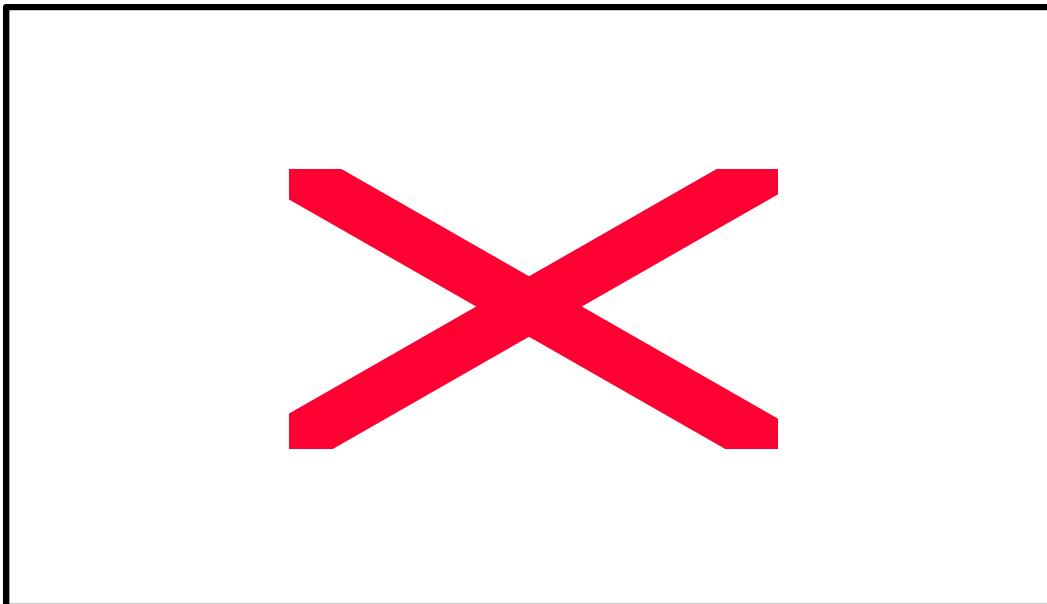
5. The “Acceleration” value is to be calculated by $\Delta v / \Delta t$ [i.e. $(v_f - v_i) / 0.25$ s for each increment]
6. “Net Drag” is determined by the relationship $F_{\text{net}} = F_{\text{weight}} - F_{\text{drag}}$, manipulating gives the following: $F_{\text{drag}} = F_{\text{weight}} - F_{\text{net}}$. $F_{\text{weight}} = \text{mass} * 9.8$ where mass is 80 kg and $F_{\text{net}} = \text{mass} * \text{acceleration}$.
7. “Calculated Drag” comes from the equation: $F_{\text{drag}} = \frac{1}{2} * C_D * \Delta * A * v^2$ where
 - C_D is the coefficient of drag and from graphs 0.31 was used
 - Δ is density of air that varies with altitude and is calculated above
 - A is cross-sectional area and for a man is about 1.2 m^2
 - v is velocity and is calculated in the table above and varies with time of fall
8. % Error is determined from finding the difference between the two drags and dividing by the calculated drag and multiplying that result by 100
9. Determine the “Net Force Down” by subtracting the calculated drag force from the weight
10. Graph the “Net Force Down” vs. the “Time” putting the time on the “X” axis

RESULTS OF ACTIVITY #2

The table below shows the expected results:

