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An Introduction to Inquiry Labs in Physics

Stephanie D. Sanders
Trinity University, stephanie.sanders@ecisd.net

Noe Perez
Trinity University, noe.perez@ecisd.net

UbD: An Introduction to Inquiry Labs in Physics

<table>
<tr><th colspan="3">Stage 1 – Desired Results</th></tr>
<tr><td rowspan="6">Established Goals
Science practice 1: The student can use representations and models to communicate scientific phenomena and solve scientific problems.
Science practice 2: The student can use mathematics appropriately.
Science practice 3: The student can plan and implement data collection strategies in relation to a particular scientific question.
Science practice 5: The student can perform data analysis and evaluation of evidence.
From the AP Physics 1 Standards on the College Board Website</td><th colspan="2">Transfer</th></tr>
<tr><td colspan="2">Students will independently use their learning to…
Investigate scientific questions by designing experiments, collecting and analyzing data, and then developing a predictive model that can be used to solve unknown problems.</td></tr>
<tr><th colspan="2">Meaning</th></tr>
<tr><td>Understandings
Students will understand that….
The development of scientific ideas is essential for building scientific knowledge.
Mathematics is a tool used to model objects, events, and relationships in the natural and designed world.
Technology is an application of scientific knowledge used to meet human needs and solve human problems.
From: http://www.frhsd.com:83/curric/images/9/90/honors_lab_physics.pdf</td><td>Essential Questions
What is science and more specifically physics?
What does useful data look like and why do we care?
How is the scientific method used to answer questions and to solve problems?
How can math be used as a tool to build models to help represent and predict real world phenomena?
From: http://www.frhsd.com:83/curric/images/9/90/honors_lab_physics.pdf</td></tr>
<tr><th colspan="2">Acquisition</th></tr>
<tr><td>Knowledge
Students will know…
Models are used to represent physical phenomena, and have inherent assumptions and limitations
Graphs are used to visually represent a large amount of data.
Useful data must be collected systematically, and the collection must be reproducible.
Data can be represented using multiple models including verbally, pictorially, graphically, and mathematically
Technology is useful in the lab to collect real-time data.
Data collection using technology can reduce systematic errors during experimental data collection.</td><td>Skills
Students will be able to…
Follow a step-wise procedure to duplicate an experiment or to create a product.
Collect data using the highest level of precision available for simple lab equipment including a meter stick and a timer.
Create and describe constant velocity motion using graphs, dot diagrams, drawings, and equations.
Analyze constant velocity using a best-fit line on a graph and the equation for a line ($y = mx + b$)
Write a lab procedure that can be implemented by a classmate.
Compare and contrast two lab experiments to determine sources of error and to estimate the magnitude of the error.</td></tr>
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<table>
<tr><th colspan="3">Stage 2 – Evidence</th></tr>
<tr><td>CODE</td><td>Evaluative</td><td></td></tr>
</table>

<table>
<tr><td>(M or T)</td><td>Criteria (for rubric)</td><td></td></tr>
<tr><td></td><td></td><td>
Performance Task(s)
Students will demonstrate meaning-making and transfer by…

The traditional algebra “when will two trains meet” problem has been used for comic effect throughout time. Comedians and jokesters alike describe their experience in algebra as “who cares about trains?” Thinking of this problem from a broader perhaps “scientific” perspective, we might note that it is important to find out when two objects will occupy the same space at the same time. Do you want to be the person on the plane that is about to occupy the same space as another plane?

Your task is to work with a team to develop a procedure that could be used to evaluate the performance of a patriot missile that will be set to intercept with an incoming missile from an unknown criminal mastermind. The only catch is that you must ensure the safety of all civilians and civilian property by ensuring that the patriot missile intercepts the scary mastermind missile within a designated safe zone. This is purely a defensive exercise.

Knowing that you are new to the world of physics and modeling, we, your program coordinators, have determined that you are not yet to be trusted with missiles until you can prove yourself with non-explosive devises. Thus, you will use cruise control cars and design a procedure to determine the performance of your car, gather intel from a long distance team about the performance of a second car (representing the bad missile), analyze the performance of the bad missile car, and then predict when to release your car so that it will intercept the other car within the designated safe zone.

You will be evaluated for your performance at each stage in the challenge and are responsible for documenting all procedures, data, calculations, and results so that this experiment can be reproduced outside of the lab. Training in the necessary skills will commence immediately.

Project documents are included below.

Other Evidence (e.g., formative)

Day 1 – Circle graphs/Learning styles surveys – used to modify “random” grouping
Day 2 – Math Pre-assessment –used to modify grouping and structure ongoing math review for 9 weeks
Day 5 – Data analysis progress check – will grade on rubric and return with comments. Students may also be held back in training if graphing skills are not sufficient.
Day 6 – Procedure practice and critique turned in (from summer assignment and part of that grade)
Day 7 – Draft procedure check (also graded according to rubric) and recommendations for improvement.
Day 8 – Data check and decision about mock data made per group
Day 9 – Data analysis and model check
Day 10 – Launch or work day (not all students will launch depending on preparedness).

Note: This project is largely about developing laboratory skills. It is critical for the teacher to return formative checks on the next day and to encourage skill growth. Thus, grades should focus on growth rather than achieving the hit.
</td></tr>
<tr><td colspan="3">Stage 3 – Learning Plan</td></tr>
<tr><td>CODE (A, M,</td><td colspan="2">Pre-Assessment
How will you check students’ prior knowledge, skill levels, and potential misconceptions?
Students were given a summer assignment with basic graphing, algebraic manipulation, and procedure writing practice. The summer assignment will be reviewed the 2nd and 3rd day of school.</td></tr>
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Learning Activities

Day 1 – First Day –Student Surveys/Grouping
This is the first day of school welcome back. I typically stand at the door and introduce myself to each student individually which takes about 20 minutes. During this time, students fill out a learning styles survey and a getting to know you circle graph and series of questions. Both may be found on ***pages 15-17 below.***

Subsequently, students will work together to inform the class about their particular learning styles. Students will read about their learning styles using resources from (http://www.thoughtfulclassroom.com/index.php?act=lsis_intro) and then work with a homogeneous learning style group to share with the class 3 strengths that their learning style will offer to others in group settings and 3 areas where they need patience or they need to grow. We usually put these on big sticky notes or poster board and keep them up in the classroom for the first 9 weeks.

