Worcester Polytechnic Institute

# Meeting the Massachusetts Professional Educator Standards

**Teaching Practicum In Middle School Science**

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This paper discusses my experience with the Forest Groove Middle School students in Worcester, Massachusetts during my science practicum. The paper includes techniques and methods used to achieve competency in the five standards for educators in Massachusetts. The document also includes on information on how my education at Worcester Polytechnic Institute and working with the community of Worcester were beneficial to the practicum.

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# Chapter One

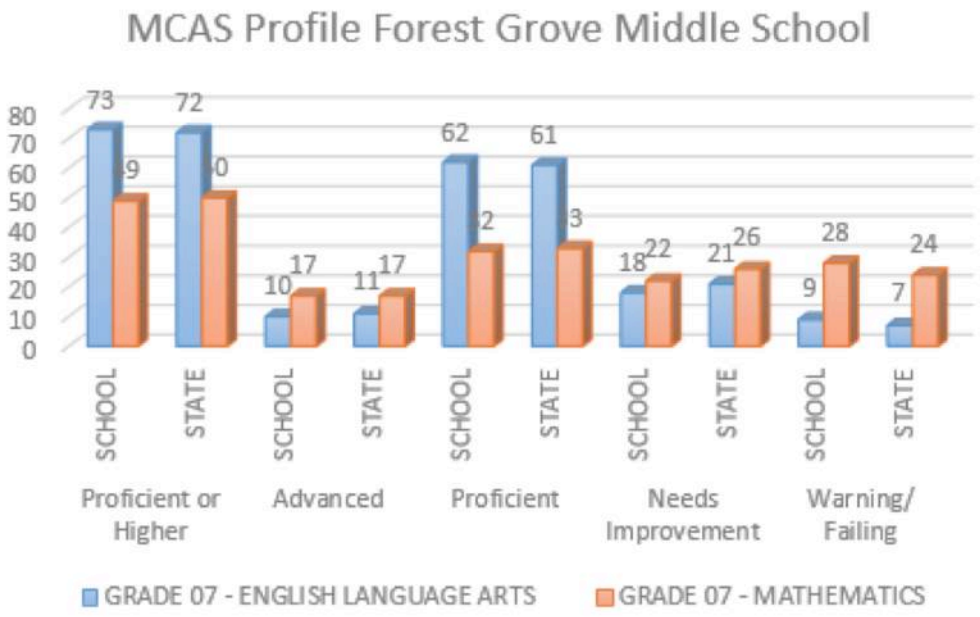
**Education In Massachusetts**

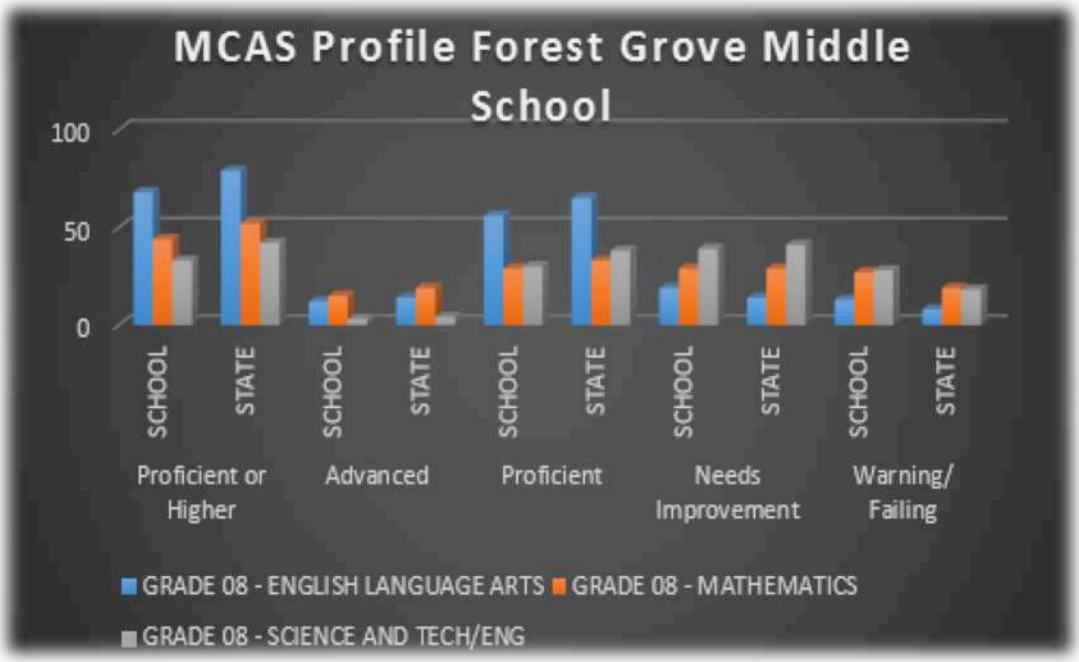
The Education Reform Act of 1993, signed by Governor William Weld, provided changes in public education of Massachusetts. The Education Reform Act, known as MERA, greatly increased the amount of funding for the schools, it set curriculum frameworks, and it took accountability for students' performance and established statewide standards for students, educators, schools and districts. The development of curriculum frameworks and other standards tasks were given to the Board of Education by legislation. In addition, the Board of Education was accountable to support local districts' implementation of standards through alignment of curriculum and instructions. The existing curriculum frameworks consist of Arts, English Language Arts, Foreign Languages, Health, Mathematics, History/Social Science, and Science/Technology/Engineering. The curriculum's frameworks provide a guide for teachers on specific content to be taught from Pre-kindergarten through high school. To measure a student's learning based on the frameworks, MERA created a state standardized test known as Massachusetts Comprehensive Assessment system (MCAS). Compared to before, the new Education Act created a solid and organized foundation for education. Therefore, the state education created a better structure since all the districts had the same guidelines and material to follow, districts had their own superintendent, and principals were given more authority. Furthermore, more funding became available to provide better materials, school facilities, and teachers.

The education that students receive in the state of Massachusetts is more advanced and more impressive compared to other states. TIMMS, Trends in International Mathematics and Science Study, is one of the only standardized tests given to students in the United States and nations around the world. Based on the TIMSS results, the average score for the state was 621 with the advanced benchmark being 625. Similarly, the U.S. Average score was 509 and the TIMSS scale average was 500.

The common core is similar to curriculum frameworks because it is a set of high-quality academics standards in Mathematics and English Language Arts (ELA). Similarly, the Common core outlines what a student should know and be able to do at the end of each year, which compares to the curriculum framework because it illustrates how much material a teacher must cover during the entire school year. The goal of the standard is to ensure that all students graduate from high school with the skills and knowledge necessary to succeed in college, careers, and the work force. Personally, I believe Forest Grove Middle School supports the common core because it provides guidelines on what material should be cover throughout the year. However, the guidelines do limit teachers to incorporate advance material into their lesson plans. For example, in the science Curriculum for middle schools, biology and chemistry are dominant while physics and chemistry are briefly introduced, with minimal details and depth. Many middle schools in Worcester have robotics, an afterschool program where students are introduced to more advanced concepts in order to build a robot to compete with the rest of the middle schools in town. Due to Students lack of basic physics knowledge, the teacher in charge of the program is forced to seek for help from nearby colleges in order to build these compatible robots.

Students who are classified as English language learners are either unable to score a 5 or above on the ACCESS for ELLs or do not pass the English language screener proficiency test in the four domains of listening, speaking, reading, and writing. The Sheltered English Instruction (SEI) is a recommended program that ELL students are encouraged to apply for because it provides a strong support system in school. Within all the SEI classrooms, students study English as a Second Language (ESL), Mathematics, science, history/social studies, reading and writing. All the courses and materials are designed to meet state curriculum standards.




MCAS Profile Forest Grove Middle School
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Proficient or Higher
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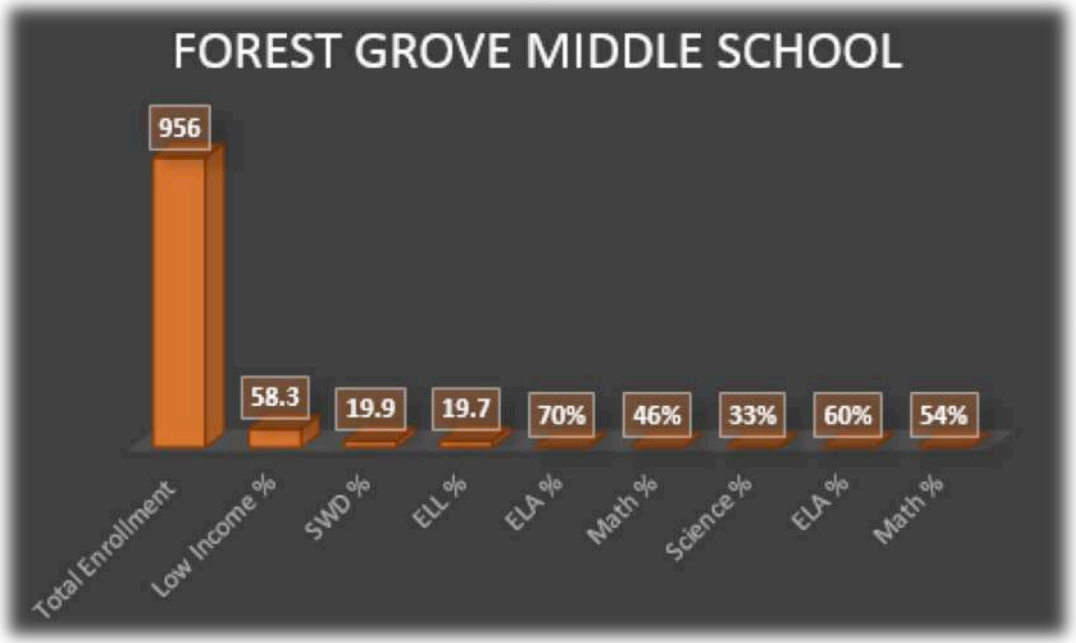
GRADE 08 - ENGLISH LANGUAGE ARTS
GRADE 08 - MATHEMATICS
GRADE 08 - SCIENCE AND TECH/ENG


FOREST GROVE MIDDLE SCHOOL
956
58.3
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70%
46%
33%
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54%
Total Enrollment
Low Income %
SWD %
ELL %
ELA %
Math %
Science %
ELA %
Math %

# Chapter Two

**Plans Curriculum and Instruction**

*1. Draws on content standards of the relevant curriculum frameworks to plan sequential units of study, individual lessons, and learning activities that make learning cumulative and advance students' level of content knowledge*

As a student teacher I was giving the segment of the curriculum that covers Technology/ Engineering. Being an engineering student in college, Mr. Brown believed I would be able to incorporate projects and stories on how math and science play an important role in the engineering field. Mr. Brown and I decided to start the practicum project by teaching students about space and after transitions to Engineering. By including hands on projects and experiments, students were able to not only learn the engineering method but also implementing it on three projects. The projects involved building a solar car, building a tower, and gathering ideas and building a spacecraft model using Legos. Students were expose to typical engineering environment while working on projects; they were giving a budget, limitations, and implication along the projects, and demands by the owners varied through the projects. Students were always working in groups communicating ideas and using their strength to help one another. In the appendix pages 46-51, you will find overall project structures and pictures of some of the student's final models.

*2. Draws on results of formal and informal assessments as well as knowledge of human development to identify teaching strategies and learning activities appropriate to the specific discipline, age, level of English language proficiency, and range of cognitive levels being taught*

To measure students understanding and comprehension from the material covered in the previous class. I structure the class to always begin with a question of the day. The questions were design to have multiple parts so more than one student would be able to participate and share with the rest of the class. Other cases of informal assessment in the course used were weekly vocabulary quizzes, projects, homework, and worksheets obtain from the book. In the appendix pages 46-49, you will find the projects used through the course. The structure of typical quizzes and worksheets used in class are also found in the appendix pages 84-89. The structure of the quizzes involved matching vocabulary words with definitions, Short response questions and a bonus question that would serve to check the ability to recall previous knowledge cover. In cases were the understanding of a specific topic was desire students would find the same bonus question word it differently to make sure all the students were on the same level.

To engage students for the last minutes of the period, I would spend the last 10 minutes on NBA Assessment. The way the assessment work was student would volunteer to answer the question being asked to the class and if they provided the right answer. The student had a chance to shot a small basketball in a hoop that was attached to the storage room door. To assure students would not be discourage from participating in the future incentives were provided.

*3. Identifies appropriate reading materials, other resources, and writing activities for promoting further learning by the full range of students within the classroom*

While teaching about the engineering design process, students were assigned to write a brief essay on an invention they would create to help someone they love. Students were required to follow the steps for the engineering design process and specify in the paper components, functions, and limitations that the device would provide as well as a special material they would use to build the device. To ensure the engineering design process was well understood by students, a small hand on project was create it. The project incorporates a famous movie known as Transformers Dawn of the Moon. In the movie scientists found buried robots on a mission to the moon. The students were giving tasks to build a spaceship was that capable of retrieving some of these robots and bringing them back to earth for further studies. The structure of this project can be found in the appendix in page 47. The goal of the writing assignments and projects were to understand how well the students understood the process and were able to apply it in a small-scale project.

*4. Identifies prerequisite skills, concepts, and vocabulary needed for the learning activities*

Before introducing the engineering/technology topic to students, words that were usually encountered within engineering were shown to students. Exposure to different types of forces, types of friction, and the three Newton's Laws of motion would help understand the material more before going in depth into projects and tasks. This make it easier for student while they were learning about the different car components and their function as part of the solar car project that they would be working on for a couple of weeks. The basic knowledge about speed, acceleration and forces also helped prepared students for the balloon rocket lab that was schedule

to be conduct towards the end of the engineering unit. At the end of this project students were asked 10 questions which was aimed to test the knowledge they were taught during the unit of engineering. The Project hand out can be found in pages 49-49 of the appendix.

