

Newport-Mesa Unified School District
Office of Secondary Curriculum and Instruction
High School Course of Study

Course Title		Mathematics, Engineering, Science Achievement 1				Course Code		K0370-371			
Transcript Title:		MESA 1AB		Grades Levels:		9-12		Board Adoption Date:		6/09/2020	
Content Area:		Interdisciplinary Elective		GPA Scale:		4.0		Date Course Submitted:		3-6-20	
Credential Required:		Single Subject Secondary Math or Science Credential		Graduation Subject Areas:		Electives		CALPADS Code:		9233	
UC/CSU “A-G” Area Approvals:			g		School Site/person that wrote and submitted the course:				Early College High School		
Recommend Skills:	None										
Next course(s):	MESA 2										
Textbook to be used:	MESA is not a textbook based course. There are multiple resources the teacher will use as indicated in the unit studies.										

COURSE DESCRIPTION (catalog summary):

In MESA (Mathematics, Engineering, Science Achievement) students apply principles of science and math, and the engineering design process in developing projects related to various disciplines in engineering. Engineering disciplines include, but are not limited to, civil engineering, mechanical engineering, biomedical engineering, packaging engineering, aeronautical/aerospace engineering, and electrical engineering. In this year-long college-preparatory course, students also explore robotics, computer programming and coding. By working in teams, students complete a series of design challenges (hands-on projects) culminating with competition-ready devices such as: prosthetic arm, balsawood bridge, working model of the heart, egg drop package, propeller airplane, mousetrap-powered car. These projects promote critical thinking, communication, collaboration, creativity and provide a foundation for data collection, analysis, reflection, presentations and technical writing skills. By successfully completing the course students will be prepared to succeed in college level science and engineering. Each unit also introduces students to the real-world application of the skills and principles and highlights how they relate to possible careers in STEM fields. All units utilize the engineering design process and require students to keep an “Engineering Design Notebook” to document their thoughts processes and test data as well provide insight into the design, test and redesign process. Engineering is problem-solving and combines math, science, language arts, social studies, team building and creativity with a practical twist. In MESA students use hands-on activities and project-based learning to retain more math and science concepts. Utilizing the engineering design process to guide students through MESA’s various project based learning modules provides students with insight into engineering as well as the skills to systematically approach real-world problems. Using the 4 steps of the engineering design process: investigate, plan, create and evaluate, students will repeat the steps until they have a project worthy of entry into the MESA competition arena. Beginning with an activity to “set the stage” for the construction of a mousetrap car, students begin to acquire the vocabulary and engage in dialogue with other students.

GOALS (expected performance outcomes for students):

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MESA is funded by the State of California and is administered by the University of California, with funding allocated from UC and the California Community College Chancellor's Office. MESA also pursues additional financial and resource support from private and public sources. MESA functions with a partnership of all the major public and private education systems in California.

MESA helps underserved and underrepresented students to achieve success in STEM studies and careers. Most MESA students are the first in their families to go to college. Most students are from low-income households and/or attend Title I funded schools. With MESA's support these students excel in science, technology, engineering and math—some of the most difficult academic subjects. California's students excel in STEM pathways, from elementary to graduate school and into careers where they accelerate and build the Golden State's leadership in research, industry, and service.

- a. Follow MESA-developed guidelines (reinforcing California State Math and Science Standards) to build hands-on projects, which will be entered into rigorous local, regional, and in some cases state and national contests.
- b. Learn and apply effective study skills techniques for academic success
- c. Enter at least one project in the MESA Day preliminary competition • <https://mesa.ucop.edu/staff/mesa-day-rules/>
- d. Compete in at least 1 virtual project • <http://mesa.ucop.edu/our-programs/mesa-statewide-virtual-computer-sciencecontest/>
- e. Attend one MESA Saturday Academies at UCI (not sure yet) • <http://mesa.eng.uci.edu/resources-students.html>

CALIFORNIA CONTENT STANDARDS (how the course aligns with California and/or national curriculum standards):

MESA provides rigorous academic development that includes math and science curriculum based on the California Math and Science Standards. MESA also offers individualized academic planning, study skills training, peer group learning techniques, career exploration, parent involvement, professional development, transfer assistance, and special orientation classes and services for students in high school, community college and four-year institutions.