Students will share out after about 10-15 minutes.

Day 2: Math/Graphing Pre-assessment and Why are we Here?
Students were given a summer assignment and access to flipped videos to practice pre-requisite algebra, trigonometry, and simple graphing skills. The bulk of the summer assignment material was taken from resource created by Delores Degende that are frequently made available at AP Institutes. The one we used may be found at the following link (http://lolhs.pasco.k12.fl.us/wp-content/uploads/lolhs/2012/05/AP-Physics-1-Summer-Assignment-2014-15.pdf).

In addition, students were asked to choose a step-wise process, write a step-by-step procedure for the process, and then film themselves completing the process. Details for this portion of the assignment are available in Day 6 when it will be used to direct the Procedure writing portion of the unit.

Day 2 will begin with a math pre-assessment. ***(See pages 18-19)***
This pre-assessment will be used throughout the first nine weeks to scaffold in math skills, and will also be used to adjust lab groups if needed. If pre-assessment suggests graphing readiness, then less scaffolding will be provided during the whole group data analysis day (day 4).

Once the math pre-assessment is complete, before it is collected, students will be asked to use the two provided post-its to write questions, areas where they felt confident, and concerns. They will then post these on the appropriate area of the board for me to address throughout the week.

After addressing two of the questions, students will be asked to use the word on their grouping card to find the 4 (or 5 depending on class size) partners. The original idea for the "Subversive Lab Group Names" grouping exercise comes from https://prettygoodphysics.wikispaces.com/PGP+First+Day and was originally posted on Frank Noschese's blog. I modified slightly for various class sizes and the printable cards may be found below on ***pages 20-21***.

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Progress Monitoring (e.g., formative data)

Students will turn in circle graphs and learning style surveys and I use them throughout the year

Students will turn in the math pre-assessment.

Post-its will be used to foster in class discussions, to structure math-based check-ins and to push students towards ownership of their strengths/weaknesses. Lab groups may be adjusted based on this information.

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Once students have found their groups, we will debrief about the exercise. Guiding questions include:

- What was hard about this exercise?
- What frustrated you? What helped you to be less frustrated?
- When did you get the bigger picture? What helped the most?
- How many times did you change your mind? Why?
- **EQ: What does useful data look like and why do we care?**

Ultimately, we are aiming to get at the ideas that:

- One data point is insufficient to build a larger picture
- Knowing other related data (what the other categories are) helps with data analysis
- Data analysis is iterative, sometimes you need to try again or get more data before you can find an answer
- Often there are multiple correct answers (i.e. Lincoln and Ford can switch).

For homework, students will be asked to access a flipped classroom video asking them to solve a Functional fixedness problem. They will be challenged to solve the candle and the box problem (http://en.wikipedia.org/wiki/Candle_problem) or another functional fixedness problem. They will be asked to write 3-4 sentences, sketch, or in some way demonstrate their proposed setup.

Day 3: Creativity, Performance Task Intro and Development of Graphing Skills
Students will start the class period by getting back in their groups from the previous day, and then picking the best candle solution as a group. Students will be randomly called (pick a name from a hat) and their group will share the best solution. Discussion will continue until we are out of solutions. We will discuss the need for creativity and flexible thinking in solving real world problems (about 15 minutes).

At this point, the project will be introduced. Students will be given the project introduction sheet, the rubric, and the memo about mission logs (pages 10-12). They will watch the introduction challenge video in the format of Mission Impossible will be played to hook the students. The schedule for the rest of the week will be included and deadlines will be highlighted (5 minutes). More teacher information is available on page 9.

EQ: What is science and more specifically physics?

EQ: How is the scientific method used to answer questions and to solve problems?

Teacher will take notes regarding the graphing abilities of each group. If necessary, lab groups will be adjusted.

Remaining time on day 3 will focus on “training.” Specifically how to handle data graphically. We will work on skills like drawing a best fit line, reading values off of graphs (including units), calculating slope (including units), and determining how well a line models data (qualitatively looking at data scatter and quantitatively using percent error). An excellent link for discussion with applets may be found at

Class will develop a list of “things to remember” when

	(http://staff.argyll.epsb.ca/jreed/math9/strand4/scatterPlot.htm). Students will work on half-poster sized laminated graphs made from a data plotting program (I used Excel). At least one graph will be assigned as out of class practice ***(see pages 22-23)***	graphing – this will be posted during the remainder of the unit.
	Day 4: Preparing for Data Analysis of Incoming Missile Day 4 will continue graphing training. First, small groups will be given one of the practice graphs on a half-poster sized laminated sheet and asked to find the best fit line, slope, equation, and an interpolated and an extrapolated point. Small groups will then compare answers to like groups to ensure that they are within a reasonable range. We will hold a very brief discussion about error based on their results (20 minutes).	Pending success with graphing, an extra day will be added as needed per class.
	Next, groups will be given distance versus time data to graph on graphing whiteboards. The data will be generated with Vernier software for various cart situations (constant velocity, speeding up, slowing down, going forwards or backwards). They will be asked to determine: • What would this look like physically? What is the object doing? • What type of equation is the likely form for each graph? • The equation for the best-fit line for the graphs that are linear? • Which equation is the best model? After each graph, we will rotate through groups asking/answering these questions.	Students will turn in pictures (iPad) of their Data Analysis by the end of the day. Students who "meet the standard" will get an APPROVED stamp to proceed with training. Others will be returned to graphing training.
	Day 5: Project Stage 1: Data Analysis of Incoming Missile On Day 5, intel (as QR codes) will be provided to the students from our double agents who have infiltrated the enemy command center and stolen performance tests for the missile threat (see page 13**)** Students will work with their groups to analyze the data and record it in their mission log (Lab journal). Students will be asked to build a predictive model, so they are prepared to determine the time range that the enemy missile will be in the target zone. Recommended discussion questions for groups: • What shape is your graph? • How reliable is the data? • What is the incoming missile physically doing? • How do you plan to deal with the data? Is there more than one way so you can check for reliability of your model? • How will you explain what you did to others? **EQ: How can math be used as a tool to build models to help represent and predict real world phenomena** **Day 6: Procedure Writing Practice** On Day 6, we will return to the training room to shore up our observation and communication skills. We will tell the kids that as usual, there has been a manufacturing delay in their practice patriot missiles. Training in observation and communication skills will commence. Student pairs will be given a paper with a QR code on it to access a video from the summer assignment (see page 20 for the assignment given to students). Students will be instructed to watch	Students will turn in their procedure and their critique of the original author's procedure. In addition, a check-out notecard will be collected pictures (iPad) of their Data Analysis by the end of the day. Students who "meet the standard" will get an APPROVED stamp to proceed with training. Others will be returned to graphing training with a specialist (the teacher).