*5. Plans lessons with clear objectives and relevant measurable outcomes*

The objectives for the day were always written on the top left hand corner of the white board for students. At the beginning of every class, the objectives were always read to the entire class to provide a preview on the material that was covered for the day. While doing projects such as the solar car and Tower students would have daily building objectives and task to accomplish for the period. To make sure the students had knowledge on main individual components of a car, the first half of the period was use to teach students about the function of the parts and the second half was used for building. For example after introducing the car project and a section on the importance of the car chassis, wheel alignment, and stability during the first half of the period. Students began to design their car's chassis and choose a location for the wheels during the rest of the class period. The following day students objectives were to choose the appropriate wheels type for their project and find a location for the electric motor. By providing students with daily objectives for the long-term projects they were able to plan their time effectively and organized their groups so they would get the most work done for the giving period.

*6. Draws on resources from colleagues, families, and the community to enhance learning*

Building connections and establishing good communications with the teachers from my assigned 7$^{th}$ grade cluster group make the transition into the second half of the school year easier for myself specially after students were coming back from their winter vacation. The observation

hours help me analyze the behaviors students or group of student demonstrated during a regular class period. During lunchtime I would ask the teachers how to approach the behaviors of certain students or how to structured the material to gain the most attention from students. The discussion on how to motivate students to put effort was emphasizing in the conversation as well. The teachers provided me with great feedback, which help me structure the material and the sitting plan when I began to teach the students.

While doing my project students were involved in many standardized testing and I reached out to the rest of the school faculty to see how they planned their curriculum with the pauses due to students testing. Some of the faculty provide me with websites such as Discovery Learning and went beyond with providing me with their personal login information to show students videos relating to the material being learned with the goal of maintaining the information fresh in their minds. Mr. Brown who was the teacher I was initially assigned for the project would frequently talk about the strategies he would use to motivate and engage students learning during the off periods. One of his strategies was using a method called shotgun. In this method a section of a chapter is giving to a group of students to read and provide the entire class with a summary of the most important information from the section. Making connections quickly in a professional and teaching environment went a long way because nothing beats experience. Being the first time teaching, in front of a classroom gathering advice from faculty who work full time helped planned lessons through the practicum.

*7. Incorporates appropriate technology and media in lesson planning*

The projector and speakers that were in the classroom were constantly used in classroom to show PowerPoint on the material. At the beginning of the teaching practicum, I spent days writing on the board but I came to realized in a short time that I lose the student concentration and focus while I would turn my back on them to write on the board. By using the PowerPoint's I was able to show visual representations of theories and scientific discoveries in forms of pictures and videos. The main advantage of using a projector was the ability to face the students throughout the entire material and also to provide them with my attention faster when they had a question relating to the material.

The ability to have technology in the classroom also helped those who are visual learners or ELL students to obtain a better understanding of the material that was being taught to them. A student name Juan, appears have been an ELL students and after showing videos or pictures on the board. He would patiently wait for me to assign work to the entire class and ask questions while I walked up and down each row. The technology was definitely a great addition to make learning fun and more enjoyable for students as they would see visual representations and watch videos on theories/material covered in class.

*8. Uses information in Individualized Education Programs (IEPs) to plan strategies for integrating students with disabilities into general education classrooms*

Although I did not have access to the IEPs information due to confidentiality. There were a couple of student in each of the color classes that needed me to re-explain the material to them in a slower or break it down for better understanding. There were students who were extremely

energetic and seem to seek attention from the rest of the class through the entire class period. For the students who need it the material explain more than once, I would walk up to their desk after assigning work to the entire class and ask if they had any questions on what was asked to be done or questions on the material as a whole. The students who demonstrated a lot of energy I would ask to help distribute worksheets and other kinds of materials that were going to be used for projects or during the class period. Evan for example was a great student who was involved in the Worcester Hockey Team. Most of the days we would come into class full of energy, which he rather used talking with friends than doing work. One day I made a deal with Evan in which if he would get done every day in class. He would be my go to students for handing out class material to the class and make office trips if needed. By Evan accepting the deal allowed him to concentrate in class and also let his friends concentrate on their work.

*9 Uses instructional planning, materials, and student engagement approaches that support students of diverse cultural and linguistic backgrounds, strengths, and challenges*

I used many techniques to accommodate and support students with diverse cultural and linguistic backgrounds, strengths, and challenges. In my lesson plans I included visual, audio, and hands of projects with the goal of enriching the students learning throughout the year. During class assigned projects, students were given different group members to work with to get used to working with any one in the future. As an ELL students I can justify that speaking with others during middle school helped me improved my English speaking level and writing. By switching group partners during future projects, students who didn't know much English were able to practice speaking to communicate with the rest of the team. Students who understood the material in depth helped their members answered any questions that they might have in mind.

A would used the technique cold called during some lesson to engaged students who were either distracted, didn't understand the material well or didn't participated much during class. Chris was a student who engages and focuses on the lesson for the day once he'd settle down in the classroom. Although he was engaged the material being taught was confusing at points for him. I would stop the lecture and break down the material in order for Chris and the rest of the class understand better. I would tend to relate the material to things that the students could relate more to keep the knowledge in their minds for future studies.

# Chapter Three

**Delivers Effective Instruction**

1. *Communicates high standards and expectations when beginning the lesson:*
    a. *Make Learning objectives clear to students*
    b. *Communicates Clearly in writing, speaking, and through the use of appropriately designed visual and contextual aids*
    c. *Use engaging ways to begin a new unit of study or lesson*
    d. *Builds on students' prior knowledge and experience*

At the beginning of every class student spent the first 5 to 10 minutes working on the question of the day. The question asked students to recall previous topics that were taught early in the year, which would transition into the topic that was covered for the day. In situations in which old material was not relatable, students would be asked to write down general knowledge regarding the topic. If they had heard about it before, what had they heard about the topic? Once all the students were down writing their thoughts, a small discussion would take place to see the level of knowledge students had regarding the topic. Students that were called on or participated were awarded at the end of the period. Although the objectives for the day were clearly written on the top left hand corner of the white board, I read it to students and made the expectations clear before proceeding with the lesson of the day. When a new lesson was introduced to students, an educational video to capture students interested was shown. For example, while teaching students basic engineering topics videos about modern technology and how an idea become something that it is used today in our society were shown to students.

2. *Communicates high standards and expectations when carrying out the lesson:*
    a. *Uses a balanced approach to teaching skills and concepts of elementary reading and writing*
    b. *Employs a variety of content-based and content-oriented teaching techniques from more teacher-directed strategies such as direct instruction, practice, and Socratic dialogue, to less teacher- directed approaches such as discussion, problem solving, cooperative learning, and research projects (among others)*
    c. *Demonstrates an adequate knowledge of an approach to the academic content of lessons*
    d. *Employs a variety of reading and writing strategies for addressing learning objectives*
    e. *Use questioning to stimulate thinking and encourages all students to respond*
    f. *Uses instructional technology appropriately*
    g. *Uses effective strategies and techniques for making content accessible to English language learners*
    h. *Demonstrates knowledge of the difference between social and academic language and the importance of this difference in planning, differentiating and delivering effective instruction for English language learners at various levels of English language proficiency and literacy*

An important tool that was used through my teaching hours was the usage of questions during the period. By using questions that relate to the material, students were able to use their critical thinking skills and come up with a clear understand on the material being taught to them. Their minds were push to thinks past the basic material and begin to comprehend the

bigger picture. In some cases questioning students were able to relate what they had learned in the past with what was being present it to them.

To assure all students had an equal chance of being picked to answer a question I would use a small-scale power ball machine, which Mr. Brown had, in the classroom. After spinning the machine the selected ball had a row number and seat number written on it. The question was then asked to the student and was giving a wait time to gather their thoughts and recall past material. In the case, which the student was not, able to answer the question I would either do small step-by-step questions that would lead to the main one that was initially asked. In other cases I would give the students a chance to "call a friend for help" in which a classmates was given the chance to answer the question. However most of the time by providing the first students with hints and asking simpler questions, they were able to answer the main question completely and had more confidence through the rest of the class.

To accommodate and assure that ELL students were gathering and grasping information on the presented material. They would be assigned with talented students and were explained the tasks that need it to be completed for the day. Being an ELL myself I understood the complication and difficulty these students go through during school, so I would always stop by to check their understanding and repeat the instructions slowly and clearly directions. At the beginning of every project, pictures were shown to students so they had an idea on how the final model would look like. This provided the ELL students to understand more of what was expected of them to accomplish.

3. *Communicates high standards and expectations when extending and completing the lesson:*
    a. *Assigns homework or practice that furthers students learning and check it*
    b. *Provides regular and frequent feedback to students to achieve competence*
    c. *Provides many and varied opportunities for students to achieve competence*

Homework was assigned daily straight from the book or class handouts. Students were giving 10 minutes at the end of the class to copy the vocabulary from the book and begin to work on the section assessment at the end of the chapter. The following day student understanding was check by asking the book questions. If student weren't able to capture the entire answer, other students were called on to add more information to complete the answer.

Students were giving the chance to present or submit homework late with the penalty that for every day the homework was late it was 10 points taking off. However I always encourage students to present homework on time because I didn't want them to make it a habit that could potentially influence their academic behavior in high school.

4. *Communicates high standards and expectations when evaluating student learning:*
    a. *Accurately measures students achievements of, and progress toward, the learning objectives with a variety of formal and informal assessments, and uses results to plan further instruction*
    b. *Translates evaluations of student work into records that accurately convey the level of student achievement to students, parents or guardians, and school personnel*

During the majority of my practicum, students were engage in doing projects that would help them better understand the important of the engineering design process. To make sure students would take away the important information for the day, I would spend the last 10 minutes on NBA assessment or quizzing students verbally. NBA assessment was effect during my project since it make students pay more attention through the lecture and want to participate for a chance to shot a small size basketball through a small hop hanging from a door. Students were chosen randomly to answer the question using a small-scale power ball wheel. Each ball within the machine had a row number and seat number. This method was constantly used to give every student a fair chance to participate in class.

When students transition into learning about the earth, weekly quizzes were giving to them that would measure their level of understanding on the topic. In science classes vocabulary is important because it carries through the entire material cover in a year so I made sure students were comfortable using and knowing the vocabulary well before continuing with the next lesson. There was always a portion in the weekly quizzes that incorporate it the vocabulary for giving sections of the book cover in the week. For reference on one of the weekly quizzes see page 89 on the appendix.

# Chapter Four

**Manages Classroom Climate and Operation**

*1. Creates and maintains a safe and collaborative learning environment that values diversity and motivates students to meet high standards of conduct, effort and performance*

*2. Creates a physical environment appropriate to the range of learning activities*

*3. Maintains appropriate standards of behavior, mutual respect, and safety*

*4. Manages classroom routines and procedures without loss of significant instructional time*

The start of every lesson or day contained a motivational quote that was used to motivate students towards school. During the first day week of teaching classroom rules were shown to students which included respecting one another, maintaining a safe laboratory/project environment, landing the plan method, one microphone rule, and bringing material into class. During Experiments students were supervised to take care of the equipment and to behave in a proper manner to continue working in projects through the year. In two different class periods I had a few students who used to forget their science book in their lockers. During the observation period I notice the pattern in which daily they would ask Mr. Brown permission to grab the book from their lockers once work was assigned. Paul was a baseball player and was always the last student putting his school material away. Constantly he would get the wrong letter day and brought the incorrect material to class for the rest of his day. Bryan was a student in the red period class. He would not carry a lot of school material with him just a notebook and pencil. Bryan constantly would ask to borrow a book from Mr. Brown with the excuse that he had left his science book at home. Daily I would encourage Bryan to bring his book to school and spoke

to him about the importance on coming prepare to class. After a week Bryan's book went from being home all the time to being kept in his locker, which allow him to complete the work, that was assigned to him. In Paul's situation, I would come to his locker to confirm the letter day so he prepare appropriately for the day.

An engaging and friendly class environment was created through the projects and classroom activities. I made sure to provide students with fun projects, which expose them to explore the course content in greater depth by applying, and facing problems as the project moved along. As a teacher creating a friendly classroom environment facilitated the ability to have students engage during the period. Students were also enthusiastic about coming into class because they knew that material was always introduced in a fun and interactive form.

# Chapter Five

**Promotes Equity**

*1. Encourages all students to believe that effort is a key to achievement*

All my lectures begin with a motivational quote of the day. I would always reminded students that although the road was tough ahead of them through the act of their own effort they would be able to accomplish high academic achievements. Since the beginning of my project I build a good student teacher relation, and while talking with one of the student from my red class. She mentioned her dream of becoming a veterinarian in the future. From my previous observation of the class, she would always stand out because she didn't want to get any work throughout the period and I would constantly see her speaking to the girls next to her desk or behind her desk. I strongly encourage her to focus more on schoolwork and place lots of effort in her schoolwork. Although it took a while for Shantee to realize that I cared about her future, she focused on doing better in school in order to attempt reaching her dream.

Another Student, Brandon, was a big basketball fan and player. He dreamed on playing for the NBA someday but was looking forward to play at the high school level. I share stories with him about friends from my varsity soccer team who were benched for most of the season due to low academic performance. I mention that although making it to the NBA was doable it required a lot of effort and time practicing just like school. I told Brandon that in life we always have to multiple plans. I spoke to him every day on how he must work hard in school because some day is the NBA doesn't happen education was going to lead him to success. A list of the motivational quotes used can be found in the appendix pages 40-45.

*2. Works to promote achievement by all students without exception*

The Motivation quote of the day was used to encourage shy students to step outside their comfort zone and participate more during the period. My idea behind the quote was to also promote confidence among students in school subjects and their daily activities such as sports. Being a student teacher I was able to prove that students who avoid eye contact are the ones who don't want to be called on to answer questions asked in class. At times instead of using the Powerball machine I would call on random students who look away as soon as I asked the question. In my eyes all my students had the ability to succeed in my classroom so I would always complemented students work through the entire period and put in effort to assure students felt confident in completing and mastering the class material.

*3. Assesses the significance of student differences in home experiences, background knowledge, learning skills, learning pace, and proficiency in the English language for learning the curriculum at hand and uses professional judgment to determine if instructional adjustments are necessary*

I was never giving access to the student's academic information, so I didn't know which students were ELL learners. However through the observations hours at the beginning of the project and helping Mr. Brown supervise students as they work. I carefully observe students and notice which ones would need instructional adjustments.