EVALUATION (how the effectiveness of the course will be monitored and assessed):

MESA measures success by helping students who are traditionally underrepresented in higher education become college- and career-ready. MESA students succeed with:

- Academic support based on high standards
- Individual counseling to ensure that college prerequisites and transfer/college graduation requirements are met
- Industry involvement in activities including mentoring, shadow days and speakers
- Reinforcement of California math and science standards through hands-on projects, group learning and constantly evolving curriculum
- Supportive student communities based on academic success
- Professional development for math and science teachers in low-performing schools
- Networks of parents, educators and industry leaders and community resources to support students
- Regional MESA center alliances that further smooth the educational pathway

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Unit 1	Length of Unit ... 4-6 Weeks			
	Key Vocabulary	Standards (referenced)	Model Tasks	Tools / Texts
<i>Simple Machines – Mousetrap Car Project</i>	Engineering	NGSS	BACKGROUND: In this introductory unit students will explore the question “how do things move and what is motion. Selected readings and guided research will help students to develop kinematic concepts of motion and apply this knowledge to the design challenge. In the unit, students will also be introduced to the engineering design cycle that will be used for the remainder of the year as a tool to solve multiple engineering design problems. The design challenge in unit one is to build a car propelled by the energy released in the snap of a mousetrap to power the car up a ramp with a 30-degree incline. Through this investigation, students apply their understanding of kinematics to analyze motion by making measurements and calculations as well as exploring the need for transportation. Throughout the engineering design cycle students are required to document their findings in an engineering notebook in preparation for panel discussions and peer dialogue about their project. PURPOSE: The purpose of this unit is to introduce or reinforce the engineering design process while introducing students to the principles of mechanical engineering. By the end of the unit students will be prepared to build a mousetrap car which climbs a ramp over 5 meters as outlined in the MESA Day Competition Rules.	<i>UC Irvine MESA Google Drive</i>
	Mechanical Engineering	MS-LS1-1 Planning and carrying out investigation MS-LS1-2 Engaging in argument from evidence		<i>UC Riverside MESA Google Drive</i>
	Engineer Design Process	MS-LS1-8 Obtaining, evaluating and communicating information		<i>MESA Day Rules and Lab Book Requirement</i>
	Design Cycle	MS-LS 1-1 Interdependence of engineering and technology		
	Physics	MS-LL1-3 Science is a human endeavor		<i>MESA DAY Curriculum</i>
	Kinematics	ELA – Literacy		
	Motion	WHST.6-8.7 Conduct short research projects to answer questions		<i>a. Composition notebook to be used as a MESA journal exclusively for this class.</i>
	Energy	WHST.6-8.8 Gather relevant information from multiple sources		
	Force	SL8.5 Integrate multimedia and visual displays		<i>b. Several sharp pencils with erasers (mechanical pencils with lead refills work nicely)</i>
	Acceleration	MS Engineering Design		
	Movement	MS-ETS1-1 Define criteria of a design project MS-ETS1-2 Evaluate competing design solutions MS-ETS1-3 Analyze data from tests MS-ETS1-4 Develop a model to generate data for iterative testing and modification		<i>c. Sticky notes or book tabs</i> <i>d. Ruler and/or protractor</i> <i>e. Colored pencils</i>

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			OBJECTIVES: At the conclusion of this unit students will: ▪ Understand the engineering design cycle and its parts and utilize them to design and build a mousetrap car ▪ Critically analyze the parts of a vehicle and choose appropriate materials to build a mousetrap car ▪ Solve problems related to force, acceleration and movement ▪ Investigate motion, simple machines and mechanical energy to understand physics principles and engineering elements ▪ Develop the “habits of mind” associated with science and engineering practices ▪ Develop an understanding of mechanical engineering and what mechanical engineers do ▪ Adjust their use of spoken, written and visual language to communicate effectively with a variety of audiences and for different purposes
Differentiation	Support -- for students who are struggling with the content	Content: <i>All materials are provided with scaffolding and differentiation modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with scaffolding and differentiation embedded for English Learners and struggling learners.</i> Product: <i>All assignments can be completed in a modified format to accommodate English Learners and students who struggle with the content.</i>	