Skydiving Lab Calculations Results

Time (s)	Altitude from grnd (m)	Altitude from S.L. (m)	Speed (km/h)	Speed (m/s)	Air Density (kg/m ³)	Accel. (m/s ²)	Net Drag F. (N)	Calculated Drag F. (N)	% Error Drag Net vs. Calc.	Force Down (N)
6.00	2937.71	3181.55	110.59	30.72	0.890					
6.25	2925.09	3168.93	114.65	31.85	0.892	4.511	423.1	168.2	-151.6	615.8
6.50	2912.48	3156.32	119.41	33.17	0.893	5.289	360.9	182.7	-97.6	601.3
6.75	2896.46	3140.30	126.92	35.26	0.894	8.344	116.4	206.7	43.7	577.3
7.00	2880.47	3124.31	135.11	37.53	0.896	9.100	56.0	234.6	76.1	549.4
7.25	2864.50	3108.34	142.59	39.61	0.897	8.311	119.1	261.8	54.5	522.2
7.50	2848.56	3092.40	148.65	41.29	0.899	6.733	245.3	285.0	13.9	499.0
7.75	2831.51	3075.35	156.08	43.36	0.900	8.256	123.6	314.7	60.7	469.3
8.00	2816.76	3060.60	162.13	45.04	0.902	6.722	246.2	340.1	27.6	443.9
8.25	2802.03	3045.87	166.08	46.13	0.903	4.389	432.9	357.4	-21.1	426.6
8.50	2785.06	3028.90	171.37	47.60	0.905	5.878	313.8	381.2	17.7	402.8
8.75	2768.12	3011.96	176.64	49.07	0.906	5.856	315.6	405.8	22.2	378.2
9.00	2750.08	2993.92	182.58	50.72	0.908	6.600	256.0	434.3	41.1	349.7
9.25	2732.08	2975.92	189.90	52.75	0.909	8.133	133.3	470.7	71.7	313.3
9.50	2715.24	2959.08	195.13	54.20	0.911	5.811	319.1	497.9	35.9	286.1
9.75	2697.30	2941.14	201.02	55.84	0.913	6.544	260.4	529.4	50.8	254.6
10.00	2680.51	2924.35	205.53	57.09	0.914	5.011	383.1	554.3	30.9	229.7
10.25	2661.52	2905.36	211.36	58.71	0.916	6.478	265.8	587.4	54.8	196.6
10.50	2644.80	2888.64	215.15	59.76	0.918	4.211	447.1	609.7	26.7	174.3
10.75	2624.76	2868.60	221.62	61.56	0.920	7.189	208.9	648.2	67.8	135.8
11.00	2605.88	2849.72	227.41	63.17	0.921	6.433	269.3	683.9	60.6	100.1
11.25	2587.04	2830.88	231.80	64.39	0.923	4.878	393.8	711.9	44.7	72.1
11.50	2569.33	2813.17	235.51	65.42	0.925	4.122	454.2	736.2	38.3	47.8
11.75	2551.66	2795.50	239.21	66.45	0.927	4.111	455.1	760.9	40.2	23.1
12.00	2535.13	2778.97	241.55	67.10	0.928	2.600	576.0	777.2	25.9	6.8



Section Two: Physics

ALT One: Kinematics and Force

Summary

Students will be given the theory behind the required calculations for the columns in the spreadsheet, Alt-1, Software Usage, Activity #2. The chapters on “Motion in One Dimension” and “Forces and the Laws of Motion” will already have been covered before this module will be used. A concept mentioned but not fully developed is “Drag Force”. Drag force is the theme of activity #1 of this section.

Activity #1:

- A. A power point presentation will be given reviewing the concepts of kinematics and force.
- B. This power point presentation will supplement this material by developing, a special type of force in fluids called “Drag Force”.
 - The power point presentation is not given in this paper
- C. Examples will be given from transparencies that students will attempt at their desks and teacher will then solve on the board.

Activity #2:

Students will do problems based upon the theory given in Activity #1. These problems will give understanding to the theory and will enable the students to fill in the columns of the “Software Applications” section.

Competencies

1. Students will demonstrate their understanding of the theory over kinematics, forces, fluid flow, etc.
2. Students will be able to understand all entries into the tables given under the Software Applications
3. Students will understand and be able to interpret the graph from the above section and any other graphs that would be constructed from this data
4. The degree of understanding will enable students to write the report required under ALT-3

Time

Activity #1: Estimated time will be one class period (about 90 minutes)

Activity #2: Estimated time will be about ½ period to one full period. Students will be given the worksheet as homework and after two days the teacher will work some of the problems on the board to illustrate how to solve for those that had difficulty.