A student name Juan, from the blue honors class was a hard worker however would always raised his hand daily to ask Mr. Brown to clarify the instructions one more time during my observation hours. Because of his daily behavior after I was done explaining the class material to

the entire class and everyone was set to start working in the assignment giving to them. I would stop by Juan desk and explain the instructions to clarify any misinterpretations. While all students were working on classroom projects, I would frequently walk by Juan's group to ask him if he had any questions on the task that needed to be complete for the day.

*4. Helps all students to understand American civic culture, its underlying ideals, founding political principles and political institutions, and to see themselves as members of a local, state, national, and international civic community*

At the start of the first class, students would say the pledge to allegiance following the lead of another Forest Groove student over the intercom. This was a procedure that all the students would follow on a daily basis through the week. While teaching the students I encourage them to participate in community events. I spoke to them about the importance of the community to our lives and how simple acts can change/help a community as a whole. During down time I would share student's stories of teen programs around Worcester, which I become involved in through high school. I told students how the experiences I went through while volunteering and helping making a change to the community helped me realized that there was a lot to be done to the city of Worcester. As a youth advocate for the community, I told students how I overcame my fear of public speaking; gain leadership skills, communications skills, and more.

Most of my students were involve in clubs or sports after school. So I would use student's afterschool activities to provide them with clear examples on how a community is like a team in which all the people who lived in it were players of the team. If everyone within the team play their role the team would succeed in anything. Every Friday morning students would

sing along Mr. Brown the Massachusetts state song which became evident to me that students felt pride and belonging to the state community.

*5. Collaborates with families, recognizing the significance of native language and culture to create and implement strategies for supporting student learning and development both at home and at school*

Although I never interacted with the student's parents and during meeting only full time staff were allowed to attend. Notes were provided to Mr. Brown or Mr. Surrette on the performance and behavior of a particular student. After the meeting students tended to change their behavior and increased their performance. Which goes to show the importance communication between parents and teachers helps keep students in the right path through their education.

During the observation period I would constantly speak to Mr. Brown about teaching techniques and strategies. Being someone that had taught for 17 years Mr. Brown had great advice on the does and don't as a teacher. An advice I learned through Mr. Brown was the Sandwich method to deliver to parents regarding student overall performance. The Method was broken down into 3 main sections. The top layer which was use to tell parents how the students behavior was during class, the middle layer explaining to parents the low performance or behavior student was demonstrating in classroom. The third layer was to end with a good note so the parents don't feel that as a teacher once was trying to fail the student rather than supporting him and encouraging him to do great.

# Chapter Six

**Meets Professional Responsibilities**

*1. Understands his or her legal and moral responsibilities*

As a Teacher I understood all the responsibilities associated with teaching. I built connections with students so they would feel comfortable asking in class questions and provided them with advice. The connections made with them were limited to a certain point to make sure the respect level toward me would never exceed its limits. During my project the science department ask for the students to take the department exam to evaluate student's knowledge learned through the year. I set up reminders for students to prepare for the exam and also administer the exam. Being the teacher in charge, I was accountable for daily attendance, reporting any bad behavior, and conduct during class.

*2. Conveys knowledge of and enthusiasm for his/her academic discipline to students*

Being an engineering Student allowed me to explained material to students in a clear and fun manner. Whenever possible I would speak and show videos to students on the importance of science in our society. At Forest Groove most of the students had high-end smartphones such as an iPhone 5 and Samsung Galaxy s5. Using their phone for an example I asked them to compare the first phone size to what they had now. Students become aware that due to engineering and science the cell phone industries were capable of down sizing the phones. The importance of material selection when building a particular object due to cost was also explain to students while teaching them the engineering design process. The ability to demonstrate enthusiasm in the project helped engage students more to ask deeper questions and be curious about the topic. The

engineering design process used during the smartphone lesson could be found in page 83 of the appendix

*3. Maintains interest in current theory, research, and developments in the academic discipline and exercises judgment in accepting implications or findings as valid for application in classroom practice*

Through my studies at WPI I had gained so much knowledge on how mechanical objects work and the details one must take into consideration while learning the behavior of the mechanism parts. While teaching students at Forest Groove Middle School, I was enrolled in ME 3901 and ME 231X at WPI. The courses increased my understanding and knowledge in my major field and although I wished to had shared some of the knowledge with students. I didn't want to overwhelm them by exposing and teaching advance material during the period. My alternative to accommodate was showing discovery videos to students about how things work so they could gain basic understanding and built upon the material as they continued their education in the school system.

*4. Collaborates with colleagues to improve instruction, assessment, and student achievement*

During the course of the project, the cluster teachers would have lunch together. A portion of the time was used to share ideas about assessment or projects. Teachers provided me advice on sitting plans that had work through the year, which improve the student's performance. Ideas on classroom rules were shared with me during the first few weeks of the project.

During the project I had 3 honor classes and one college level. The honor class students were well behaved during the period. However, most of them had groups that sat together during class, which made it hard for them to concentrate on classwork. The college level class was an interesting class because they responded back and the majority of the class refused to do work on a daily basis. Through clusters teachers and Mr. Brown advice I began to build a good relationship with these types of students. They mention to me how it was critical to create the relationship since one demonstrates to them how much as a teacher one cares about their academic performance. A method known as shotgun was learning from Mr. Brown, the method assigned student a portion of the chapter to read and work on a summary that would later be presented to the entire class for better understanding. The students from the red class enjoy having attention so this method was affective however it was not used frequently due to students fooling around and speaking random topics while they were presenting to the entire class. Having colleagues who were experienced in teaching definitely helped me plan the lessons and improved on my instruction to assure student achievements through out the practicum.

*5. Works actively to involve parents in their child's academic activities and performance, and communicates clearly with them*

As mention before I was not able to communicate with parents directly however, Notes were provided to Mr. Brown or Mr. Surrette prior to attending a parent meeting so that I could also have a saying in the meeting even though I was not physically present. Assuring good academic achievement from students does not only depend on the teachers. It depends on both parents and teachers communicating back and forth to come up with solutions and arrangements to make sure student is engage in their academics and learns through the school year. Within the

notes that were giving Mr. Brown, I would provide parents with feedback on the positive things students were accomplishing in class and the areas where students could use improvement.

*6. Reflects critically upon his or her teaching experience, identifies areas for further professional development as part of a professional development plan that is linked to grade level, school, and district goals, and is receptive to suggestions for growth*

During the entire project weekly Friday meetings were held with the current working teacher to evaluate my class performance for the week. During the meetings I would speak first on how well I thought I was doing and the areas that I thought needed work. Mr. Brown or Mr. Surrette provided me with their honest opinions on my performance and the feedback received was taking in consideration while planning lessons for the upcoming week. As an example when I first started teaching, I had some trouble projecting my voice for the entire class. The words, colors, and font on the PowerPoint's were not readable for the majority of the students in every period. Mr. Brown brought it to my attention during a brief conversation between a small period break and actions were taking to assure the next class and future lessons would not contained similar mistakes. Notes were also taken at the end of every period to reflect upon the positive and negative results from the class. The notes were analyzed at the end of the school day and were later discussed at the end of the week with Mr. Brown. The notes served well to avoid repeating mistakes and preparing better lesson plans for the upcoming day and weeks.

*7. Understands legal and ethical issues as they apply to responsible and acceptable use of the Internet and other resources*

During my observation period of the project students were involved in a science project, I offered to help them clear any potential questions that could came up during their school winter break through my WPI email. I took the responsibility to make sure that respect was demonstrated from both ends of the emails. I understood that incase an incident occurred, my responsibility was to immediately report it to the school faculty. Although I built a great student to teacher relationship with the students, I never received or was asked to become friends with them through social media. Students were aware at all times that in the class or outside the school I was a student teacher, which deserve all the respect and the same rules applied similar to regular teacher.

# Chapter Seven

**My Worcester Polytechnic Institute Education**

The level of education I have receive at Worcester Polytechnic Institute as a Mechanical Engineer helped me provide in depth explanation on the importance of science and math to the 7th grade students at Forest Grove Middle School. As a college freshman taking the calculus series and basic physics, I would constantly wonder how could the material being learned be implemented in future courses. Within the basic Calculus and Physics courses the professors would incorporate the material that was taught to real life scenarios that help me realize the important role both Math and Science play in our society. Mr. Brown the science teacher I was assigned for the project, incorporated engineering as part of the curriculum. Being a student studying Engineering, Mr. Brown requested for me to explore and explain the engineering design process and to used two old projects he had used in the pass so student could exercise the Method.

A deep explanation of The Engineering Method served as a good introduction to engage students to begin to think like engineers during the first week. Through my education I have notice that students gain more knowledge through hands on experience such as class projects. After introducing the Engineering Method, students were given a small class project to complete. The project was base of the popular movie Transformers: Dark of the Moon. The main task student had to accomplished was to excavate the robots scientists had found in a previous exploration at the moon and be able to bring the robots back to earth for further studies. The outline of the project included using the engineering design method to achieve building a spaceship that could travel to the moon and back to earth using Legos. A portion of Legos were passed on to the groups once they provided that they had a drawn model of the spaceship and had

completed all the steps in the engineering design process. To see a more detail explanation of the class project refer to the appendix page 47.

The Tower and Solar Car projects were more advance projects that would test and provide practice to students on using the Engineering Method. Basic Knowledge of statics system and physics were taught to students to accomplish the goals for the given project. Through the tower projects students learned the importance of analyzing forces and engineering implications that engineers deal with in real life. Students were expose to the different kind of stress that can be found in structures as well as some of the forces that exist in the world. Through the tower project students were able to understand that force was not just an equation that numbers were plugged in to obtain a number. Instead they were able to see how the value of force was useful to built strong structures to withstand certain loads. Through the project students learn the importance of stability in a structure helps prevent the Force of wind from destroying a building. The car project was an interesting project because the importance of both science and math were shown to students. Through the project I was able to enforce on students the importance of studying molecules, such as electrons led to society to explore solar power. I also explain to students the role math plays within the solar power because people are constantly interest in benefits from designs, knowing how much power can be collect it through solar panels. After providing good usage of the Engineering Method, Students begin to build their solar cars and see from hands on experience critical car parts and their functions. Refer to the appendix for more details on the tower on page 46 of the appendix. The lesson giving to students during the solar car project can be found on pages 64-75. Students were shown a few slides of the PowerPoint a day with the goal of providing them with enough knowledge to begin building their own solar car model.

Being able to fully explain the material to student and provide real life scenarios through the projects helped answer the old question on why they needed to learn the material or if it was going to be useful to them in the future. The education I have receives at Worcester Polytechnic Institute in the Mechanical Program was beneficial to the IQP project because I was able to answer outside questions that students would bring to class while they were learning about different kind of forces and Engineering. The knowledge and efficient learning styles seen at my institution were keys components, which help me provide the students of Forest Groove with basic understanding of complex material learn through my college career.

# Chapter Eight

**My Green and Red Class**

As the bell rings exactly at 9:50 AM, the quiet school hallways slowly begins to fill up with many conversations between students. Lockers begin to open and close constantly throughout the halls and teachers made their way outside their respective classroom to welcome their class for the period. As student entered the classroom they began to fill up the empty wooden chairs and Black Laboratory tables gradually and proceeded to work on the question of the day. As I stand on outside the classroom on the left side of the door waiting for the green class students to come in to check attendance for the day. Nasjely, 5 feet Spanish students who is part of the red class walks across the hall greeting me and asking what will be doing today for the period. Before I get a chance to say something, She walks into the classroom to read the agenda for the day that was written in the top left corner of the white board. She was satisfied with the assignments written for the day, she turned around and said good-bye and continued walking down the hall for her next class.

As the bell rang for the beginning of the class, two or three students per row begin to raise their hands to answer the question of the day. There were 30 students in the green class; many talents and abilities were seen among the students. Most of them were involved in sports and some in club teams. The class was known in the cluster for demonstrating outstanding academic performance so they could keep being involved in after school activities that enrich their education. Najola and Abraham were two students who had knowledge beyond the material that was being covered in class. Najola sat at the end of the second row away from my desk and was always the first student to raise her hand to answer questions, when the chance was giving to her to answer. She went in deep explanation beyond the basic knowledge that the 7$^{th}$ grade

science book covered. Although she was aware of how smart she was, she was humble and didn't look down on the rest of her classmates. Instead she was always willing to help the other two girls that sat to her left and right, Cindy and Britney. Najola was always the first student to complete the quizzes and department exams; she would demonstrate respect and maturity for her age. She was a top student in the science class and enjoyed learning.

Abraham was so knowledgeable of the importance of science in general. His father was an engineer and in a conversation had mention to me about the different software's his father had expose him to early on in life such as SolidWorks. Abraham would sit on the 4th row ends closes to the windows and the huge dinosaur head Mr. Kept in the classroom. He was a humble student and was always willing to help others understand the material. Abraham was a great student but would lose focus on the classwork because he became involved in conversation with Reece and others around him. I would constantly come up to his sit and encourage him to continue doing his work.

Chris was the funny guy from the green class. At the beginning of the class he would always act goofy around his science table to make his friends laugh. His assigned seat was the second seat to the left, 4th rows down from my desk. Chris's attention would immediately turn to the board when I would read to the class the quote of the day. The quote of the day was used to encourage the students to continue providing good academic standing and pursuing a higher education. After listening to the quote, he concentrated his attention to the lesson. Although for the majority of the time he would not understand the material that was being presented to him. I constantly stop and asked the class if anyone else didn't understand the material. Even if no one else raised his or her hands, I proceeded to breaking down the material for Chris so he could grasp and understand the material. Encouraging and motivating Chris helped him to accomplish

a lot of work during the schedule class time and also built confidence to ask the typical question "well how do we apply forces to real life?" which led me to explain real life scenarios that the students encounter in their daily lives.