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Evaluation	Formative Assessments (ongoing & mid-lesson): - Assessment worksheets - Oral presentations with rubrics - Project testing and evaluation			
	Summative Assessments (unit final evaluation): - MESA Notebook with rubric scoring - Final Project with rubric scoring - Video of Project construction (optional)			

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Unit 2	Length of Unit ... 4 Weeks			
	Key Vocabulary	Standards (referenced)	Model Tasks	Tools / Texts
<i>Model Science – The Human Heart</i>	Force Friction Reaction Force Energy Quantitative Information Technical Information System	California Common Core • Grades 9-10 - o RST No. 4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. - o RST No. 5: Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). - o RST No. 7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. • Grades 11-12 - o RST No. 4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. - o RST No. 9: Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.	BACKGROUND: Utilization of Engineering Design Process to integrate technical or quantitative information expressed in words in a text with a version of that information expressed visually in a model, diagram, flow chart and graph. Utilizing factual materials provided in the online MESA curriculum and research conducted through selected websites, students will develop scientific and technical terms to express the inter-relationships of the various components of the human heart. Students are also required to present their findings in a white paper and be prepared to entertain questions before a peer panel. The culmination of this unit is an articulated model of the human heart that must contain specified components and demonstrate the blood flow through the four chambers of the heart. Throughout the project students will utilize the engineering design cycle and document their findings in their engineering design notebooks. PURPOSE: The Human Heart module will introduce students to the field of biological science and its corresponding careers. The module will introduce students to the role of the human heart; the location, functions, and appearance of its various structures; and associated disorders and diseases. At the end of the module students will be prepared to construct and label a model of the Human Heart as well as answer questions prepared	<i>UC Irvine MESA Google Drive</i> <i>UC Riverside MESA Google Drive</i> <i>MESA Day Rules and Lab Book Requirement</i> <i>MESA DAY Curriculum</i> <i>a. Composition notebook to be used as a MESA journal exclusively for this class.</i> <i>b. Several sharp pencils with erasers (mechanical pencils with lead refills work nicely)</i> <i>c. Sticky notes or book tabs</i> <i>d. Ruler and/or protractor</i> <i>e. Colored pencils</i>

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		California's Next Generation Science Standards (NGSS) • Grades 9-12 o HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. o HS-LS1-2: Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. o HS-LS1-2, HS-LS1-4 Crosscutting Concept: Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.	from information contained in the attached documents. OBJECTIVES: Upon completion of this module, students will: ▪ Be familiar with the MESA Day contest rules ▪ Have a working knowledge of the function of the Human Heart ▪ Be able to identify the structures and appearance of the Human Heart ▪ Be familiar with diseases/disorders related to the Human Heart ▪ Be able to construct a working model of the Human Heart based on the knowledge acquired in this module ▪ Be prepared to answer a set of questions taken form the information contained in this module	
Differentiation	Support -- for students who are struggling with the content	Content: <i>All materials are provided with scaffolding and differentiation modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with scaffolding and differentiation embedded for English Learners and struggling learners.</i> Product: <i>All assignments can be completed in a modified format to accommodate English Learners and students who struggle with the content.</i>		
	Extension – for high achieving students.	Content: <i>All materials are provided with enrichment modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with enrichment embedded for high achieving students.</i> Product: <i>All assignments can be completed in a modified format to accommodate high achieving students.</i>		

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Evaluation	Formative Assessments (<i>ongoing & mid-lesson</i>): • Assessment Worksheets • Project Testing and Evaluation • Ability to correctly answer questions related to the function of the Human Heart		
	Summative Assessments (<i>unit final evaluation</i>): • MESA Notebook with rubric scoring • Final Project with rubric scoring • Video of Project construction (optional)		