Materials

- Computer connected to TV demonstrating the Power Point presentation
- Overhead with transparencies giving problems for examples
- Chalkboard used to solve examples after students attempt
- Worksheet used for homework

Instructions

Activity #1

Specific items covered in the Power Point presentation include the following:

- Velocity & Delta velocity
- Acceleration
- Force, Net Force, Weight vs. Mass
- Drag Force, Reynolds Number, and Stokes' Law
- Turbulence, Viscosity, and Laminar Flow
- Terminal Velocity
- This material is extracted from the following two sources:
 - "Fundamentals of Physics" by Halliday and Resnick, John Wiley & Sons, 1988, Essay #6, E6-2 →E6-6, between pages 391 & 392
 - "Physics, A General Introduction" by Alan Van Heuvelen, Harper Collins Publisher, 1986, pages 306→308

Activity #2

- Students will be given a worksheet to do as homework / give two nights
- Will grade worksheets in class
- Teacher will do a few of the problems on the board to clarify any misunderstandings

Evaluation / Assessment of Students Competency

Students will be assessed in a traditional way by giving a test over the material presented under this section. The written test will consist of 1/3 of the test being essay questions and definitions with the other 2/3 being problem solving. Students will be expected to have a class mean score of 80 %.

Closure

The two activities in this section will enable students to understand all theory and problem solving associated with this module. This understanding will enable students to write the report under ALT-3 with a high degree of competency.

Alt-1 / Physics / Activity #2 – Worksheet

Having been given a theoretical and practical understanding of kinematics and forces from coverage of textbook material and supplemental information on fluid mechanics, including Reynolds Number and Drag Forces, students should be able to do the following problems. Be sure to show your work. The following fluid mechanics equations should be added to your list of kinematics and force equations:

- The equation for Reynolds number that predicts the onset of turbulence is $R_{\text{Reynolds \#}} = vL\Delta / \theta$ where v is the velocity, L is the length or diameter of the object, Δ is the density of the fluid, and θ is the fluid's viscosity
- The equation for the force of drag on a spherical object falling through a liquid is $F_D = 6B\theta rv$ for laminar flow
- The equation for force of drag on an object through the air with turbulent flow is $F_D = 1/2C_D\Delta Av^2$ where C_D is the coefficient of drag, Δ is the density of air, A is the cross sectional area of the object and v is the velocity

Problems:

1. Estimate the air drag force on a 1130 kg compact car when it is moving at a speed of 27 m/s. The cross-sectional area of the car is roughly 2.0 m^2 , and the drag coefficient C_D is approximately 0.5 for a well-designed car. The density of air is 1.3 kg/m^3 .
[Answer $\sim 470 \text{ N} = \sim 100\#$]
2. Estimate the terminal velocity of a Ping-Pong ball weighing 0.02 N whose radius is 0.019 m. The ball experiences a turbulent drag force with a drag coefficient of 0.60.
[Answer $\sim 7.1 \text{ m/s}$]
3. Blood flows at an average speed of 0.40 m/s in an artery whose radius is 0.50 cm. Based on a calculation of the Reynolds number, determine whether the flow is laminar or turbulent..
[R # = 1040 indicating laminar]

4. A 2300 kg luxury car has a 0.60 drag coefficient and an effective frontal area of 2.8 m^2 . Calculate the air drag force on the car at (a) 24 m/s (55mi/h) and (b) 31 m/s (70 mi/h). The density of air is 1.3 kg/m^3 . [Answer a-630 N & b-1050 N]

5. Calculate the drag force on a red blood cell having a radius of $1.0 \times 10^{-5} \text{ m}$ and moving through 20° C water at a speed of $1.0 \times 10^{-5} \text{ m/s}$ assuming laminar flow exists. [Answer $1.9 \times 10^{-12} \text{ N}$]

6. A colloidal clay particle having a constant downward force of $3 \times 10^{-17} \text{ N}$ acting on them. The particles settle 10 cm in water in 100 minutes. Calculate the radii of these particles. The viscosity of water is $0.001 \text{ N}\cdot\text{s} / \text{m}^2$. [Answer $9.5 \times 10^{-7} \text{ .m}$]

7. A balloon floats down through the air, pulled by a constant downward force of 0.050 N. A drag force opposing the balloon's motion is given by the equation $F_D = 0.03 v^2$, where F_D is in N if v is in m/s. Calculate the terminal velocity of the balloon. [Answer 1.3 m/s]