	the video carefully and then to individually write a step-by-step procedure from memory. After comparing their procedures, the students will rewatch the video and work together to write a revised procedures. (about 20 minutes). Students will then critique the filmmaker's procedure and both warm and cool feedback (10 minutes). Students who aren't ready to move on from graphing will continue with graphing practice/small group instruction during this time/ Class will end with a brainstorming session for data collection procedures on our "missiles" (remind students that they will need to write a procedure for their own data collection as soon as the practice patriot missiles are available). • What did they have to measure? • What equipment did they use? (Remember: no electricity available) • How many ways can we think of to do this effectively? **EQ: How is the scientific method used to answer questions and to solve problems?**	Students will turn in a draft procedure and materials requisition sheet, and data table to the teacher (likely electronically or in pictures on teacher iPad). Teacher will grade and return as APPROVED or with recommended modifications.
	Day 7: Project Stage 2: Experimental Design On Day 7, we will begin evaluating our newly minted practice patriot missiles. Students will be assigned a missile (constant velocity cart) and asked to write a method for finding the motion performance of their cart. Because the unknown criminal mastermind has been Tweeting about taking down the evil American army, we need to move quickly. Thus, there will be no time for training on the high tech data measurement equipment. Students will have access to any equipment in command central (meter sticks, rulers, timers, phones, videos on phones etc.) If they can think of it, they know how to use it, and we have it, they can use it. They must fill out a materials requisition sheet, have an approved procedure, and an acceptable data organization system prior to testing. Students will further be instructed that command wishes to review these operation plans tonight, so they must turn them in by 21:00. **EQ: How is the scientific method used to answer questions and to solve problems?**	Students will turn in a data or revised procedure by the end of class. Students without a final procedure will be given mock data (for a loss of points) or an optional tutoring data collection session. Students will turn in data analysis and model. Those unprepared for launch day (tomorrow) will be allowed until 10:00 or they will not launch (points are bonus).
	Day 8: Project Stage 2: Experimental Design Revision/Data Collection Approved and revised plans will be returned to students. Those with approval may begin immediate implementation. Others must gain approval from command (teacher). Materials requisition must also be approved prior to experimentation. Students will be allowed to collect data and begin analysis. **EQ: How is the scientific method used to answer questions and to solve problems?**	Students will turn in all revisions, etc. for a **final performance task grade/assessment**. The conclusion will not be graded, but will be for formative feedback.
	Day 9: Project Stage 2: Data Collection and Analysis Students will complete the data collection stage. Those who fail to complete	

	this stage will be added to another lab group (to allow for continuation of learning experience). Students will analyze their data and have a model that tells them when to release their defensive missile in the launch sequence of the incoming missile. Models will be submitted to command by end of the day for approval **EQ: How can math be used as a tool to build models to help represent and predict real world phenomena** **Day 10: Project Stage 3: Launch** Students with approved models will proceed to the launch testing stage. On launch day, students who are ready will launch, others will work on completing their logs with an explanation as to why their mission failed. During the last 15 minutes of class, a class discussion will ensue with a focus on concluding the performance task. As a class, we will analyze our success/failure, report our results, and determine possible sources of error. Students will take notes and add a concluding paragraph to their mission log for homework. **EQ: How can math be used as a tool to build models to help represent and predict real world phenomena** **EQ: How is the scientific method used to answer questions and to solve problems?** **EQ: What does useful data look like and why do we care?** **EQ: What is science and more specifically physics?**	

	Monday	Tuesday	Wednesday	Thursday	Friday
August	**25** Welcome back Learning Styles Survey Data based grouping Algebra review – summer assignment	**26** Quiz: Math and graphing – pre-assessment Data – what is it? Why do we care? What is science/physics? *<u>Formative: Math Preassessment</u>*	**27** ***Project Introduction*** Summer Assignment graphing review	**28** ***Project Stage 1: Data Analysis of incoming missile car – whole group***	**29** ***Project Stage 1: Data Analysis of incoming missile car – small group*** *<u>Formative: Graphing and data analysis</u>*
September	**1** Procedure writing review Use Procedures/videos from summer assignment to generate discussion Discuss how data was taken in Stage 1 – brainstorm.	**2** ***Project Stage 2: Planning/Procedure Writing*** *<u>Formative: Procedure check to grade</u>*	**3** ***Project Stage 2: Planning/Procedure Writing/Data Collection***	**4** ***Project Stage 2: Data Collection/Analysis*** *<u>Formative: Model, analysis check to grade</u>*	**5** ***Project Stage 3: Test for hit, Conclusion***

Teacher Notes for Performance Task

Background

AP Physics 1 is a new course for the 2014-2015 school year and the emphasis on inquiry based laboratory experience will be new for our students, primarily juniors. Historically, our juniors have taken PreAP physics where they learn to use mathematics and graphs to model data and then learn a method to communicate their findings in a lab report format. Inquiry labs have been introduced primarily in AP Physics B, or senior level classes. Feedback from our AP Physics B classes indicates a need for more guidance on writing procedures, developing analysis methods, and ultimately posing questions that can be tested in the lab. Thus, we plan to begin the year in AP Physics 1 with two weeks dedicated to helping students develop procedure writing and data analysis skills that we will build throughout the year. By the end of the unit, we expect students to author procedures that can be followed by peers within the same class, and we expect them to increase their facility with the use of multiple modes for communicating and analyzing motion including observations, diagrams, verbal descriptions, graphs, and mathematical models.