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Unit 3	Length of Unit ... 4-6 Weeks			
	Key Vocabulary	Standards (referenced)	Model Tasks	Tools / Texts
Egg Drop	Rigid Motion Corresponding Sides Corresponding Angles Congruency Volume Ratio Newton's First Law Newton's Second Law Mass Acceleration Gravity Velocity Unbalanced Force Assessment Boundary One-Dimensional Motion	Geometry Congruence G-CO 7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. Geometric Measurement and Dimension G-GMD 3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. Modeling with Geometry G-MG 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). Next Generation Science Standards (NGSS) PS Physical Sciences High School (9-12) HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.[Clarification	BACKGROUND: Scientific principles to explore include Newton's First and Second Laws, free fall and acceleration of gravity, momentum and impulse connection and typical value of drag co-efficiency. In preparation for this project, students will be required to research Newton's laws and be prepared to defend their project design to their peers by citing specific examples of the laws. The design challenge in unit three relates to packaging engineering, culminating with the design and construction of an egg drop container of a specified size that will achieve the highest possible ration of surviving eggs to total eggs used. As in the previous projects, drawings and research findings documented in the engineering notebook help students to convey their thoughts into words. In this unit, the engineering design notebook also helps students prepare a lab report that must include internal and external drawings of their initial designs, testing data, redesign with drawings and calculations of the surface area and volume of the container. PURPOSE: The purpose of this unit is to reinforce or introduce the engineering design process to MESA students, while introducing students to principles of package engineering. Students will be prepared to build an egg drop container at the end of the unit that will achieve the	<i>UC Irvine MESA Google Drive</i> <i>UC Riverside MESA Google Drive</i> <i>MESA Day Rules and Lab Book Requirement</i> <i>MESA DAY Curriculum</i> <i>a. Composition notebook to be used as a MESA journal exclusively for this class.</i> <i>b. Several sharp pencils with erasers (mechanical pencils with lead refills work nicely)</i> <i>c. Sticky notes or book tabs</i> <i>d. Ruler and/or protractor</i> <i>e. Colored pencils</i>

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	Non-Relativistic Speed	Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force.] [Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.] HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. *[Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.] [Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.]	greatest “surviving egg to total egg” ratio at the MESA Day competition. OBJECTIVES: At the end of this unit students will: ▪ Know the parts of the design cycle and relate them to an egg drop project ▪ Critically analyze packaging materials and choose appropriate materials to complete their tasks ▪ Solve problems related to energy ▪ Solve problems related to surface area and volume ▪ Understand the practical applications of the design process for students and for engineers ▪ Build a competitive egg drop container for the MESA competition	
Differentiation	Support -- for students who are struggling with the content	Content: <i>All materials are provided with scaffolding and differentiation modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with scaffolding and differentiation embedded for English Learners and struggling learners.</i> Product: <i>All assignments can be completed in a modified format to accommodate English Learners and students who struggle with the content.</i>		

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Evaluation	Formative Assessments (<i>ongoing & mid-lesson</i>): • Assessment worksheets • Oral presentations with rubrics • Lab reports with rubric • Project testing and evaluation		
	Summative Assessments (<i>unit final evaluation</i>): • MESA Notebook with rubric scoring • Final Project with rubric scoring • Video of Project construction (optional)		

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Unit 4	Length of Unit ... 4-6 Weeks			
	Key Vocabulary	Standards (referenced)	Model Tasks	Tools / Texts
Wrightstuff - Aircraft	Ratio	Common Core and NGSS Common Core Mathematics	BACKGROUND: This unit reinforces the engineering design process through the principles of flight and aircraft design applied to the construction of a balsawood propeller airplane. Objectives of this unit include: analysis of design and construction in relation to the flight mission; application of principles of the engineering design cycle to aircraft design and construction; problem solving related to flight, lift and drag; problem solving related to balance and torque. Students will be required to compute the volume and surface area of two or three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms. In addition, students will plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. Students will also construct and interpret scatter plots for bi-variant measurement data to investigate patterns of association between the quantities. Students will share their findings with their peers via power point presentations. PURPOSE: The purpose of this unit is to reinforce or introduce the engineering design process to MESA students, while introducing them to the principle of flight and aircraft design. Students will be prepared to build and fly a model aircraft that will sustain a long flight time in MESA Day competition.	<i>UC Irvine MESA Google Drive</i>
	Proportion			
	Bivariate Data	Ratios and Proportional Relationships 6. RP		<i>UC Riverside MESA Google Drive</i>
	Outliers	3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g. by reasoning about tables of equivalent ratios, tape diagrams, or equations.		
	Positive Association	3c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percentage.		<i>MESA Day Rules and Lab Book Requirement</i>
	Negative Association			<i>MESA DAY Curriculum</i>
	Linear Association			<i>a. Composition notebook to be used as a MESA journal exclusively for this class.</i>
	Non-Linear Association	Statistics and probability 8. SP		
	Scatter Plots	Investigate patterns of association in bivariate data		<i>b. Several sharp pencils with erasers (mechanical pencils with lead refills work nicely)</i>
	Dot Plots	1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering outliers, positive or negative associations, linear or non-linear associations.		
	Histograms	2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear relationship, informally fit a straight line, and points to the straight line		<i>c. Sticky notes or book tabs</i>
	Box Plots			
	Geometric Constructions			<i>d. Ruler and/or protractor</i>
	Typographical Grid Systems			<i>e. Colored pencils</i>