Mahainee was a light skin color student, with blond curly hair. She was very smart student however didn't like to see loads of work being presented in front of her. The motivation quotes and constantly telling her "you got it" or "you can handle it" encourage her to finished the hands out and also complete other assignments in time. At the beginning of the practicum she was one of the shy students and avoid it eye contact so she wouldn't be called upon. Over time she become more confident in asking questions and for help. At first she was not interested in classroom work because she would rather speak with Marisabella than completing the work. She was also the type of student that wanted the answers to be giving to her right away without putting effort or time. Over time while I was teaching she learned by herself that completing a task after investing time provide a comfortable feeling. Mahainee learned quickly how much hard work pays off.

Bryant was a student from the red class. I dedicated most of my time giving advice and motivating him to work hard and do work during class. He brought to school the newest sneakers in style. He enjoyed grabbing others attention and refused to do work. When I spoke with him one day after class. I asked him what motivated him and who was his role model. Bryant rapidly responded my mom. He spoke to me about how much she worked to buy him shoes and provide him with everything he needed at home. I tried motivating Bryant daily through the quote of the day and advising him to work hard and attained good grade as appreciation towards his mother's efforts. I allocated time for him during the class period to get him started on the work. However it never work because after I'd left his desk he would turned to speak to his neighbors distracting

them from doing their own work. I would always pull Bryant on the side to speak to him about his behavior and reminding him to do get good grades for his mother. Bryant would agreed to work harder in class after the side conversation but the following day he would get back to goofing around and distracting others. Although I never gave up on motivating him or helping him get work done. Bryant continued to behave in the same manner through the entire project.

Alyssa and Shantee were two young students in my class with dreams of attending Harvard University. Both of them however never wanted to get work done or do homework. I explained and spoke with both students individually on the homework loads Harvard students have every night. I advised them both to create the habit of working hard now while they were young which would make it easier for them when they begin their college education. Alyssa would often tell me that she would worry about the load once she got to that point in her life. She would always fool around and distracted surrounding students from doing their assigned class work. Shantee tried to change her habits of not doing work into getting more done during the class period. After assigning the class with work for the period, I would stop by Alyssa's desk and encourage her to do the assigned work often. I tried building a student-teacher relation with Alyssa however in most conversations she kept her answers shorts and demonstrated no interest in the conversation. She would demonstrate no interest in being motivated or how much I care for her to succeed in her education. The motivation quotes and the side conversations were not successful with Alyssa.

Nasjely was always right and would constantly mock me during the lectures. She always had the last word in a conversation and would answer rudely back when I could call on her to stop disrespecting the classroom. At first I tried building a student-teacher relationship but did not take me seriously because I was a student teacher. I tried motivating her and speaking to her

about the importance of education in her life for the future however she constantly ignore my words and say that rappers make a good living without attending school. One time I had to sent her to the principal to not only show her that I should be taking seriously as a teacher but to calm her behavior for the upcoming lesson for the week. Nasjely was a student that influence the behavior of two other female student and even if I sent her to the back of the room. She always seemed to find a way to disturb or grab the two students attention to continue fooling around during the lesson. While working in the projects she would concentrated for a couple of minutes but after she would use the time to speaks to friends and destroy project materials. None of the approaches I tried using were successful with Nasjela because she never took things seriously.

## Conclusion

My teaching practicum experience allow me to understand the hard work and energy teachers must bring into the classroom daily and the hours on planning that goes on during and off school hours. Teaching at Forest Groove Middle School allowed me to understand the implications and struggles teacher face throughout the school year. Making accommodations and encouraging students to do work was something I encounter during my first week in the project. However I provided students with motivation quotes daily and encourages them before the period end to continue working hard towards their dreams. The ability to motivate a young generation and provide them with support along the way was the most rewarding experience during my science practicum. Being a teacher and working daily in a classroom is not easy and I have a greater appreciation level for my past teachers at the Middle School and High School level. In conclusion I strongly believed that I was able to meet the Massachusetts Professional Educator standards during my science practicum.

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# Appendix

## Motivational Quotes

"In every day, there are 1440 minutes. That means we have 1440 daily Opportunities to make a positive impact." -Les Brown

"Help others achieve their dreams and you will achieve yours"

- Les Brown

"Shoot for the moon and if you miss you will be among the stars"

" Your goals are like road maps that guide you and show you what is possible for your life "

" Life takes on meaning when you become motivated, set goals and charge them in an unstoppable manner"

" Don't let someone else's opinion on you became your reality"

"Life has no limitations, except the ones you make"

" Forgive yourself for your faults and your mistakes and move on"

" Too many of us our not leaving our dream because we are living our fears"

" If you take responsibilities for yourself you will develop a hunger to accomplish your dreams"

"If you set goals and go after them with all the determination you can muster, your gifts your gifts will take you places that will amaze you"

"If you believe it you can see it, not is you can see then you will believe it"

" Just because fate doesn't deal you the right cards, it doesn't mean you should give up. It just means you have to play the cards you get to their maximum potential"

"You don't have to be great to get started, but you have to get started to be great"

"Honor your commitments with integrity "

"Believe you possess a basic goodness, which is the foundation for the greatness you can ultimately achieve"

"When life puts you on tough situations, don't say, "why me?" just say, "Try me!"

“No one rises to low expectations”

“Anytime you suffer a setback or disappointment, put your head down and plow ahead”

“You are never too old to set a new goal or dream of a new dream”

“You must remain focused on your journey to greatness”

“Failure will never overtake me if my determination to succeed is strong enough”
- Og Mandino

“In order to succeed, we must first believe that we can”
- Nikos Kazantzukis

“Always do your best what you plant now you will harvest later”
– Og Mandino

“It does not matter how slow you go as long as you don’t stop” – Confucius

“ You have to learn the rules of the game. And then you have to play better than anyone else” - Albert Einstein

“Things do not happen. Things are made to happen”
– John F. Kennedy

“Our greatest weakness lies on given up. The most certain way to succeed is always to try just one more time” – Thomas A. Edison

“The secret of getting ahead is getting started” Mark Twain

“A creative human is motivated by the desire to achieve, not by the desire to beat others” – Ayn Rand

“Keep your eyes on the stars, and your feet on the ground” – Theodore Roosevelt

“We may encounter many defeats but we most not be defeated” – Maya Angelou

“Problems are not stop signs, they are guidelines” – Robert H. Schuller

“Either way I will find a way, or I will make one” – Phillip Sidney

“ What you do today can improve all your tomorrows” – Ralph Marston

“Your talent is god gift to you. What you do with it is your gift back to god”
- Leo Buscaglia

“ Always do your best. What you plant now, you will harvest later.”
- Og Mandhino

“ With the new day comes new strength and new thoughts”
- Eleanor Roosevelt

“ If you dream it, you can do it” - Walt Disney

“ Don’t watch the clock; do what it does. Keep going.” – Sam Levenson

“Believe in yourself! Have faith in your abilities! Without a humble but reasonable confidence in your own powers you cannot be successful or happy.
- Norman Vincent Peale

“ Expect problems and eat them for breakfast” - Alfred A. Montapert

“ The will to win, the desire to succeed, the urge to reach your full potential. These are the keys that will unlock the door to personal excellence.” - Confucius

“ Success is not final, failure is not fatal: it is the courage to continue that counts.”
- Winston Churchill

“The starting point of all achievements is desire.” - Napoleon Hill

“Success is how high you bounce when you hit bottom.” - George S. Paton

“ Always be yourself, express yourself, have faith in yourself, do not go out and look for a successful personality and duplicate it.” - Bruce Lee

“ Success is not the key to happiness. Happiness is the key to success. If you love what you are doing, you will be successful.” - Albert Schweitzer

“ Do aim for success if you want it; just do what you love and believe in, and it will be come naturally.” - David Frost

“ Try not to become a man of success, but rather try to become a man of value”
- Albert Einstein

“ Success consists of going from failure to failure without loss of enthusiasm.”
- Winston Churchill

“ All you need in this life is ignorance and confidence, and then success is sure”
- Mark Twain

“ A successful man is one who can lay a firm foundation with the bricks others have thrown at him”
- David Brinkley

“ Happiness lies in the joy of achievement and the thrill of the creative effort.”
- Franklin D. Roosevelt

“ If everyone is moving forward together, then success takes cares of itself.”
- Henry Ford

“ The difference between a successful person and others is not a lack of strength, not a lack of knowledge, but rather a lack of will.”
- Vince Lombardi

“ Success is finding satisfaction in giving a little more than you take.”
- Christopher Reeve

“ When love and skill work together, expect a masterpiece.” - John Ruskin

“ Success is a lousy teacher. It seduces smart people into thinking they can’t lose.”
- Bill Gates

“ Success depends upon previous preparation, and without such preparation there is sure to be failure.”
– Confucius

“ Success is to be measured not so much by the position that one has reached in life as by the obstacles which he has overcome. “
- Brooker T. Washington

“ Success is nothing more than a few simple disciplines, practiced every day.”
- Jim Rohn

“ There is only one success – to be able to spend your life in your own way.”
- Christopher Morley

“ Success isn’t measured by your money or power or social rank. Success is measured by your disciplines and inner peace.” - Mike Ditka

“ Success is a science; if you have the conditions, you get the results.”
- Oscar Wilde

“Action is the foundational key to all success.”
– Pablo Picasso

“ Success is simple. Do what’s right, the right way, at the right time. “

“ I’ve failed over and over again in my life and that is why I succeed. “
- Michael Jordan

“ Success comes from knowing that you did your best to become the best that you are capable of becoming.”
- John Wooden

“ Most people give up just when they’re about to achieve success. They quit on the one-yard line. They give up at the last minute of the game, one foot from a winning touchdown. “
– Ross Perot

“ Always bear in mind that your own resolution to succeed is more important than any other.” - Abraham Lincoln

“ Success is dependent on effort” - Sophocles

“ The ladder of success is best climbed by stepping on the rungs of opportunity”
- Ayn Rand

“ It is no use saying, ‘we are doing our best.’ You have got to succeed in doing what is necessary. – Winston Churchill

“ Strive not to be a success, but rather to be of value”
- Albert Einstein

“ Success is not forever and failure isn’t fatal” - Don Shula

“ Success is achieved and maintained by those who try and keep trying”
- W. Clement Stone

“ Eighty Percent of success is showing up” - Woody Allen

“ Success is a state of mind. If you want success, start thinking of yourself as a success.” – Joyce Brothers

“ Education is the most powerful weapon you can use to change the world” – Nelson Mandela

“ The roots of education are bitter, but the fruit is sweet” - Aristotle

“ Education is not preparation for life; education is life itself” - John Dempsey

“ Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime” – Maimonides

“ An investment in knowledge pays the best interest” - Benjamin Franklin

“ Develop a passion for learning. If you do, you will never cease to grow”
- Anthony J. D’angelo

“ Today knowledge has power. It controls access to opportunity and advancement”
- Peter Drucker

“ If you want to be successful you need to be hungry”
- Les Brown

“Desire is the key to motivation, but its determination and commitment to an unrelenting pursuit of your goal - a commitment to excellence - that will enable you to attain the success you seek.”
- Mario Andretti

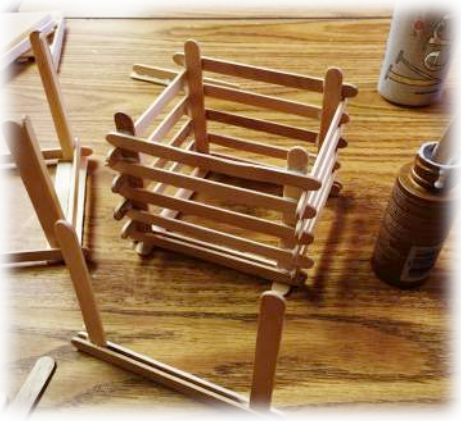
“Ability is what you're capable of doing. Motivation determines what you do. Attitude determines how well you do it.”
- Lou Holtz

“I'll always use the negativity as more motivation to work even harder and become even stronger.”
- Tim Tebow

“Believe you can and you’re halfway there”
- Theodore Roosevelt

“A #2 pencil and a dream can take you anywhere”
- Joyce Meyer

# TOWER PROJECT



**Purpose:** Evaluating student's ability to utilize the engineering design method while working in groups of 4-5. The students will use the their basic knowledge of engineering equations to built a tower that will stand real life scenarios such as earthquakes, wind, and load.