8. A balloon, whose radius when inflated is 0.20 m, falls slowly through air with a terminal speed of 0.40 m/s. Its drag coefficient C_D is approximately 0.50. a) What is the drag force on the balloon? b) What is the balloon's weight when falling at terminal speed? c) What is the balloon's mass? [Answers (a) $6.5 \times 10^{-3} \text{ N}$, (b) $6.5 \times 10^{-3} \text{ N}$, (c) $6.7 \times 10^{-4} \text{ kg}$]

Section Three: Mathematics & TI Calculators

ALT One: Tools of Physics

Summary

The most significant tools of physics are the various mathematical skills and electronic facilitators such as calculators and computers. The mathematical skills used in physics and competencies in graphing calculators such as TI-82, 83, 92, etc. has already been taught in class as part of prior knowledge necessary to do problem-solving for previous concepts. Much time was spent on setting up solutions for problems, actual equation solving, and how to use calculators.

As a result of previous work no “Activities” are especially planned for this module. If material was not satisfactorily learned in the past, this will be a good place to catch-up.

The new material of doing equation solving through use of the Microsoft Excel Spreadsheet has already been discussed and taught by way of the Activities #1 & #2 on Software Applications. The various columns required mathematical solutions that were repeated all the way down each column.

Competencies

1. Students should already have demonstrated their knowledge of problem-solving throughout the previous concepts taught in physics up to this time. This includes the ability to:
 - Determine what is important for the solution of the problem
 - Set up the equation establishing the proper relationships
 - Use of proper units throughout
 - Calculator usage in solving the problem
2. Students should already have demonstrated their knowledge of graphing calculator usage by way of
 - Doing problem solving, performing all required functions on the calculator for such problem-solving
 - Graphing any required relationships, both single variable and two variable relationships and interpreting those results
 - Establishing statistical results including: Various measures of central tendency, standard deviations, box & whisker diagrams, quartiles, etc.
 - Regressions to establish adequate equations to describe relationships of varying complexities
3. Students are in the process of developing skills in spreadsheet problem-solving. These skills include the following that have already been discussed under Software Applications
 - Establishing an equation for the column or a row to be used all the way down or across

- To be able to tally a column's values or perform statistical analysis upon a column or row
- To graph relationships in columns or rows
- To be able to perform regression analysis upon given relationships
- It has been found that the range of regression equations are limited on the computer where as the calculators enables a greater range of powers to be explored. (Note: The teacher has not had experience on the 2000-Microsoft system so this may no longer be true.)
- Skills on calculators and spreadsheets should be comparable.

Time

1. Problem-solving skills has been an on-going process and is continuing with each concept taught in physics including unit conversions
2. Calculator skills required about at least a week that included statistic and regression skills. Several worksheets were used with this learning process.
3. Spreadsheet skills will take 4→5 days. Two days have already been identified under "Software Applications / Activities #1 & #2" and additional worksheets may be given to establish the competency expected.

Materials

A variety of materials have already been used: Chalkboard, transparencies, calculators, computers with spreadsheet capabilities, worksheets, textbooks, etc.

Instructions

No new instructions are being given. All this material has already been presented. This section is just a review of competencies that should be mastered, or be in the process of mastering. (The spreadsheet work is the new work that may still be in the process of learning.)

Evaluation / Assessment of Student's Competency

Evaluation of the competencies have already been discussed under the Software Applications, and Physics sections. No new evaluations will be made since mathematics is an integral part of all this material. It is difficult to separate one from the other.

Closure

A review of the competencies for this section help to put into perspective where the student should be in his / her understanding of this module. This is all valuable in preparing for the

ALT-3 section where a report will be made expressing the overview of the concepts taught and an understanding of most all material taught in physics up to this point.

Section One: Software Application

ALT Two: Access Database

Summary

Most students have had little experience with Microsoft Access Database. The main purpose of this section and activity will be to acquaint students with Access and specifically to show them how to transfer an Excel table into Access. This activity is really not necessary to finish out the application questions that follow since all information needed has already been generated by Excel. However, the use of Access was one of the objectives in my work at Onyx and will be a valuable lesson for students to experience.