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		Higher Common Core Mathematics Algebra 1- A1 Quantities N- Q Reason quantitatively and use units to solve problems. 1- Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Seeing Structure in Expressions in A-SSE. Write expressions in equivalent forms to solve problems. 3-Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Statistics and Probability Interpreting Categorical and Quantitative Data S-ID 1-Represent data with plots on the real number line (dot plots, histograms, and box plots.) Make geometric constructions. G-CO 12-Make geometric constructions using a variety of tools and methods (compass, and straight edge, sting, reflective device, paper folding, dynamic geometric software, etc.). Geometric Measurement and Dimension G-GMD 4-Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects	OBJECTIVES: At the end of the unit students will: ▪ Know the parts of the design cycle and relate them to aircraft design and construction ▪ Critically analyze the design and construction in relation to the flight mission ▪ Solve problems related to flight, lift and drag ▪ Solve problems related to balance and torque ▪ Solve problems related to angles ▪ Understand the practical applications of the design process for students and engineers

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		Engineering Design MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit potential solutions. MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well the meet the criteria and constrains of the problem. MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.		
Differentiation	Support -- for students who are struggling with the content	Content: <i>All materials are provided with scaffolding and differentiation modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with scaffolding and differentiation embedded for English Learners and struggling learners.</i> Product: <i>All assignments can be completed in a modified format to accommodate English Learners and students who struggle with the content.</i>		

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Evaluation	Formative Assessments (ongoing & mid-lesson): - Assessment work sheets - Oral presentations with rubrics - Lab reports with rubrics - Project testing and evaluation			
	Summative Assessments (unit final evaluation): - MESA Notebook with rubric scoring - Final Project with rubric scoring - Video of Project construction (optional)			

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Unit 5	Length of Unit ... 4-6 Weeks			
	Key Vocabulary	Standards (referenced)	Model Tasks	Tools / Texts
<i>Prosthetic Arm</i>	Biomedical Engineering	National Science Education Standards Grades 9-12 (ages 14 - 18)	BACKGROUND: Prior to the start of this project, students will be required to research prosthetic devices through selected readings and recommended online websites. Where available, students will visit a Veterans' Administration hospital as part of their research. Combining biomedical engineering, biotechnology and kinematics, this unit culminates with the design and construction of a working prosthetic arm. Utilizing principles of electrical and mechanical engineering, students incorporate circuitry and "micro processing technology to activate the fingers of the hand to grasp and relocate various specified objects. To design and construct the arm and hand students will conduct online research to investigate the following: types of motion, magnitude of motion, direction of motion, location of motion – kinematics. Included in the development of the project are scaled plans and renderings. This unit also includes the development of a technical paper, an academic display and an oral presentation, mimicking the process utilized by teams of engineers in the workplace. The paper must contain examples of math and science concepts used in the design of the arm. The academic display must provide isometric and orthographic drawings of the device. The oral presentation outlines the design process and various testing and	<i>UC Irvine MESA Google Drive</i>
	Biotechnology	CONTENT STANDARD B: Physical Science. As a result of their activities, all students should develop understanding of Motions and forces		<i>UC Riverside MESA Google Drive</i>
	Kinematics	Interactions of energy and matter		<i>MESA Day Rules and Lab Book Requirement</i>
	Magnitude of Motion	CONTENT STANDARD E: Science and Technology. As a result of activities, all students should develop Abilities of technological design		
	Direction of Motion	Understandings about science and technology		<i>MESA DAY Curriculum</i>
	Location of Motion			<i>a. Composition notebook to be used as a MESA journal exclusively for this class.</i>
	Range of Motion	Standards for Technological Literacy - All Ages		
	Degrees of Freedom	The Nature of Technology Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.		<i>b. Several sharp pencils with erasers (mechanical pencils with lead refills work nicely)</i>
	Isometric			
	Orthographic			<i>c. Sticky notes or book tabs</i>
	Upper Extremity	Technology and Society Standard 7: Students will develop an understanding of the influence of technology on history.		
	Joint			<i>d. Ruler and/or protractor</i>
	Joint Angle			
	Sagittal Plane	Design Standard 9: Students will develop an understanding of engineering design.		<i>e. Colored pencils</i>
	Transverse Plane			