Materials Needed

- Constant velocity carts – 1 per group of students + 1 per testing station
  - These may be found through many science supply stores for a range of price (http://www.arborsci.com/constant-velocity-car?gclid=CPLV0ZnF9L4CFcpj7AodRgwAYQ)
  - Cars may be altered to create a range of velocities (https://www.youtube.com/watch?v=InItMOaO3a0)
- Meter sticks – 1 per group *required* at least 2 per group recommended
- Timers – 2 per group (I have mine use their phones)
- Acceptable range circle. Pending test runs, I plan to draw a 0.5 m diameter circle in chalk on a black sheet of paper and tape it to the floor and then surround it with army men (spaced apart to allow cars through).
- Project documents – 1 of each per student
  - Project Introduction and rubric (front and back)
  - Briefing memo
  - QR Code for Intel Data Memo (will need to be filled in prior to distribution) – printed

Optional Materials

- Slow motion cameras – like those found on iPhone 5
- Tape or another method for marking the floor or wall
- Tape measurers
- Anything the students come up with that they already know how to use.

Preparation

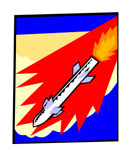
- Test all incoming missile carts, measure and record data on the Intel Memo for student use
  - I plan to use Vernier motion detectors and/or photo gates and to average at least 3 trials/car
- Prepare QR Codes and post "enemy missile data" online for student access. I plan to have at least 4 enemy missiles to force groups to work as independent units.
- Intel memos might be pieced out over several days (data first, and then locations for prediction)
- Set up enemy (perhaps a rival school?) and friendly "base locations" throughout the room. Then assign students to a base and have them prepare to "protect" against the nearest enemy bases.
- Anything the students come up with that they already know how to use.
- Introduction and "encouragement" videos. We plan to have a local college (one of our colleagues works with them) help us to set up "Mission Impossible" type instruction videos to engage and encourage the students or to answer "intel" questions that come up during the unit. This could also be done live.

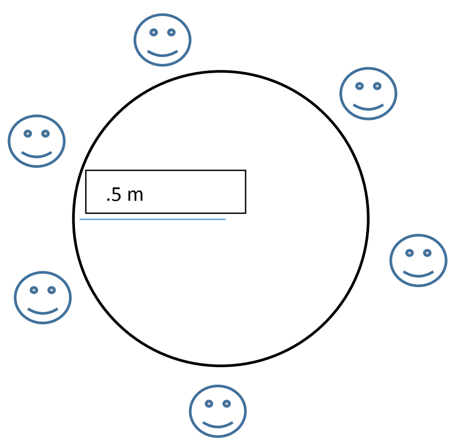
Protect these Soldiers

Your mission, should you choose to accept it, is to stop an incoming missile while protecting our soldiers on the battle field. Historically, the enemy Rocketites are willing to accept catastrophic losses to achieve their goals. Fortunately, we have been aware of the Rocketite threat and have spent months gathering intel on the enemy missiles. Our spies are working to gain access to the location of the missile launch site, and are placing override systems that will allow us to preemptively launch the missiles. We do not yet have the technology to override the programmed trajectory; currently these missiles are aimed directly at Hornetville military command, an area filled with civilians and military troops. Our best hope will be to prepare to use our new Patriot defense missiles, and then to launch the enemy missile at the appropriate time to intersect our defense missile in the designated safety zone. Once the missiles are destroyed, our troops can move in and take down the enemy bases. From our intel, we know that the missiles have a blast radius of 0.5 m, and we have designated "safety zones" where the explosions must occur. Your task is to analyze our Patriot missiles, use any Intel to estimate the performance of the enemy missiles, and then to designate a launch time for the enemy missile and the patriot missile to ensure contact in the safe zone.

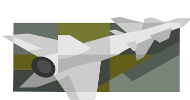
Due to the potential for disaster, you must keep an accurate and up to date Mission Log (lab book). The goal of your mission log is to clearly document all procedures and analysis for both protection in a disaster and future training of the incoming recruits (freshman). Logs should be aimed at the incoming recruit level.

Rocketites

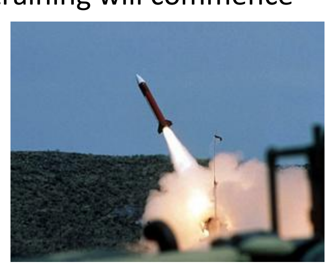




Ours



After you have a predictive model, it is time to launch a training exercise to test our readiness. We must have this system ready to "go live" by the end of the month. This is a critical hole in our defensive system, so notify your commander, Colonel Teacher, when you are ready for testing. Civilian and solider casualties must be minimized, and the goal is zero. Intel will be distributed as it becomes available, and training will commence immediately.