## Materials per Group

- 30 Popsicle sticks
- 1 piece of 12'' by 12'' Cardboard
- 1 bottle of glue

## Project Restriction:

- 5'' height (least)
- Used only 30 Popsicle sticks
- Used glue only

## Testing Scenarios

- Withstand a wind test
  - Using a spring scale
- Withstand a certain amount of weight
  - A Stapler
  - A granite block
- Withstand an Earthquake test
  - Mr. Brown shaking machine

*** As an Engineer you guys always want to analyze the positive aspect of the project and the negatives. As always there is room for improvement so within your group using a blank piece of paper make three columns. In the first column list what worked well within the group. In the second list your opinions on what could be improve for the next projects. In the third Column list what didn't work well within the team or project.**

# SPACE SHUTTLE PROJECT

**PURPOSE:** Using Legos students will build a space shuttle capable of retrieving robots found on the moon on a previous mission. Students will be able to apply knowledge about the engineering design method to come up with good designs after performing some research on the needs of the spacecraft. In groups of 3-4 students will gather ideas on an overall design for the spacecraft,

**Directions**: In the give groups

- Define the Problem
  - In your group define the problem or problems to tackle
- Research the problem
  - How have people achieved traveling to the moon in the past
  - What implications do you guys have account for during the design process
- Brainstorm Ideas
  - Used existing mechanism for ideas (Excavation tools, removal, and lifting)
  - How much space will be needed for the spacecraft
  - What tools will your group bring to the moon
  - How much fuel with you the spacecraft need for lift
- Choose the best solutions
  - Draw a design of the model
- Build a model or prototype using Legos
- Explain to the Class how the spacecraft will operate
  - Explain why the team choose the design
  - Provide the class with overall details on how the spacecraft will operate

## Tasks:

- Built a spacecraft capable of transporting robots back to Earth
- Ability to carry machines to excavate
- Ability to lift or pull objects
- Provide oxygen and living conditions for astronauts

**Note: Limited amount of Legos will not be giving to groups unless provided with a full design and details of the components of the spacecraft. Groups should demonstrate understanding and application of steps 1 through 5 of the engineering design method.**

# Balloon Rocket Lab

## Materials:

- 1 balloon (round ones will work, but the longer "airship" balloons work best)
- 1 long piece of kite string (about 10-15 feet long)
- 1 plastic straw
- Tape

**Procedure:**

1. Using the materials available, design and construct a balloon rocket.

2. Blow up the balloon and clamp it shut with the clothespin again.

3. Thread the string through the drinking straw. Tape the long side of the balloon along the length of the straw.

4. Make sure the string is stretched tight.

5. Slide the balloon-straw system down the string until the clamped end reaches the end of the string. (The side that is taped)

6. Release the clothespin. Record your observations. Complete at least 4 trials and record.

7. Blow up the balloon and repeat steps 5 and 6 but this time only fill the balloon half full of air. Repeat 4 times and record your data in the data table

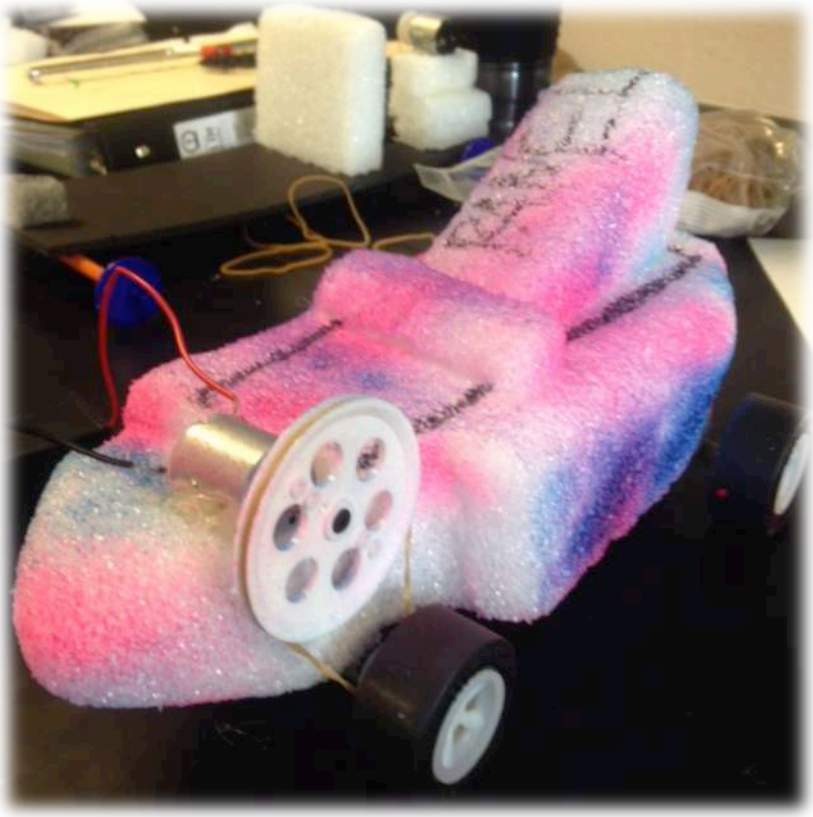
8. Calculate average distance traveled and average speeds for each test in the table below.

9. Answer the conclusion questions after you have completed the data table.

# Data Table

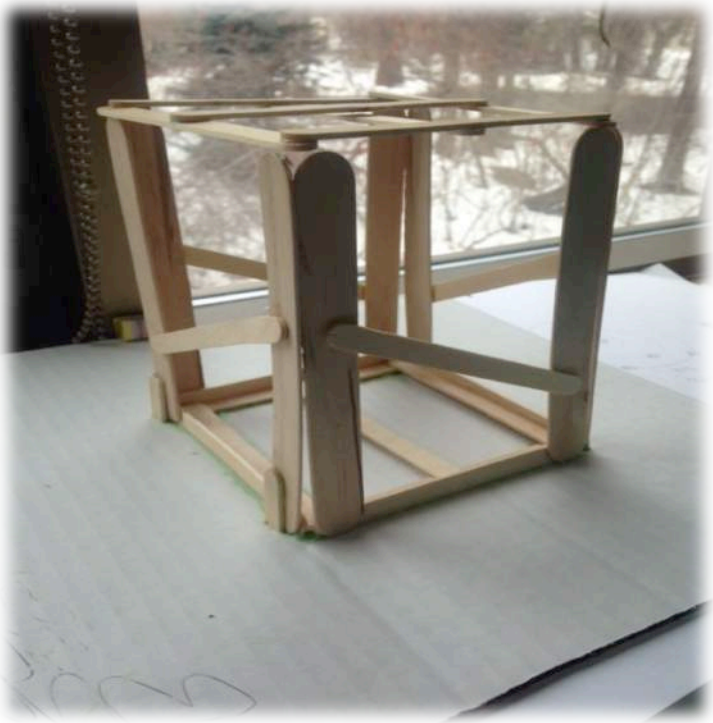
| Trial | Distance Traveled (m) | Time (s) | Average Speed |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| Trial | Distance Traveled (m) | Time (s) | Average Speed |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

1. What force is propelling the rocket?
2. **What was the average velocity of your rocket?**
3. What is the escape velocity of your rocket?
4. **What other forces were acting on you balloon rocket?**
5. What happened when the amount of force (amount of air in the balloon) was changed?
6. **What other forces were acting on your balloon rocket?**
7. What happened when the amount of force (amount of air in the balloon) was changed?
8. How did your results compare to other students designs?
9. How might you modify your design to make it travel further and faster?
10. **What does this lab demonstrate?**



**Solar Car Built By Abraham, Juan, Reece**

**Solar Car Built By Corey, Josh, James**



**Tower Built By Marisabella, Maria, Mahainee**

**Built by Nijola's team**

**Lesson Plan 1 For Engineering Unit**

B Day
March 3, 2015

-Ask for feedback after each lecture!

Page 1

Intro to Engineering Principles.

Activator: Who was Isaac Newton?
Difference between Engineering and Science

Motivation: "Our greatest weakness lies in giving up. The most certain way to succeed is always to try just one more time"
Thomas A. Edison.

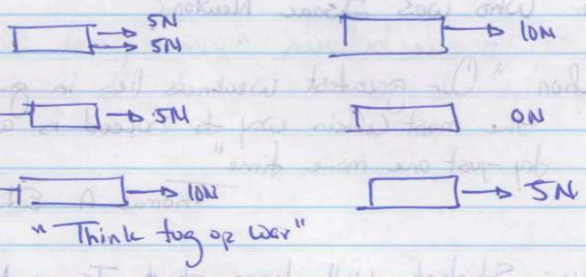
Objective: Students will learn about Isaac Newton laws and learn how to approach word problems.

Development of lesson:
Introduce Newton's laws
1) Every material object continues in its state of rest, or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it.
Simplify: An object in motion will remain in motion unless it experiences an opposing force.

2) The overall acceleration of an object is directly proportional to the net force acting on the object, is in the direction of the net force, and is inversely proportional to the mass of the object.
basically: $a = \frac{\Sigma F}{m}$ if F increases,

Explaining Net force.

Applied forces | Net force




Forces is a Vector Quantity
↳ Invokes both magnitude (amount) and direction fully by

Scalar Quantity: fully describe a magnitude alone (numerical value)

Law #3: Whenever one object excerts a force on a second object, the second object excerts an equal and opposite force on the first
"for every action there is an equal and opposite reaction".

Examples: 1) Dropping a ball.. What happens when the ball hits the ground?

2) Man pulling on a spring.. What is the spring natural states compressed or uncompressed? (use rubber band!)

3) Friction is a good Example.. Why??

# Intro to Engineering Principles

## Testing your knowledge...

1) A cart is pulled to the left with a force of 100 N and to the right w/ a force of 30N. What is the net force on the cart.

2) Why do we say that force is a Vector quantity?

## Newton's third law.

1) Consider hitting a baseball w/ a bat. if we call the force on the bat the action force, identify the reaction force.

## Mass vs Weight

Mass: [kg] → The quantity of matter in an object.
More specifically, it is the measurement of the inertia or sluggish that an object exhibits in response to any effort made to start it up.

Weight - The force upon an object due to gravity

Would your weight change or be any different if you were to be standing on the moon?

When acceleration is g - free fall.
→ When air resistance and the like are negligible - we say that the object is in a State of free fall.
→ The "a" of free fall is independent of weight

When Acceleration is less than g - non-free fall.
As a falling object gains Speed, the force of air resistance finally builds up until it equals the weight of the falling object. The net force becomes Zero and the object no longer Accelerates. it falls at Constant Speed. When Acc. is terminate, we say the object has reached its terminal Speed

Concerned w/ directions, down for falling objects, we say the object has reached it terminal Velocity.

once another force acts upon an object it becomes non-free fall.

So why do Engineers Care about Forces?
- Measure weight on a Structure
- Provide proper support to a Structure
- Stress - force per unit Area
→ The ratio of applied force F and Cross Section

Tensile Force
10N ← → 10N

Compressive force

Shear Force

glue

Does it mind you of formation of mountains / plate tectonics
Divergent Boundaries

Tensile Stress - Stress that tends to stretch or lengthen the material - acts normal to the Stressed area

Compressive Stress - Stress that tends to Compress or Shorten the material - acts normal to the Stressed Area.

Shearing Stress - Stress that tends to Shear the material - acts in plane to the stressed are at right angles to Compresive and tensile stress

Tensile or Compressive Stress - Normal Stress

$\sigma = F_n / A$

$\sigma$ = normal stress (Pa) $N/m^2$, psi)
$F_n$ = Normal Component (N, lb,
A = Area ($m^2$, $in^2$)

Example: A force of 10 kN is acting on a Circular rod w/ diameter 10mm The Stress in the rod Can be Calculated as....

$\sigma = (10 \times 10^3 N) / [\pi ((10 \times 10^{-3} m)/2)^2]$
$= 127.3885535 \ (N/m^2)$
$\sigma = 127 \ (MPA)$

Shear Stress - Stress parallel to the plane.

$\tau = F_p / A$

$\tau$ = Shear stress (PA), $N/m^2$, psi)
$F_p$ = Parallel Component (N)
A = Area ($m^2$, $in^2$)

Strain = deformation of a solid due to stress and can be Expressed as

$\varepsilon = dl / l_0$

$= \sigma / E$

$dl$ = change of length (m, in)
$l_0$ = initial length.
$\varepsilon$ = Unit less measure of engineering strain
$E$ = Young's modulus Can be use to predict the elongation or Compression of an object

Example of Stress and change in length.

The rod in the Example above is 2m long and made of Steel w/ Modulus of elasticity 200 GPA. The change in length is?

$dl = \sigma l_0 / E$ $\quad \varepsilon = dl / l_0 = \frac{\sigma}{E}$

$dl = \frac{l_0 \sigma}{E}$

$= (127 \cdot 10^6 \text{ Pa})(2\text{m}) / (200 \times 10^9 \text{ Pa})$

$= 0.00127\text{m}$

$dl = 1.27\text{mm}$

**Lesson Plan 2 For Engineering Unit**

Engineering principles 3/4/15 D-Day Yellow - Red.

Activator: Is Speed a Vector or Scalar?
is Velocity a Vector or Scalar? why?

Motivation: "In order to Succeed, we must first believe that we can" Nikos Kazantzakis.

Objective: Students will learn about displacement, Velocity, and Acceleration

Development of lesson:
- Giving Velocity Another Shot!
- Introduce displacement, Speed, Velocity, Acceleration

What is displacement?
= Displacement is also known as distance
- Unless otherwise Specified, displacement is defined along a straight line

Example: We might say that Minneapolis, minesota is 100km from from Rochester, minesota along a straight line.

However if you take route 52 displacement would turn out to be closer to 120 km because this highway does not follow a straight path from Rochester to Minesota.

Displacement As a Vector?
When describe in a straight line, it is a Vector quantity because it has both magnitude (expressed in meters, km, or other distance units) and direction (which can be defined in various ways)
- Displacement magnitude is expressed in lowercase d.
- Displacement Vector is denoted by a ~~bold~~ lowercase boldface letter d!

So... The displacement Vector from of Minneapolis relative to rochester would be approximately 100km in the northwesterly direction

But if rate 52 is taken so displacement is denoted as a Scalar. The direction of displacement is constantly changing.
So in this case displacement is $\approx$ 120km.

How is displacement determined? Magnitude is determined by mechanically measuring distance or by inferring it w/ observations and mathematical calculations

How do your parents know how far is your aunt house using the car? with the odometer

↳ Counts the number of wheel rotations and multiplies this by the Circumference of the wheel.

How would you guys measured in a lab?

w/ a meter stick, by triangulation, or by measuring the how it takes for a ray of light to travel between two points given the constancy of the Speed of light

$C = 2.99 \times 10^8$ m/s

What's Speed?

Speed is an expression of the rate at which an object moves relative to some defined reference point of view

- The referenced frame is Consider Stationary.

**Speed is a Scalar**

- Standard Unit of Speed is the meter per second (m/s)

Speed can, of course, change the time, if you hit the brakes to avoid a deer Crossing the road, your Speed will decrease Suddenly.

How is Speed determine

$d = V_{avg} t$ , $V_{avg} = d/t$

$t = d/V_{avg}$

Example:

1) Sliding a ruler/Lego on the table...