Competencies

1. Demonstrate a rudimentary ability to use Access
2. Transfer a table with data into Access
3. Establish a simple query to retrieve data
4. Be able to apply this data to applications that follow

Time

Estimated time will be at least one full period (about 90 minutes)

Materials

- Set of laptop computers
- Chalk board and / or overhead
- Data results from Excel on a floppy disk
- Page of directions how to use Access and especially to transfer from Excel to Access

Instruction

1. Students will be each given a laptop computer
2. Students will start up the Access Database program
3. Students will be given a floppy disk containing the saved data from the Excel activity
4. Students will be given a page of directions for starting up Access and transferring the Excel table already generated

Note: Most students already have a working knowledge of Excel but not Access. That is why no written instructions were given on ALT-1.

5. Upon successfully transferring the data table students will develop a simple “query”
6. Students will be able to demonstrate the retrieval of data from Access

Evaluation

Students will be assessed by teacher going to each student and checking their computer results. Students can help each other and work together but each student must demonstrate their individual work.

Closure

Upon completion of this activity students will have gained experience with Access. This working familiarity will give them confidence for future work with Access and show some possible applications for its use.

As stated previously, this activity does little for generating answers to the rest of the model. To gain experience with Access is the only real objective of this effort.

Note: The intentions of going to Onyx was to set up an Access database. However, in accessing their immediate need and short-term future needs, all work was done in Excel, and Access was never used. However, it is my intention to do a transfer of the extensive Excel table into Access for future long-term use just as an “aside” to give a working base. Procedures and manpower is not yet available to maintain an accurate tracking system and to make an Access Database a viable option.

Alt-2 / Software Applications / Instructions in Microsoft Access Database & Worksheet

Instructions: How to Use Access Database

1. Open Access and select “Blank database”
2. Select “Create” from right side of box – database box occurs with six tabs / Tables is default
3. Select “File” from upper left of screen / not in box – menu results
4. Select “Get External Data” - another option occurs to the right
5. Select “Import” – another dialogue box results
6. Go to the bottom of the box and click on the “down arrow” for “Files of type” and select “Microsoft Excel” – results in Microsoft Excel being posted in that space
7. Go up in the same box to the top “Look in” and select the location of the file you stored your Excel file in for ALT-1
8. Select “Import” – results in new dialogue box “Import Spreadsheet Wizard”
9. Use default of “Show worksheets” and select the appropriate sheet (probably Sheet 1) and select “Next” at bottom of screen – results in new dialogue box
10. Check “First row contains column headings” if that is true / Select “Next” at the bottom – results in a new dialogue box
NOTE: Be sure your Excel table is set up so that the first row actually DOES show the field names / column headings. You may wish to copy the exact table you want transferred into Access on “Sheet 2” of Excel and modify the headings. Then select Sheet 2 for Access.
11. Select “In a New Table” at the top and select “Next” at the bottom – results in new dialogue box
12. Can modify the field names in this dialogue box / do not select “indexed” (say no) / then select “Next” at the bottom – results in new dialogue box
13. Select “Let Access add primary key” / select “Next” – results in new dialogue box
14. Check options at bottom if you wish for analyzing and getting help / Select finish
15. General Access dialogue box appears / Select “Open” to see resulting Access table that should be like the one in Excel

This completes the transfer of data from Excel into Access.

To get the “Tabular” data into an Access “Form” do the following:

16. Save the Table from the above steps and get out of the table format
17. Select “Forms” from the General Access Dialogue box
18. Select “New” from the right side – and a “New Form” dialogue box occurs
19. Select “Form Wizard” and OK – results in new dialogue box
20. Select ALL of the fields by “>>” – results in all of the field names being selected
21. Select the form of the layout (Columnar) & press “Next” – results in a “Style” box
22. Select the style you prefer & press “Next” – Results another dialogue box
23. Write in the name you wish to call this form & press “Next”- results in the finished form
24. Pressing the “>” on the bottom of the box reveals your many entries

To establish a “Query” do the following:

25. Select “Query” from the General Access Dialogue box & Press “New” – results in New Query dialogue box

26. Select “Simple Query Wizard” – results in field names desired in query
27. Select the field names desired and press “>” for each selected name & press Next
28. Write in the Title desired for the query
29. Select “Finish”