Save these Soldiers – Rubric **Final Score ________/80**

Topic	Exceeds Expectations	Meets Expectations	Approaching Expectations	Does not meet expectations
	Up to 20 pt	**Up to 15 pt**	**Up to 10 pt**	**Up to 6 pt**
Writing explaining /analyzing calculating data from given car	Explain in full detail how the data given to you was analyzed. Include a diagram of the motion and use words to describe the motion shown by the data. All students can give independently explain the calculations. This would be easy for a younger high school student to understand.	Explain how the data given to you was analyzed. Include a diagram of the motion and use words to describe the motion shown by the data. All students can give an outline of the calculations.	The calculations are there, but not in detail. A general idea of what the data physically means in terms of motion is stated in a few sentences. One student in the lab group is able to explain what is going on.	There is no logic when looking at your group's paper. No one in group is able to explain what the data mean or procedure for calculating.
Graphs *(Note: missing calculations will exclude you from hit bonus)*	All graphs are have been included; every step is explained clearly and neatly. Written as a dialectical journal with explanations for each step about the car velocity. Also detail graph with best fit line is shown and there is a clear indication as to the physical meaning of the slope. . Graph is titled and axes are labeled.	All graphs are included. Some steps may be missing or skipped, but there is still a clear thought process. Graph with best fit line is drawn and the slope is explained. Graph is titled and axes are labeled.	Steps are not followed and or major graphing errors are not present. Some type of graph is in the lab book.	You have numbers with no graphs.
Procedure for collecting data)	Every detail about your car is given. How these details were obtain is also given in full description. Detailed drawings of the car and motion of car need to be included. Your procedure for data collection is either in paragraph or list format. The procedure would be reproducible by a high school student who is not in physics. A detailed/labeled sketch of the setup and a list of materials is included and integrated in to the procedure. All students can then explain how this data came to be.	Some details for your car are given and you have included a paragraph or list explaining how you collected your data. The procedure would be reproducible by a classmate who is not on your team. A minimum of 5 sentences describe the data and what it means. A sketch of the setup and a list of materials is included. All students can give an outline on the procedures	The procedure is there, but lacks detail. A general idea of where the data came from is stated in a few sentences. One student in the lab group is able to explain what is going on. A physics teacher from another class could do the experiment, but only by guessing some of the steps.	There are no steps for reproducing your data. A physics teacher in another class could not follow this procedure
Data (x.5	Data is recorded in a neat, easy to read table with units. At last 10 points are included.	Data is recoded in a neat table. At least 8 points are included.	Data is difficult to read or there are less than 8 points.	Data is difficult to read AND there are less than 8 points.
Calculations/ graphs for your car. (x.5)	All calculations are included and every step is shown and explained clearly and neatly. Written as a dialectical journal with explanations for each step about the car. A detailed graph with best fit line is shown and slope is clearly recognizable. Graph is titled and axes are labeled.	All calculations are included and explained. Some steps may be missing, but there is still a clear thought process. Graph with best fit line is drawn. . Graph is titled and axes are labeled.	Steps are not followed and or major calculation errors or misconceptions are present. Some type of graph is in the lab book.	You have numbers with no calculations and graphs.
BOOM BOOM HIT (x.5)	Calculations and models are approved and a test is allowed. A full on hit occurs on the first try. The hit is contained in the blast zone and no soldiers are killed.	Calculations and models approved. The test is run, and maybe the cars come close to hitting in the target zone without killing too many soldiers.	Insufficient calculations and models were complete for approval, but the calculations match the teacher's model.	Some calculations are expressed but no drawings and it is predicted that you would kill many soldiers/townspeople.

BRIEFING MEMO

East Central Mission Control

Hornetville, Qatar

August 26, 2014

MEMORANDUM FOR MISSILE DEFENSE TRAINEES

FROM: CENTRAL COMMAND

SUBJECT: Mission logs - UPDATE New Format

Mission logs are now required to have the following format:

1) You are to have all your team members listed
2) The start date of your mission
3) Then a brief paragraph summarizing the purpose of your mission
4) Experiment Description (incoming rocket) *this will need an approval stamp*
    a. The material used to gather your information
    b. Diagram or picture of the set up
    c. Instruction/method for performing experiment
5)Results
    a. Data (table please)
    b. Calculations
    c. Graph (best fit line)
    d. Results of test launch
    e. All of the above must have a verbal descriptions
6)Conclusion/ Summary of results
    a. Experimental result (hit or no hit)
    b. Evaluation of what worked in the method
    c. Recommendation for improvement
    d. Error assessment

7)All mission logs are written in 3rd person (no I, we, you, or our)
    a. Should be in Paragraph Format
    b. No bullets
    c. Single line for ~~mistakes~~
    d. Must be written in pen (blue/black ink)

Figure 1http://ectechhornet.blogspot.com/2012/11/star-chart-update-1152012.htm

INTEL MEMO

East Central Mission Control

Hornetville, Qatar

August 27, 2014

CONFIDENTIAL: ENEMY MISSILE INTEL

FROM: INTEL

SUBJECT: Missile Performance Intel

Be aware that the following intel has caused the threat level to increase to red. All missile command stations are urged to prepare to defend against an imminent threat to Hornetville, Qatar.