2)

- Play demo w/ Cars

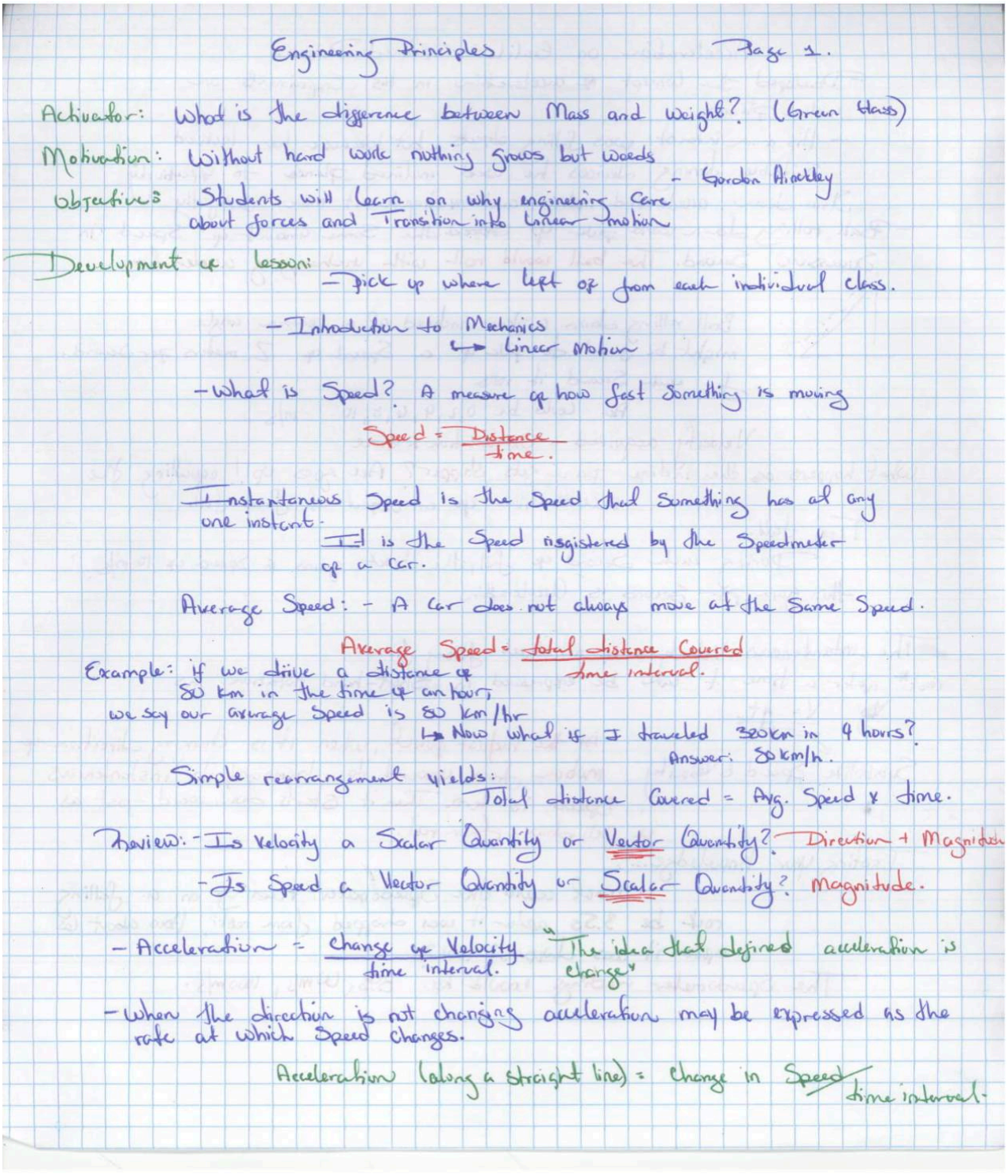
Set up.

Three Columns "Displacement, time Velocity

→ three trials

→ Three Scenarios Soft push, medium, moderate.

**Lesson Plan 3 For Engineering Unit**



Engineering Principles Page 1.

Activator: What is the difference between Mass and weight? (Green Hass)

Motivation: Without hard work nothing grows but weeds - Gordon Ainsley

Objectives: Students will learn on why engineering care about forces and Transition into linear motion

Development of lesson:

- Pick up where left of from each individual class.
- Introduction to Mechanics
  - ↳ Linear Motion
- What is Speed? A measure of how fast something is moving

Speed = Distance / time.

Instantaneous Speed is the Speed that something has at any one instant.

It is the Speed registered by the Speedmeter of a car.

Average Speed: - A car does not always move at the Same Speed.

Average Speed = total distance Covered / time interval.

Example: if we drive a distance of 80 km in the time of an hour, we say our average Speed is 80 km/hr

↳ Now what if I traveled 320km in 4 hours? Answer: 80 km/h.

Simple rearrangement yields:

Total distance Covered = Avg. Speed x time.

Review: - Is Velocity a Scalar Quantity or Vector Quantity? Direction + Magnitude

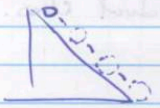
- Is Speed a Vector Quantity or Scalar Quantity? Magnitude.

- Acceleration = change of Velocity / time interval. "The idea that defined acceleration is change"
- When the direction is not changing acceleration may be expressed as the rate at which Speed changes.

Acceleration (along a straight line) = change in Speed / time interval.

## Acceleration on Galileo's inclined Planes.

- Developed the concept of acceleration in his Experiments on incline planes
  - His main interest was falling objects, but because he lacked suitable timing devices he used inclined planes to effectively slow down accelerated motion and investigate it more carefully.
- Ball rolling down would pick up speed the same amount of speed in successive second. The ball would roll with unchanging acceleration.



Ball rolling down a plane inclined at a certain angle might be found to pick up a speed of 2 meters per second. for each second it rolls.

Acc could be 0, 2, 4, 6, 8, 10 ... m/s

Velocity acquired = Acceleration x time

What happens as the incline plane gets steeper? Acc goes up!! equalling the acceleration of an object at free fall.

Free fall.

During each second of fall, the object gains a speed of 10 m/s. this gain per second is Acceleration

The instantaneous Velocity v of an object falling from rest* after a time t can be expressed in short-hand notation as

$V = gt$.

Symbolize Speed & Velocity

At the highest point, when it is changing direction of motion from upward to downward, its instantaneous speed is zero. Then it starts downward just as if fell down from rest.

Testing your knowledge....

What would the Speedometer reading on a falling rock be 3.5s after it was dropped from rest? How about 6s after it was dropped? 100s?

The Speedometer readings would be 35m/s, 60 m/s, 1000 m/s.

## Lesson Plan Revised by Mr. Surette

FOREST GROVE MIDDLE SCHOOL
**LESSON PLAN**

**Student Teacher: Hector Rivas** **Discipline: General Science**
**Approved By: Michael Surette**

**Week of: 6/8/2015**

**WEEKLY OBJECTIVES:**

**MA CURRICULUM FRAMEWORKS:**

- Compare and contrast properties and conditions of objects in the solar system (i.e., sun, planets, and moons) to those on Earth (i.e., gravitational force, distance from the sun, speed, movement, temperature, and atmospheric conditions).
- Recognize that heat is a form of energy and that temperature change results from adding or taking away heat from a system.
- Explain the relationship among the energy provided by the sun, the global patterns of atmospheric movement, and the temperature differences among water, land, and atmosphere.

**MA LITERACY FRAMEWORKS:**

- Engaging instructional strategies which accommodate a variety of learning styles;
- Vertically aligned academic vocabulary.

**ESSENTIAL QUESTIONS:**

- What are the geocentric and heliocentric systems?
- How did Copernicus, Kepler, and Galileo contribute to our knowledge of our solar system?
- What objects make up the solar system?

**ASSESSMENTS:**

**Formative: Cold Calling, Group Discussion.**

**Summative: Take home assignments and post-presentation evaluation.**

---

**EVIDENCE BASED BEST PRACTICES**:

| **EBBP:** | DEFINITION: | EXAMPLES: | WHAT I AM DOING: |
|---|---|---|---|
| **Gradual Release of Responsibility** | I Do, We Do, You Do Together, You Do Alone | Modeling-Scaffolding-Group Work, Partners-Assessment | Peer reading, flash card games. |
| **Academic Vocab** | Cross Content Vocab and Transition Words | Questions-Prompts-Objectives | Comprehending vocabulary. Making connections within the text. |
| **Writing** | Write to Learn; Public Writing | Questions; Paragraphs; Notes; Essays; Labs; Research Paper. | Reflective writing based on classroom discussion and presentation. |
| **Formative Assessments** | Assessment used to inform instruction | Bell work; Exit Slips; Dip-Sticking; Cold Calling; Discussion; Classwork, etc. | Cold Calling, Groups Discussion. |

**READING ACTIVITIES:**
**Peer reading, home reading. Making connections between key concepts and vocabulary.**

**Solar Car PowerPoint Slides**

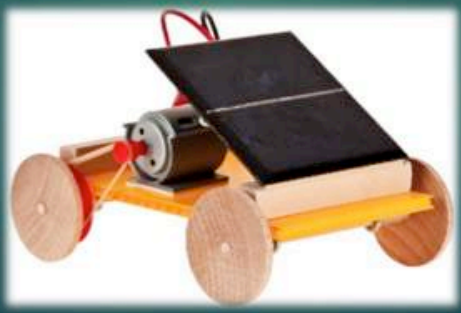
## Bell Work

How is design different than problem Solving?

- Thinking about the tower project. Did you handle it differently than how you normally handle a math or science word problem?

## Building a Solar Car

STUDENT TEACHER: HECTOR RIVAS



# Motivation

- Do you want to know who you are? Don't ask. Act! Action will delineate and define you.

- Thomas Jefferson

# Engineering Design Process

- Remember the Design Process

Step 1: Identify the need or problem

Step 2: Research the problem

- Examine the current state of the problem and current solutions. You don't have to start from scratch, sometimes engineers are able to build/expand current design to meet their needs.

-Use resources such as internet, library, interviews

Step 3: Develop Possible Solutions

-Brainstorm possible solution (s)

-Articulate the possible solution in two and three dimensions

-Refine the possible solution

# Engineering Design Process

- Step 4: Select the best possible solution
  - Keep in mind the constraints
  - -Establish requirements (function specs)
  - -Determine solution best meet the original need or solve the original problem
- Step 5: Construct a prototype
  - -Model the selected solution (s) in two or three dimension
- Step 6: Test and Evaluate the solution (s)
  - -Does it work ?
  - -Does it meet the original design constraints?

# Engineering Design Process

- Step 7: Communicate the solution
  - -Make an engineering presentation that includes a discussion on how the solution best meets (s) the initial need or the problem
- Step 8: Redesign
  - -Using feedback from presentation and tests to improve on the solution found

# Components to build the car

- Chassis
- Wheels
- Power Source
- Transmission
- Body shell

# Chassis

- Purpose
  - The car's chassis is its frame. It holds all the of the cars' main parts together

How else it is useful?

- Could be use for electricity purpose, to ground the rear lights so the manufacturer does not have to run a cable through the entire car

Weight and stiffness:

- YOU DO NOT want your car too heavy.. Why?

It is easier for a motor to push a light car than a heavy one.

- In solar cars, efficiency is very important, and you don't want to waste energy

# Chassis

- CAUTION : A light car can easily be pushed by the wind!
  - Even if the wind does not blow the car over, it may make it harder to go in a straight line (This depends not only on the weight, but on where the weight is, and the shape of the body, too)
- Materials
  - Cardboard, Balsa wood, Styrofoam, and foam core
- Difference between stiff and strong?
  - Strong means it will not break easily, while stiff means it will not bend easily
  - For a solar car, which is more important strength or stiffness?

# Chassis

- Does shape matter?
  - Yes it could help a material that is not stiff become more stiff
- Experiment (Demo)
  - Place two books on the science table
  - Now place a piece of paper across each book
  - What happens?
  - Now try the same experiment but this time fold the paper in a "U" shape and put it back across the books.
  - Now what happens?

# Chassis

- How about orientation? Does it matter?
  - Yes, examining the previous example. It is noticeable on how changing the orientation of the paper edges affected it stiffness
- Example (Demo)
  - Use a popsicle stick
- Bend it applying force to the thinness way, now do the same but apply the same force across the thickest direction

# Chassis Takeaway

- Remember to be smart about you material selection, as well as the importance of shape and orientation of the materials. By doing this you will have more control over the weight of your solar car

# Tradeoff for Cars

- Different between a Lamborghini vs Subaru 2013 ?
  - Fuel Efficiency:
    - In sports Car, performance and speed are VERY important
  - When designer use larger engine for greater performance,

They have to sacrifice usually fuel efficiency

- City cars, the fuel efficiency is must important so the

designer decides which goals are more important

To meet!

Engine Sound

Remember for the tower project

You decided all the dimensions and shapes of the tower

# Wheels and Bearings

- Purpose:
  - Wheels support the chassis and allow the car to roll forward.

Bearings support the wheel while allowing them to rotate

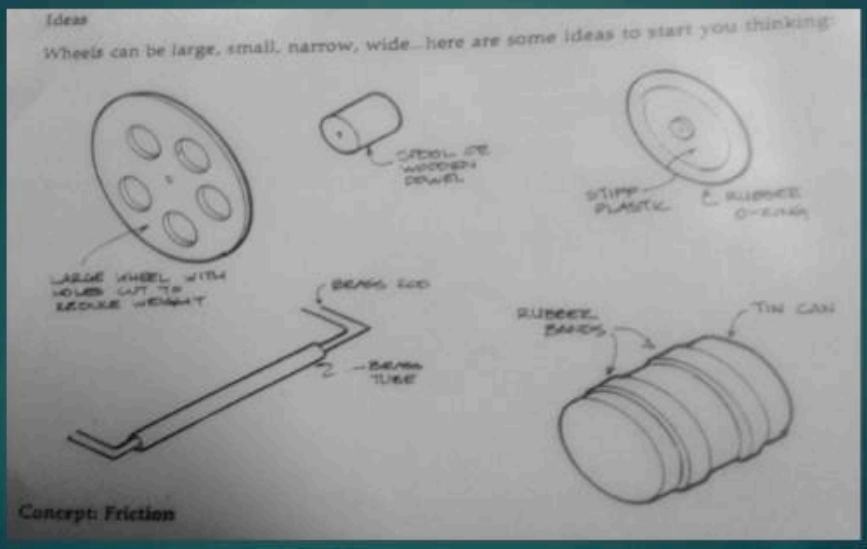
Design Consideration:

- Size: large, small, narrow, wide
- How to reduce the weight of the wheels?
- How to fight friction?
  - Friction keeps things from sliding against each other. While building your cars, there are some parts that you will want to slide easily, and there are other parts you don't want to slide at all.