RESULTS OF ALT-2 / ACCESS DATABASE

ID	Time (s)	Alt-grnd	Alt-SL	Speed-1	Speed-2	Air- Den	Acceleration	Drag F-Net	Drag F-Calc	% Er
1	(s)	(m)	S.L. (m)	(km/h)	(m/s)	(kg/m ³)	(m/s ²)	(N)	(N)	
2										
3	6	2937.71	3181.55	110.59	30.719444444	0.8903435480				
4	6.25	2925.09	3168.93	114.65	31.847222222	0.8915087698	4.5111111111	423.11111111	168.18283949	
5	6.5	2912.48	3156.32	119.41	33.169444444	0.8926744030	5.2888888889	360.88888889	182.67639023	
6	6.75	2896.46	3140.3	126.92	35.255555556	0.8941571711	8.3444444444	116.44444444	206.7197321	43.6703
7	7	2880.47	3124.31	135.11	37.530555556	0.8956393097	9.1	56	234.64757875	76.1344
8	7.25	2864.5	3108.34	142.59	39.608333333	0.8971217357	8.3111111111	119.11111111	261.78060059	54.4996
9	7.5	2848.56	3092.4	148.65	41.291666667	0.8986035108	6.7333333333	245.33333333	284.97442156	13.9104
10	7.75	2831.51	3075.35	156.08	43.355555556	0.9001908306	8.2555555556	123.55555556	314.72920182	60.7422
11	8	2816.76	3060.6	162.13	45.036111111	0.9015659929	6.7222222222	246.22222222	340.12004655	27.6072
12	8.25	2802.03	3045.87	166.08	46.133333333	0.9029411122	4.3888888889	432.88888889	357.43908737	
13	8.5	2785.06	3028.9	171.37	47.602777778	0.9045276036	5.8777777778	313.77777778	381.24079014	17.6956
14	8.75	2768.12	3011.96	176.64	49.066666667	0.9061137001	5.8555555556	315.55555556	405.75955131	22.2308
15	9	2750.08	2993.92	182.58	50.716666667	0.9078054372	6.6	256	434.31729895	41.0568
16	9.25	2732.08	2975.92	189.9	52.75	0.9094961446	8.1333333333	133.33333333	470.7157551	71.6743
17	9.5	2715.24	2959.08	195.13	54.202777778	0.9110803567	5.8111111111	319.11111111	497.86628234	35.9042
18	9.75	2697.3	2941.14	201.02	55.838888889	0.9127706681	6.5444444444	260.44444444	529.35638472	50.7997
19	10	2680.51	2924.35	205.53	57.091666667	0.9143550725	5.0111111111	383.11111111	554.33623232	30.8883
20	10.25	2661.52	2905.36	211.36	58.711111111	0.9161499324	6.4777777778	265.77777778	587.38127433	54.7520
21	10.5	2644.8	2888.64	215.15	59.763888889	0.9177327456	4.2111111111	447.11111111	609.68691109	26.6654
22	10.75	2624.76	2868.6	221.62	61.561111111	0.9196329399	7.1888888889	208.88888889	648.24677145	67.7763
23	11	2605.88	2849.72	227.41	63.169444444	0.9214262256	6.4333333333	269.33333333	683.89216465	60.6175
24	11.25	2587.04	2830.88	231.8	64.388888889	0.9232186931	4.8777777778	393.77777778	711.93344466	44.6888
25	11.5	2569.33	2813.17	235.51	65.419444444	0.9249063662	4.1222222222	454.22222222	736.24848875	38.3058
26	11.75	2551.66	2795.5	239.21	66.447222222	0.9265928501	4.1111111111	455.11111111	760.94899808	40.1916
27	12	2535.13	2778.97	241.55	67.097222222	0.9281729002	2.6	576	777.23242522	25.8908

NOTE: 1

I was not able to copy the “Form” format into Word so a hard copy was made to illustrate the results of the first six items.

Note: 2

I was not able to copy the “Query” format into Word so a hard copy was made to illustrate the results for the three field names chosen. Notice that the query results shows what has been seen from the Excel table and the Access table, that the longer the fall, the faster the speed and the less the net force upon the skydiver.

ALT Two: Determination of Application Questions

Summary

Students will be given the theory behind “Stress” and “Strain”. Theoretical application questions will be asked on a worksheet that are required to be worked on by each student. From this theory and given assumptions, students will then be able to calculate the stress and strain on a parachute that leads into the ALT-3 where a report will be made. The two activities with this section runs concurrently with the third section on math applications since math skills are needed to solve these problems.