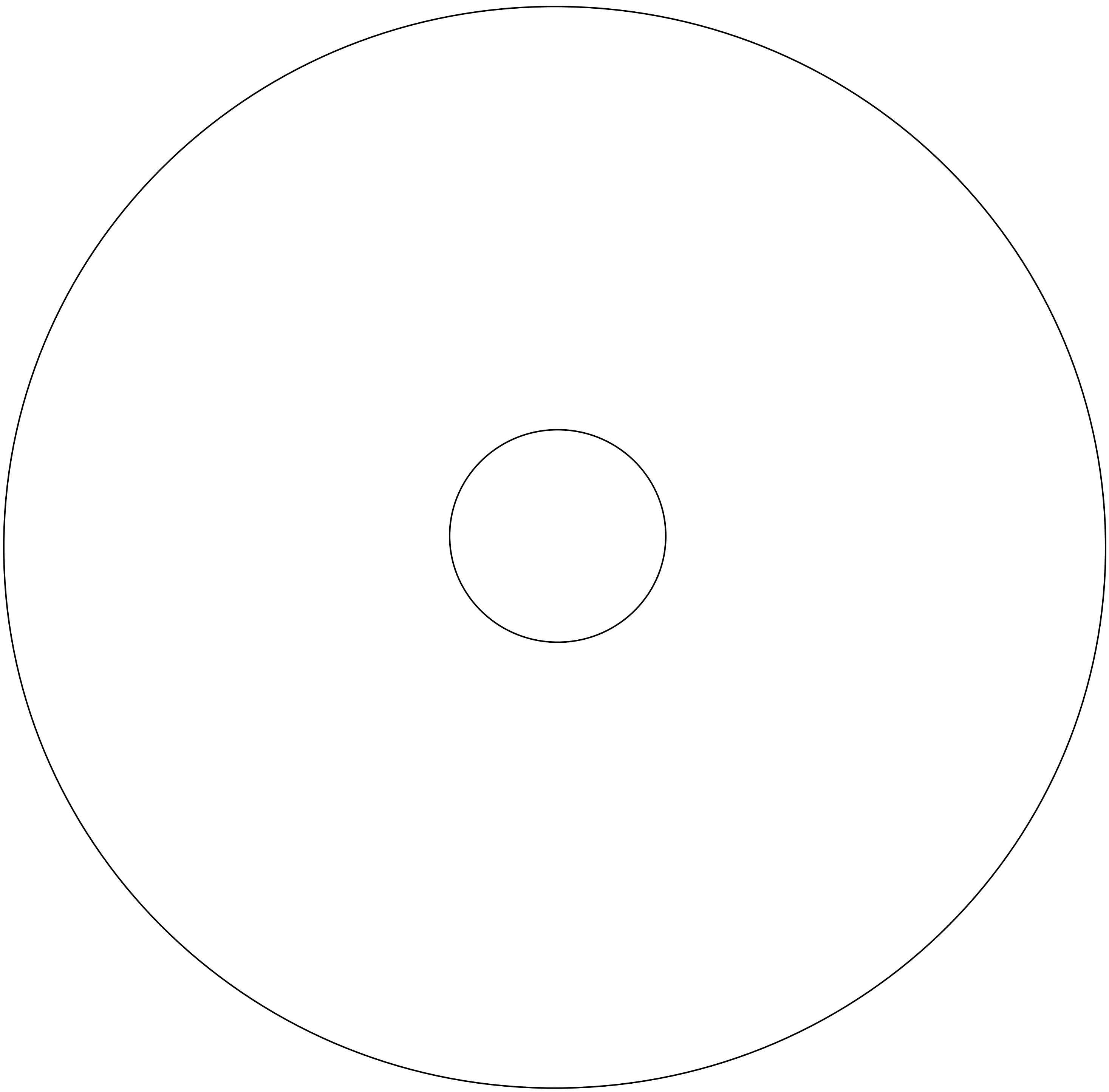
The following data was stolen yesterday from enemy headquarters. The Rocketites performed three missile simulations and tested a prototype for the four missiles, and our soldiers were able to recover the data from these strike simulations. The possible enemy missile sites near your base assignment have been located at the following locations, though Intel is still being gathered:

- 10 m @ 300 degrees South East of Hornetville, Qatar
- 11.7 m @ 200 degrees South West of Hornetville, Qatar
- 5.2 m @ 84 degrees North East of Hornetville, Qatar
- 3.5 m @ 118 degrees North West of Hornetville, Qatar

The missile flight performance data is as follows:

Distance (m)	Time (s)

Resources/Lesson Plans



Getting to Know You Survey

What has been your favorite subject/class to date in your school career?

What strengths do you have to contribute to our learning community?

What is an area where you need practice or help to grow?

What are your post-graduation plans (including future career if you have an idea)?

What is the one thing that you really enjoy? [For example, “the Olympics”, “new phone”, “music”, “Japanimation”, “computer programming”, etc.]

What is one thing that I should know so I can be a better teacher *for you*?

What is one thing that you wish your past teachers knew about you?

Anything else you want me to know….

Likes:

- ☐ to work with and remember facts and details
- ☐ to speak and write directly to the point
- ☐ to complete tasks in an organized and orderly manner
- ☐ to know and follow procedures, guidelines, and instructions
- ☐ immediate results and having goals
- ☐ being acknowledged for thoroughness and detail
- ☐ to practice skills

Dislikes:

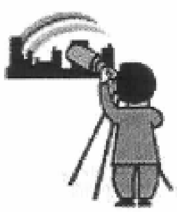
- ☐ completing tasks which have no practical uses
- ☐ activities that require imagination and intuition
- ☐ activities with complex directions
- ☐ open-ended activities without closure
- ☐ activities that focus on feelings or other intangible results

Likes:

- ☐ to study things affecting people's lives rather than facts or theories
- ☐ sharing personal feelings and experiences with others
- ☐ personal feedback
- ☐ opportunities to be helpful in class
- ☐ receiving personal attention and encouragement
- ☐ to persuade people through personal interaction
- ☐ to observe human behavior
- ☐ working with people and trying to help them

Dislikes:

- ☐ long periods of working alone silently
- ☐ emphasis on factual detail
- ☐ highly competitive games where someone loses
- ☐ detailed and demanding routines



Likes:

- ☐ time to plan and organize work
- ☐ working independently
- ☐ working with ideas and things that challenge his/her thinking
- ☐ likes to see the "big picture" – how things relate to each other
- ☐ activities that require logical analysis
- ☐ interested in ideas, theories, or concepts
- ☐ planning and carrying out projects of his/her own making
- ☐ to learn from books and other symbolic forms

Dislikes:

- ☐ routine or rote assignments
- ☐ memorization
- ☐ concern for details
- ☐ rigid rules and predetermined procedures

Likes:

- ☐ to think, imagine, and create
- ☐ searching for alternative solutions to problems
- ☐ being able to learn through discovery
- ☐ recognition for personal insights and discoveries
- ☐ creative and artistic activities
- ☐ open-ended discussions of personal and social values
- ☐ activities that enlighten and enhance – myths, human achievement, drama, etc
- ☐ discussing real problems and looking for real solutions

Dislikes:

- ☐ too much attention to detail
- ☐ facts, memorization, rote learning
- ☐ tasks with predetermined correct answers
- ☐ detailed and demanding routines

Created by Melendez, B. (2010) using Silver, H. Strong, R. & Perini, M. (2000). *So each may learn: Integrating learning styles and multiple intelligences*. Alexandria, VA: ASCD.