# Friction

- Friction = μmg
  - $\mu$ = coefficient of friction
    $\mu_k$ = coefficient of kinetic friction
    $\mu_s$ = coefficient of static friction
- Which is harder to make a box start sliding on the ground or to keep it sliding?
- What's the difference between kinetic and static friction?
  - Static = stationary object. Thus static friction must be overcome
  In order to move and object. While kinetic is the friction that exist
  As the object is undergoing motion
  Think about it!!!
  Both the object surface and the floor are still in contact as it's being
  Move from one side of the room to another.

# Wheel Ideas

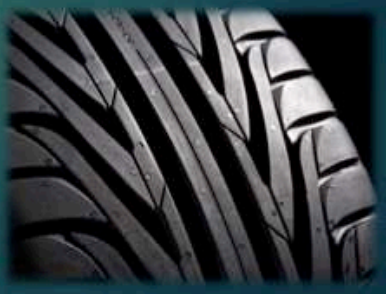


# Tire Traction

- **Traction** is the resistance between the tire and the ground in reaction to torque being exerted by the wheel axle under engine power

- Difference between treaded tires and slick?
  - **Tread** acts to channel water off to the sides, away from the tire center. In mud or snow, deep treaded tires act almost like a gear, locking onto loose material instead of sliding over it like a typical tire would.

  - **Slick** They often lack any type of tread pattern at all. These smooth-surfaced tires, Their advantage is that they provide tremendous traction. The downside is that they wear out so quickly that they have to be replaced for every race, if not more often



# Tire traction

- Mountain Bike Vs a Racing Bike
  - Mountain bike have big,fat, knobby tires, why ?
    - Knobs of rubber are used to grip onto the dirt or rocks which keep the tiresd from slipping on the ground
    - The thickness of the tire matters in mountain bike so the material can take the abuse from the trail!
- So, why don't racing bicycles have fat , knobbing tires if these wheels have good traction ?
  - Remember that there are always tradeoffs in the designing the wheel!

Mountain bike tires disadvantage

1. Knobby rubber which provides lots of traction makes them inefficient (why?)
2. The tires weight
   1. Weight in the tires is actually more difficult to move than weight in the chassis

# Tire traction Continued

- Racing Bicycles
  - DO NOT have the same type of tires because traction is not as important. (Tradeoff)
  - Efficiency is more important, so that the bicyclist does not need to expand a lot of energy

# Weight distribution and traction

- Trouble in car wheel:
  - The rear wheels on your solar car are slipping! Your partner makes the suggestion to add some rubber bands around the wheels to increase traction, and you agree.
- But……. The wheels are still slipping. Your other partner suggest adding weight to the car. Placing the weigh exactly in the middle
- But… it doesn't work again. What can you do ?
  - Move the existing weight, and now it works. To what position would you move the weight?

# Speed Vs. Force

- Direct Drive
  - Simple Transmission: Motor is connected directly to the axle of the driven wheel. Direct drives are not common in vehicles
  - Unicycle is one of the few vehicles that uses *direct drive*
    - Every time your feet make one revolution, the front wheel makes one revolution
- Testing your understanding!
  - Imagine two of your neighbors have a unicycle
    - Bruce's unicycle has a regular wheel of diameter 5 , and Karen's wheel has twice the diameter. If Both of them pedal at the same rate, which one of them will win?
- If the person who lost in the previous scenario wants to win, what must they do in order to accomplish it?

# Combinations on Engines

Combo 1


Combo 2


Combo 3

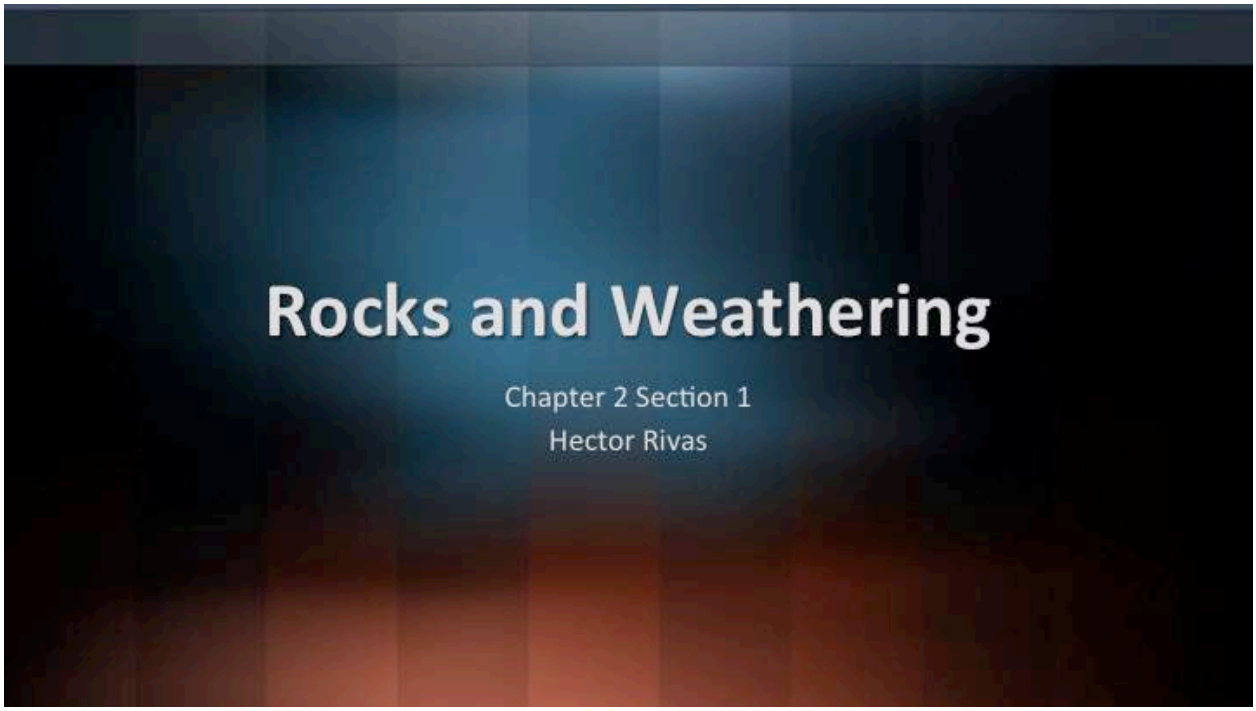

- For every full rotation of wheel one, wheel two would have completed a full rotation as well
- Would both wheel undergo a complete cycle at the same time?
- How is the speed of wheel 2 affect as the wheel is reduced in size?

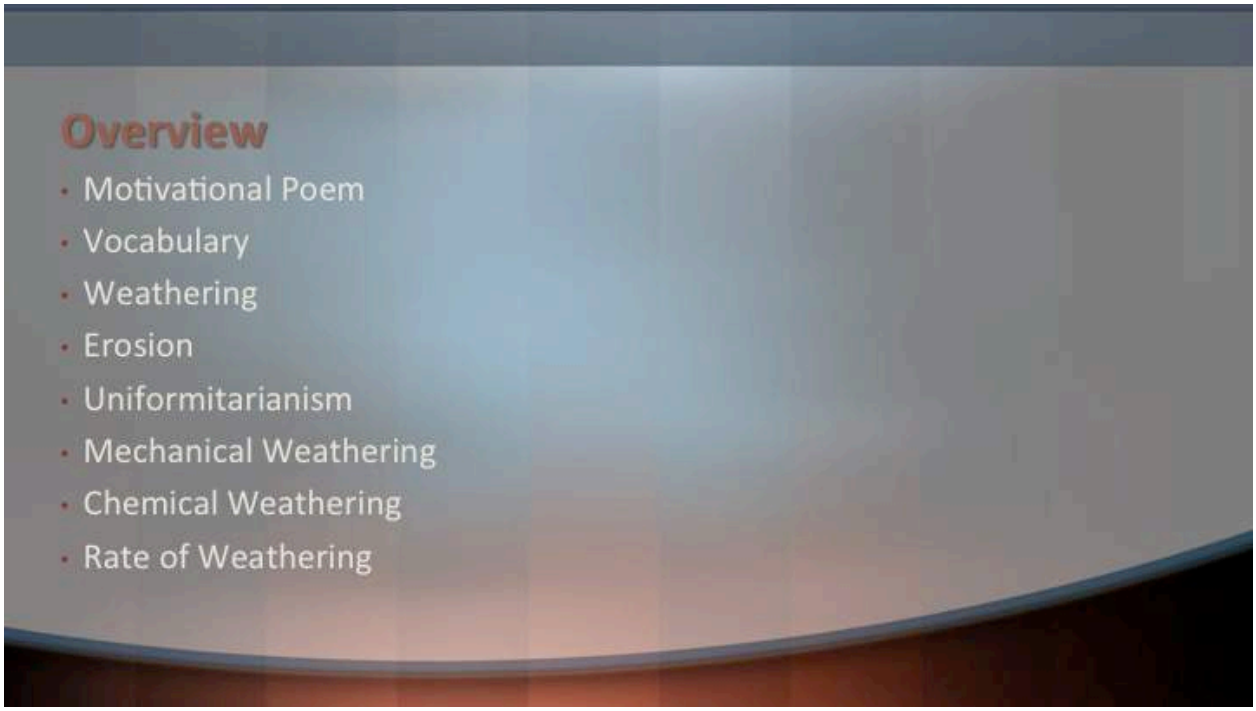
# Gears

- Similar to pulleys in that their motion is usually circular and continuous
  - Advantage or pulleys. They cannot slip!
- They transmit rotary motion. They increase or decrease the speed , Change the direction of motion, and transmit a force
- Torque = Effort X R [ N*M]
  R = A distance from the of the nut
- Gears are used in groups of two or more. A group of gears is called a *gear train*

# Questions ?

**Lesson On Erosion and Rocks Slides**



## Motivation

When things go wrong, as they sometimes will,
When the road you're trudging seems all uphill,
When the funds are low and the debts are high,
And you want to smile, but you have to sigh,
When care is pressing you down a bit-
Rest if you must, but don't you quit.
Life is queer with its twists and turns,

As every one of us sometimes learns,
And many a fellow turns about
When he might have won had he stuck it out.
Don't give up though the pace seems slow -
You may succeed with another blow.
Often the goal is nearer than

.

It seems to a faint and faltering man;
Often the struggler has given up
When he might have captured the victor's cup;
And he learned too late when the night came down,
How close he was to the golden crown.
Success is failure turned inside out -

The silver tint in the clouds of doubt,
And you never can tell how close you are,
It might be near when it seems afar;
So stick to the fight when you're hardest hit -
It's when things seem worst that you must not quit.


## Vocabulary

- Weathering
- Erosion
- Uniformitarianism
- Mechanical weathering
- Abrasion
- Ice wedging
- Chemical weathering
- Oxidation
- Permeable

## Weathering

- The process that breaks down the rock and other substances at Earth's surface
  - The forces of weathering break rocks down into smaller and smaller pieces
- Examples:
  - Heat
  - Cold
  - Water
  - Ice

Weathering = Breaking down

## Erosion

- Removal of soil and rock from one location on the Earth's crust, then transport it to another location where it is deposited

Erosion = Take away

- Note! Weathering and Erosion work together continuously to wear down and carry away the rocks at the Earth's surface.

## Uniformitarianism

- The theory that changes in the earth's crust during geological history have resulted from the action of continuous and uniform processes
- Simple terms: The same processes that operate today operated in the past

## Mechanical Weathering

- Any of the various weathering processes that cause physical disintegration of exposed rock without any change in the chemical composition of the rock.
  - Example: If two rocks were to collide with each other. One of them if not both would break into small pieces. The small pieces of each rock have the same composition as the rock they came from.
- Causes of Mechanical Weathering
  - Freezing and thawing**
  - Release of pressure
  - Plant growth
  - Actions of animals
  - Abrasion
    - Refers to the grinding away of rock by rock particles carried by water, ice, wind, or gravity
- Open Book to Page 40.

## Chemical Weathering

- The process that break downs rocks through the chemical changes.
- Causes of Chemical Weathering
  - Action of Water
  - Oxygen
  - Carbon Dioxide
  - Living organisms
  - Acid Rain

## Chemical Weathering continued..

- Each rock is made up of one or more minerals. Chemical weathering can produce new minerals as it breaks down rock.
  - Example: Granite is made of many minerals as it breaks down rock, including feldspar, quartz, and MICA!
- Water
  - Most important cause of chemical weathering.
  - Water weather rock by dissolving it. When a rock or other substance dissolves in water, it mixes uniformly throughout the water to make a solution. (Overtime many rocks will dissolve in water)
- Oxygen
  - The oxygen gas in air is an important cause of chemical weathering.
    - Have you ever left your bicycle outside of the house? What happens to the bicycle overtime?
- Rocks that contain iron also oxidizes, or rusts. Rust make rock soft and crumbly and gives it a red or brown color

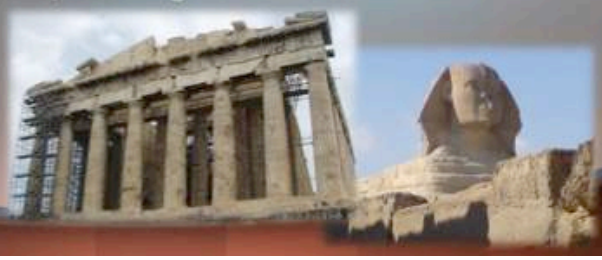
## Chemical Weathering continued..

- Carbon Dioxide
  - Another gas found in the air, which also causes chemical weathering
  - Carbonic Acid is the result of carbon dioxide dissolving in rainwater or water that sinks through the air pockets in the soil. Carbonic acid will dissolve minerals from a rock body leaving cavities in the rock. These cavities may generate sinkholes or cave features such as stalactites and stalagmites.

- Living Organisms
  - Book example: Imagine a seed landing on a rock face. As it sprouts, its roots push into the cracks in the rock. As the plant's roots grow, they will produce weak acids that slowly dissolve rock around the roots

## Chemical Weathering continued..

- Acid Rain
  - Over the years people companies have been burning large amounts of coal, oil, and gas for energy. Burning these fuels can pollute the air with sulfur, carbon, and nitrogen compounds. These compounds react chemically with the water vapor in clouds, forming acids.