Activity #1:

- A. A power point presentation will be given reviewing the concepts of stress and strain and related concepts
Note: The power point presentation is not given in this paper
- B. Actual demonstrations will also be given in class
- C. Examples will be given from transparencies that students will attempt at their desks and teacher will then solve on the board.
- D. Students will be asked to discuss related concepts such as Young’s modulus, bulk modulus, tensile strength and volume strain, also compressibility and compression strengths, shear and elasticity
- E. Students will do problems based upon the theory given.

Activity #2:

- A. Conditions will be given about the parachute
- B. Students will be asked to make calculations based upon their newly acquired knowledge and data given
- C. These calculated solutions will be used as part of the required report in ALT-3

Competencies

1. Students will demonstrate their understanding of the theory over stress and strain by solving the given problems
2. Students will understand related concepts of
3. Students will be asked to discuss related concepts such as Young’s modulus, bulk modulus, tensile strength and volume strain, also compressibility and compression strengths, shear and elasticity
4. The degree of understanding will enable students to write the report required under ALT-3

Time

Activity #1: Estimated time will be two class periods (about 180 minutes) , plus homework time

Activity #2: Estimated time will be about one full period.

Materials

- Computer connected to TV demonstrating the Power Point presentation
- Overhead with transparencies giving problems for examples
- Chalkboard used to solve examples after students attempt
- Worksheet used for homework

Instructions

Activity #1

Specific items covered in the Power Point presentation include the following:

- Stress
- Strain
- Young's modulus
- Bulk modulus
- Tensile strength
- Volume strain
- Compressibility and compression strengths
- Shear and shear modulus
- Elasticity

This material is extracted from the following two sources:

- "Fundamentals of Physics" by Halliday and Resnick, John Wiley & Sons, 1988, pages. 293-296
- "Physics, A General Introduction" by Alan Van Heuvelen, Harper Collins Publisher, 1986, pages 313→323

Students will be given the worksheet as homework and after two days the teacher will work some of the problems on the board to illustrate how to solve for those that had difficulty.

Activity #2

- Students will be given the size of the parachute, speed after ejecting the parachute, the time for speed change, the number of strings, size of strings kind of material
- From the above information the students will be asked to find forces on strings and on parachute cloth, amount of stretching of material, stress, strain, / give two nights
- Will grade worksheets in class
- Teacher will do a few of the problems on the board to clarify any misunderstandings

Evaluation / Assessment of Students Competency

Students will be assessed in a traditional way by giving a test over the material presented under this section. The written test will consist of 1/3 of the test being essay questions and definitions with the other 2/3 being problem solving. Students will be expected to have a class mean score of 80 %.

Closure

The two activities in this section will enable students to understand all theory and problem solving associated with elastic properties of solids and the forces involved. This understanding will enable students to write the report under ALT-3 with a high degree of competency.

Alt-2 / Physics / Activity #1 – Worksheet

Problems:

1. A table with four identical legs, each of cross-sectional area 1.0 E-3 m^2 , supports a weight of 600N. Calculate the stress in each leg. [Answer 1.5 E5 N/m^2]

2. A rope 2.4 m long, used to pull a car from a mud hole, has a strain of 0.050. How much is it stretched when pulling the car? [Answer 0.12 m]

3. A violin string is stressed to produce a strain of 2.0 E-4 . If its length is increased by 1.4 E-2 cm, what is the unstretched length of the string? [Answer 70 cm]

4. A wire supporting a 50N metal ball has a stress of 6.4 E7 N/m^2 . Calculate the cross-sectional area and radius of the wire. [Answer 7.8 E-7 m^2 , 5.0 E-4 m]

5. Calculate the change in length of a rope used to pull a car as its tension increases from zero to 8000N. The radius of the rope is 1.0 cm, its original length is 3.0 m, and its Young's modulus is $3.0 \times 10^9 \text{ N/m}^2$. [Answer 2.5 cm]

6. A wooden block 0.20 m wide, 0.40 m long, and 0.50 m high and with a shear modulus $9.0 \times 10^9 \text{ N/m}^2$ is glued to a floor. A shearing force of $2.5 \times 10^5 \text{ N}$ is applied to the top surface. Calculate the distance that the top edge of the block is displaced by the shear force. [Answer $1.7 \times 10^{-4} \text{ m}$]

7. The oil in a hydraulic press occupies a volume of 0.500 m^3 when the pressure is 2 atm. Calculate the change in volume when the pressure is increased to 12 atm. The bulk modulus of oil is about $1.5 \times 10^{10} \text{ N/m}^2$. [Answer -3.33 cm^3]

Alt-2 / Physics / Activity #2 – Worksheet

Use the following data to determine the answers for the requested information that will be used in the report of ALT-3.