Diagnostic Math Pre-assessment

Complete the following math questions independently and to the best of your ability.

Solve the following equations for the indicated variable. Your answers should be in variable form:

1. . $qV = \frac{1}{2}mv^2$ Solve for *v*

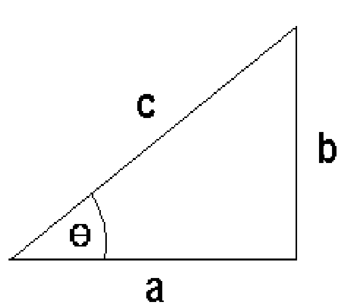
2. $y = \frac{1}{2}at^2$ Solve for *t*

3. $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ Solve for d_i

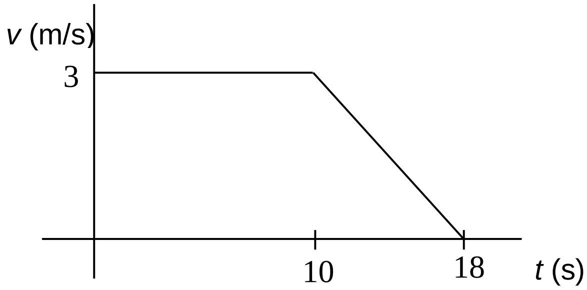
4. $T = 2\pi\sqrt{\frac{L}{g}}$ Solve for *L*

5. Convert 65 cm/min to m/s.

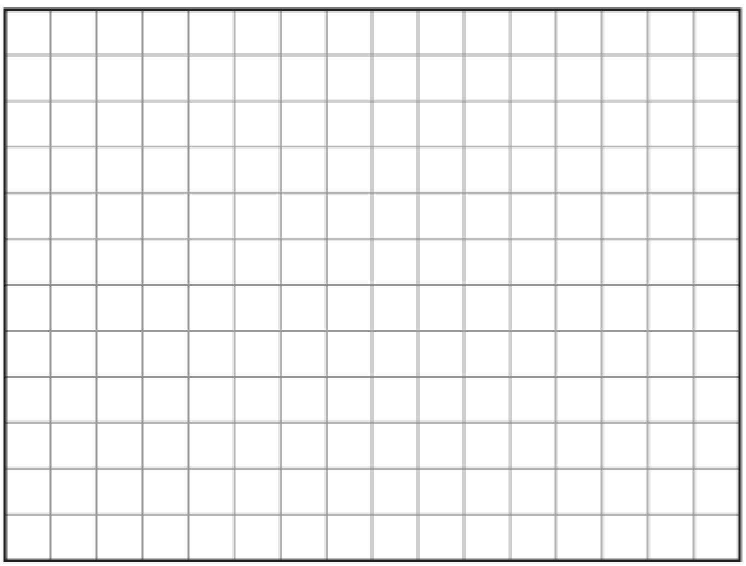
6. *b*= 17.8 m and θ = 65º, solve for *a* and *c*.



7. What is the area under the curve below? Show your work and include the appropriate units.



8. In an experiment with electric circuits the following data was recorded. Plot a graph with the data:



Acceleration (m/s^2)	Force (N)
1.0	13.0
2.5	31.0
4.0	57
5.0	68.5
7.0	106
8.5	72.0

a. What kind of curve did you obtain?

b. What is the relationship between the variables?

c. What is the force when the acceleration is 3.2 m/s^2?

PLUTO	**MICKEY**
DONALD	**GOOFY**
VENUS	**MARS**
SATURN	**EARTH**
FORD	**HONDA**
DODGE	**CHEVY**
LINCOLN	**WASHINGTON**
JEFFERSON	**ADAMS**
FLORIDA	**CALIFORNIA**
INDIANA	**IOWA**
MERCURY	**IRON**
NEON	**COBALT**
DAISY	**TREE**
FERN	**GRASS**
Use the above cards for a class of 28	

DAISY	**NEPTUNE**
TOYOTA	**BUSH**
TEXAS	**OXYGEN**
Use the above 6 cards + the first 6 groups from page 1 (Pluto through Cobalt) for a class of 30	