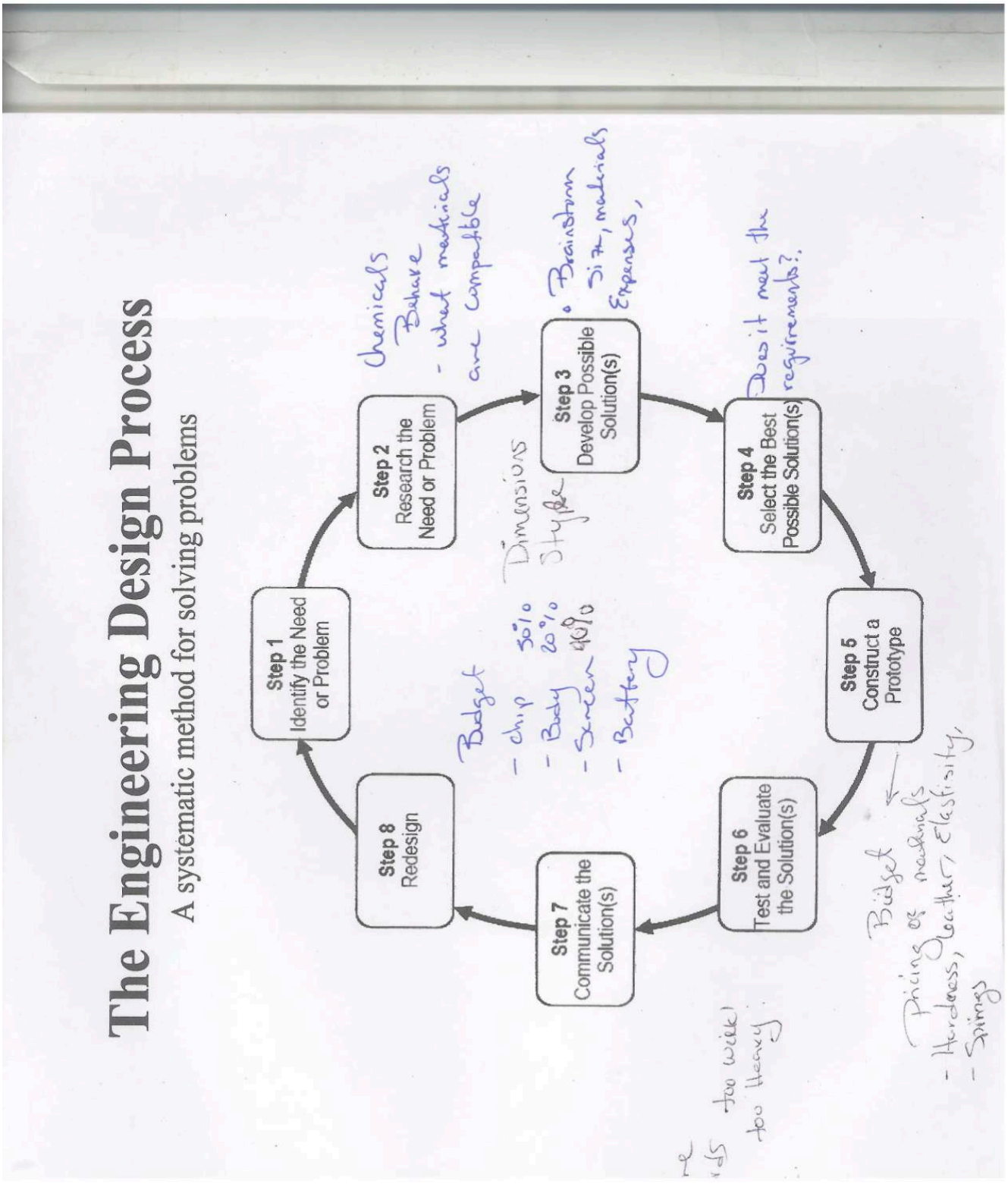
## Rate of Weathering

- The most important factors that determine the rate at which weathering occurs are the type of rock and the climate
- Type of rocks
  - Rock made of materials that do not dissolve easily in water weathers slowly
  - Rock made of materials that dissolve in water weather at a faster rate
  - Some rocks weather more easily because it is permeable
    - Permeable means having pores or openings that permit liquids or gases to pass through

    Permeable rock weathers chemically at a fast rate. Why ?
- Climate
  - Refers to the average weather conditions in an area. Both Chemical and mechanical weathering occur faster in wet climates
    - Rainfall provides the water needed for chemical changes as well as for freezing and thawing
    - Why do chemical reactions occur faster at high temperature?
- Check out figure 5 on page 45.
  - Can you see how different material properties contribute to the rate at which weathering can occur?

## Questions

**Details on the Engineering Design Process Used During Classroom**



State of matter
S → L → G → Plasma.
pp. 9-10

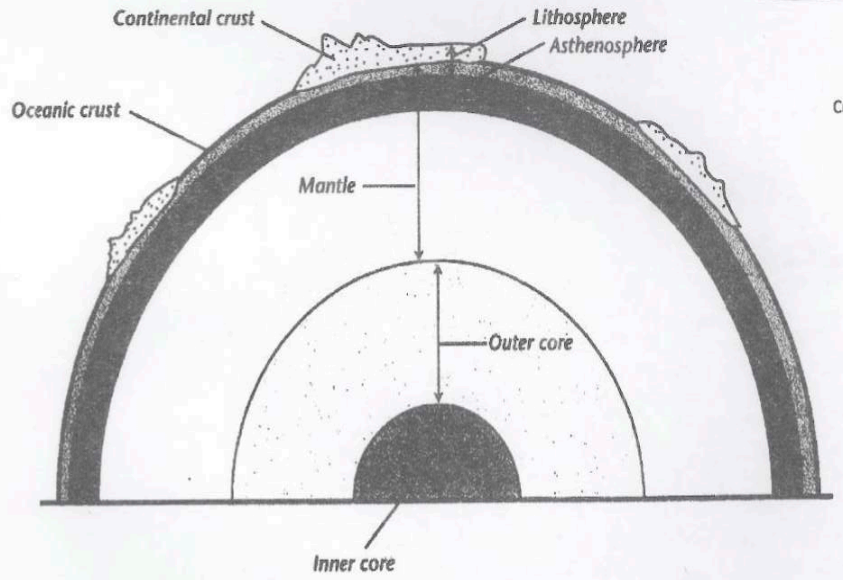
Hector Rivas

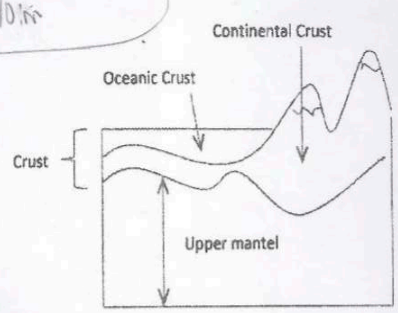
**Earth's Interior**

1 km = 1,000 m

1.4°C / 40 km

Conversion factor.




**KEY**

- ☐ Crust
- ☐ Mantle
- ☐ Outer Core
- ☐ Inner Core

| | Crust | Mantle | Outer Core | Inner Core |
|---|---|---|---|---|
| Pressure | Atmosphere Pressure | Small increase in Pressure | Moderate Pressure | Highest Pressure |
| Temperature | 1,750°C | 73,425°C | 139,075°C | 224,465°C |
| State of Matter | Solid Rock that includes both dryland and the ocean floor. | Rocks that are very hot but Solid | Liquid | Solid metal |
| Special Property | Basalt & Granite | thickess layer. | Enormous Pressure. | Pressure squeezes the atom of iron + nickel so much that they cannot Spread. |

**Homework/Classroom Work**

Name _____ Date _____ Class _____

Directed Reading for Content Mastery

## Key Terms
## Weathering and Erosion

Homework/ Classwork

**Directions:** *Draw a line to connect the term on the left to its description on the right.*

| | |
|---|---|
| 1. slump | mixture of weathered rock, organic matter, water, and air |
| 2. mechanical weathering | erosion caused by wind that can lower the land's surface |
| 3. runoff | gravity causing rock or sediment to move downhill |
| 4. soil | thick layers of loose sediment moving downhill along a curved surface |
| 5. mass movement | process in which composition of the rock changes |
| 6. creep | wearing away and removal of rock material |
| 7. topography | sediments moving slowly downhill due to freezing and thawing |
| 8. chemical weathering | breaks rocks into pieces without changing their composition |
| 9. erosion | erosion, caused by wind, that produces smooth, polished rocks |
| 10. deflation | surface features of land that influence type of soil |
| 11. abrasion | water that flows over Earth's surface |

Name _____ Date _____ Class _____

Directed Reading for Content Mastery

## Section 2 ▪ Erosion of Earth's Surface

**Directions:** *For each of the following, write the letter of the term or phrase that best completes the sentence.*

_____ 1. Erosion called mass movement is caused by _____.
**a.** wind **b.** gravity **c.** earthquakes **d.** runoff

_____ 2. The major result of heavy rains or melting snow and ice is _____.
**a.** abrasion **b.** creep **c.** valley glaciers **d.** mudflow

_____ 3. Sediment of different-sized particles left by ice from glaciers is called _____.
**a.** till **b.** outwash **c.** cirque **d.** slump

_____ 4. Small channels called _____ are cut into Earth's surface when sheets of water flow around obstacles and become deeper.
**a.** gullies **b.** sand bars **c.** rills **d.** deltas

_____ 5. _____ are the most important agent of erosion on Earth.
**a.** Winds **b.** Glaciers **c.** Sand dunes **d.** Streams

**Directions:** *Complete the paragraphs by filling in the blanks using the terms listed below.*

**mudflows** **rock** **gravity** **ice**
**glaciers** **mass movement** **erosion**
**rock slides** **water** **slump** **cirques**

6. _____ is the wearing away and removal of 7. _____ material. Erosion occurs because 8. _____, 9. _____, wind, and 10. _____ sculpt Earth's surface. Gravity causes different kinds of 11. _____ such as 12. _____, creep, and 13. _____. Gravity also causes 14. _____, layers of rock breaking loose and sliding down slopes.

In cold regions, snow can accumulate over many years to form huge masses of ice called 15. _____. They can remove rock from mountain tops, leaving depressions called 16. _____.

**Homework Worksheet**

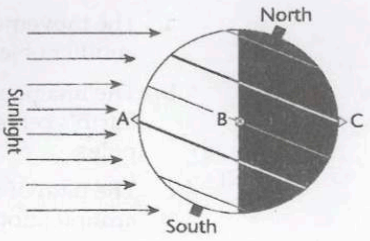
Name _____ Date _____ Class _____

Earth, Moon, and Sun • *Review and Reinforce*

# Earth in Space

## Understanding Main Ideas

*Use the following figure to answer questions 1 through 3. Write your answers on a separate sheet of paper.*




1. In the diagram, what season is it in North America?
2. Would a person at each of the points A, B, and C see the sun? If so, where would the sun be in the sky?
3. Which is a person standing at point B seeing, sunrise or sunset? Explain.

## Building Vocabulary

*Match each term with its definition by writing the letter of the correct definition in the right column on the line beside the term in the left column.*

| | |
|---|---|
| ____ 4. astronomy | a. The path of Earth as it revolves around the sun |
| ____ 5. axis | b. System of organizing time that defines the beginning, length, and divisions of a year |
| ____ 6. rotation | c. Line passing through Earth's center and poles |
| ____ 7. revolution | d. The study of the moon, stars, and other objects in space |
| ____ 8. orbit | e. The sun is farthest north or south of the equator at this time. |
| ____ 9. calendar | f. Movement of Earth around the sun |
| ____ 10. equinox | g. Movement of Earth around its axis |
| ____ 11. solstice | h. The noon sun is directly overhead at the equator at this time. |

Name _____ Date _____ Class _____



## Earth in Space *(continued)*

### How Earth Moves

*Match the term with its definition.*

| Term | Definition |
|---|---|
| ____ 2. axis | a. The movement of one object around another object |
| ____ 3. rotation | b. The imaginary line that passes through Earth's center and the North and South poles |
| ____ 4. revolution | c. The path of an object as it revolves around another object in space |
| ____ 5. orbit | d. The spinning motion of Earth on its axis |

6. What causes day and night?

_____

_____

7. Each 24-hour cycle of day and night is called a(n) _____.

8. Why is an extra day added to February every four years?

_____

_____

_____

_____

_____

### The Seasons on Earth

9. Why is it warmer near the equator than near the poles?

_____

_____

_____

_____

10. Why does Earth have seasons?

_____

_____

_____

Name: _____
Date: _____
Class: _____

# Rocks and Weathering Quiz

Match the following Vocabulary words with their respective definition

1. Permeable _____
2. Abrasion _____
3. Weathering _____
4. Mechanical Weathering _____
5. Oxidation _____
6. Chemical Weathering _____
7. Ice wedging _____
8. Uniformitarianism _____
9. Erosion _____

a. The process that breaks down rock through chemical changes.
b. The grinding away of rock particles carried in water, ice, or wind
c. The process by which water, ice, wind, or gravity moves weathered rock and soil.
d. Characteristics of a material that is full of tiny, connected air spaces that water can seep through
e. A chemical change in which a substance combines with oxygen, as when iron oxidizes, forming rust.
f. The geologic principle that the same geologic processes that operate today operated in the past to change Earth's Surface
g. Type of weathering in which rock is physically broken into smaller pieces
h. Process that splits rock when water seeps into cracks, then freezes and expands
i. The chemical and physical processes that break down at Earth's surface

Answer the following questions in a separate sheet of paper. Make sure to write your name, date, and class color to the paper. Make sure to staple both papers and place them face down at my desk.

10. What are two factors that affect the rate of weathering?
11. A granite monument is placed outside for 200 years in a region with a cool, dry Climate. What would its rate of weathering be? Explain
12. Compare and contrast Mechanical Weathering and Chemical Weathering

**Bonus Question**

Name two out of the three kinds of stress learned during the Engineering Unit.