After falling for the times and distances given in the original table on page 9 the parachuter pulled the ejection string with the chute opening. It took 2.8 seconds for his speed to diminish to 16 m/s from his maximum 67.10 m/s. There are 8 strings 2.6 m long on two sides (total of 16 strings) with all material of parachute and strings being silk. Silk has a Young's modulus of $6 \times 10^9 \text{ N/m}^2$ and a shear modulus of $2 \times 10^9 \text{ N/m}^2$. The harness fits around each of his legs and has a width of 2.4 cm. Assume his mass is 80 kg as was the consideration for all the calculations in the tables on pages 8 & 10.

Find the following:

1. Size of parachute necessary to produce that deceleration – give a safety factor of 2
2. Size of string diameter – give a safety factor of 2
3. Force necessary to tear the chute
4. Thickness of chute material to prevent tearing – give a safety factor of 2
5. Distance the silk thread stretches
6. Stress on parachuters legs from harness pulling up
7. Thickness of harness if it also is made of silk

Calculate all of the above and show your work. Record the answer in the blank with appropriate units.

1. Size of parachute necessary to produce that deceleration – give a safety factor of 2

_____1)

2. Size of string diameter – give a safety factor of 2

_____2)

3. Force necessary to tear the chute

_____3)

4. Thickness of chute material to prevent tearing – give a safety factor of 2

_____4)

5. Distance the silk thread stretches

_____5)

6. Stress on parachuters legs from harness pulling up

_____6)

7. Thickness of harness if it also is made of silk

_____7)

Section Three: Mathematics & TI Calculators

ALT Two: Solving Application Questions Using Math

Summary

The mathematics and calculator skills have already been taught in class as part of prior knowledge necessary to do problem-solving for previous concepts. No new math skills were taught and as was stated in the previous section there will be no need to do additional activity for this section.

Section Four: Communication

ALT Three: Report Writing

Summary

Students will take the perspective of being a consultant to a parachute manufacturer. Using all of the information, both given and calculated, they will write a report that will be submitted for material and design consideration.

Competencies

1. Demonstrate ability to interpret graphs
2. Demonstrate understanding of all concepts covered in module
3. Be able to take theoretical knowledge and apply to real-life situations
4. Be able to interpret all answers and give a meaningful explanation of what is being said
5. Show a willingness to take on challenging tasks where the solution and techniques are not obvious – be a problem solver
6. Show an ability to write technical papers

Time

Will give two days (180 minutes) of actual class time. Will give one full week to the assignment.

Materials

- Laptop computers

Instructions

1. Take all material given and calculated and put together a meaningful report of sufficient length to include all the aspects of physics concepts with documentation of their validity by way of graphs, charts, tables, etc.
2. This report should include at least three graphs (two in addition to the one already required).
3. It should cover all of the information from the Excel exercise and ALT-1 and ALT-2 of physics.
4. All calculated answers should have work shown that includes the equation used, the substituted in parameters, and the answer with units.
5. No length will initially be given although it would be assumed to be around 1000 words in length.
6. Have a cover page with title, name, date
7. It is an open assignment. Let your creativity and enthusiasm be your guide
8. Bottom line, I WANT RESULTS!!!

Evaluation

Students will be assessed by the results of their report. It is very meaningful and will count as a full traditional test grade.

Closure

This activity is an excellent conclusion to not only this section but to the whole module. Depending upon the students effort they will be rewarded correspondingly for what they have done. Objective achieved are the following:

- New skills with Excel
- Exposure to Access
- Physics concept of drag force
- Physics concepts related to elasticity, stress, and strain
- Insights as to what engineering is all about

This module will be a project realistically taking between two to three weeks and will be a great review of old concepts and introduction of many new concepts. This will be a very worthwhile module to include in my curriculum.