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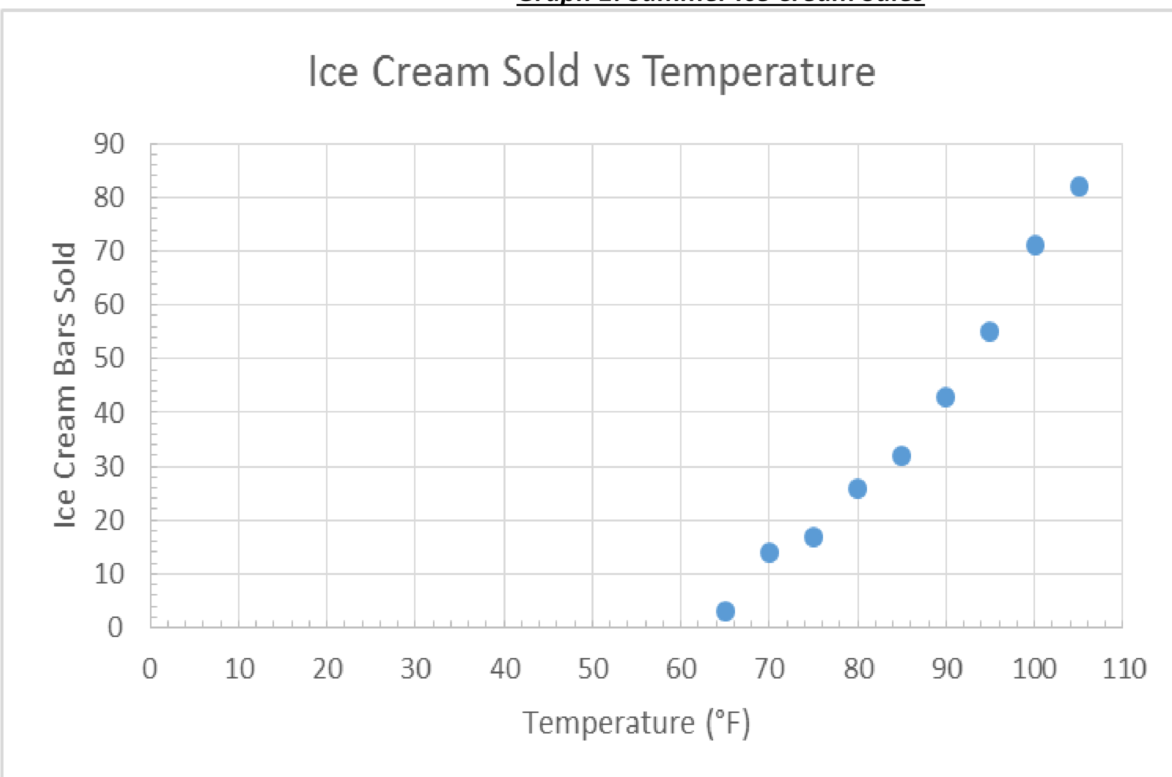
Graphing Practice

For each graph, do at least the following:

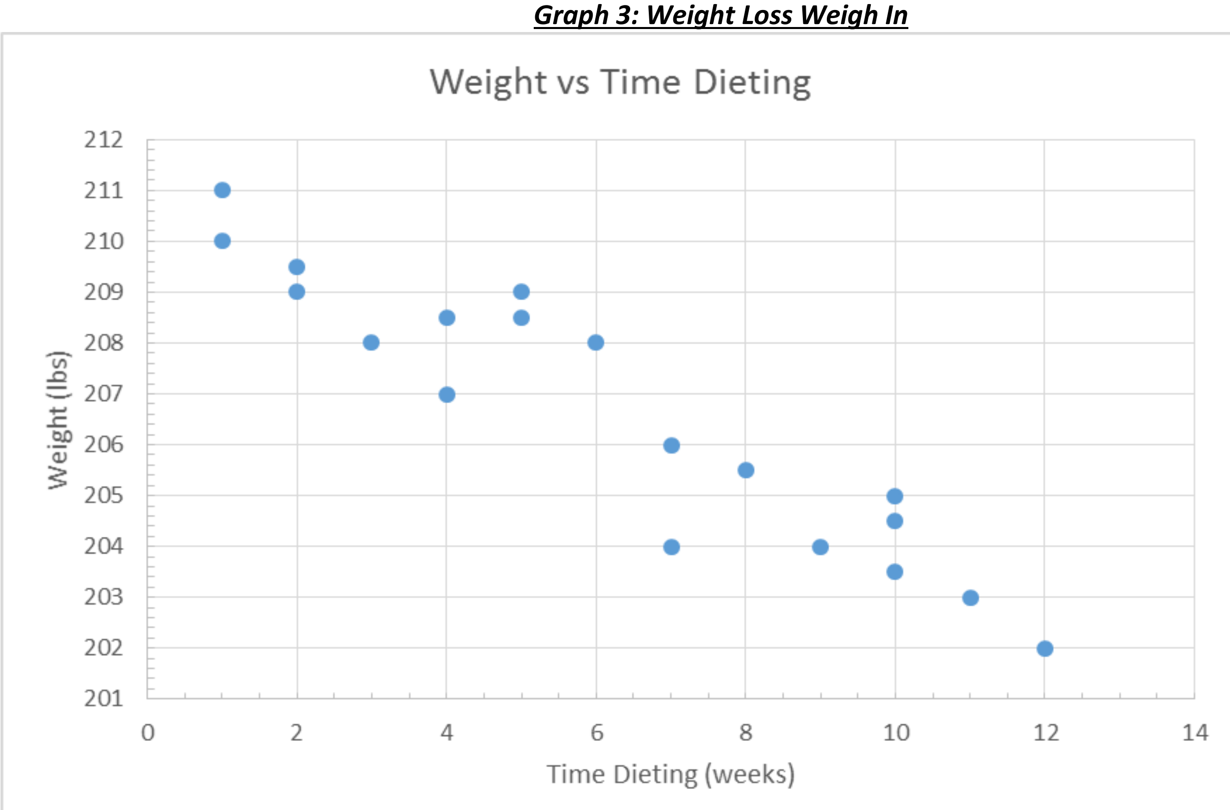
- *Draw a best-fit line (remember, make sure you have the same number of points above and below the line)*
- *Pick two points on the line and find the slope (don't forget units!)*
- *Find the y-intercept.*
- *Write the equation in the slope-intercept format (y=mx+b)*
- *Pick a data point and plug the x in to find y.*
- *Do a percent error calculation on the data y and the y from your equation model.*
- *Is this a strong or weak linear correlation? How do you know?*
- *Are the x and y variables proportional or inversely proportional?* How do you know?

<u>Graph 1: Summer Ice Cream Sales</u>



Graph 2: Money in your Pocket while Shopping

Graph 3: Weight Loss Weigh In



AP Physics B Summer Assignment – In Addition to math review

PART VI. Writing Laboratory Procedures (50% of Grade)

1. This year, you will learn to design laboratory experiments. To do this, you need to gain facility with writing clear, concise instructions. You have the freedom to express your creativity here, but as always, keep it school appropriate and safe.
    - Write a step-by-step procedure for something that takes more than 10 steps.
    - Include sketches, diagrams, and pictures as appropriate.
    - Film yourself doing the procedure and post it to Edmodo by the first day of school.
        - *See Edmodo for an example that you MAY NOT USE*