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	Coronal Plan Anterior Posterior Superior Inferior Lateral Medial Distal Proximal Superficial	Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. Abilities for a Technological World Standard 11: Students will develop abilities to apply the design process. The Designed World Standard 19: Students will develop an understanding of and be able to select and use manufacturing technologies.	thought processes that lead to the final design. PURPOSE: Develop a robot arm using common materials. Students will explore design, construction, teamwork, and materials selection and use. Note: This lesson plan is designed for classroom use only, with supervision by a teacher familiar with electrical and electronic concepts. OBJECTIVES: As a result of this activity, students should develop an understanding of: ▪ design concepts ▪ teamwork needed in the design process ▪ impact of technology in manufacturing ▪ Learn design concepts ▪ Learn teamwork ▪ Learn problem solving techniques ▪ Learn about simple machines	
Differentiation	Support -- for students who are struggling with the content	Content: <i>All materials are provided with scaffolding and differentiation modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with scaffolding and differentiation embedded for English Learners and struggling learners.</i> Product: <i>All assignments can be completed in a modified format to accommodate English Learners and students who struggle with the content.</i>		
	Extension – for high achieving students.	Content: <i>All materials are provided with enrichment modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with enrichment embedded for high achieving students.</i> Product: <i>All assignments can be completed in a modified format to accommodate high achieving students.</i>		

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Evaluation	Formative Assessments (<i>ongoing & mid-lesson</i>): • Assessment work sheets • Oral presentations with rubrics • Lab reports with rubrics • Project testing and evaluation		
	Summative Assessments (<i>unit final evaluation</i>): • MESA Notebook with rubric scoring • Final Project with rubric scoring • Video of Project construction (optional)		

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Unit 6	Length of Unit ... 2-4 Weeks			
	Key Vocabulary	Standards (referenced)	Model Tasks	Tools / Texts
Solo Math - SAT	SAT	A key priority of the math common core is to cover fewer topics in greater depth. Also, Common Core states, "The high school standards specify the mathematics that all students should study in order to be college and career ready."	BACKGROUND: Proficiency in higher level mathematics will serve students well in their pursuit of a STEM career. This unit focuses on student preparation and competency in higher level mathematics courses and builds on the skills gained in previous units. Using content measured by the math sections of the PSAT and SAT, students will be provided with opportunities to hone their skills in this area through classroom instruction, peer tutoring, and practical application in the various units outlined above. The culmination of this unit provides an opportunity for students to self-assess their math skills by participating in an exam that simulates the math section of the redesigned SAT and measures competency in: mastery of linear equations and systems; problem solving and data analysis; manipulation of complex equations; and geometric and trigonometric skills most relevant to college and career readiness. Students who can: make sense of problems and persevere in solving them; reason abstractly and quantitatively; construct viable arguments and critique the reasoning of others; model with mathematics; use appropriate tools strategically; attend to precision; look for and make use of structure; look for and express regularity in repeated reasoning are students who can master higher level mathematics courses on the way to a STEM major.	UC Irvine MESA Google Drive
	PSAT			UC Riverside MESA Google Drive
	Evidence-Based Reading			
	Evidence-Based Writing	The math section of the redesigned SAT draws from fewer topics that evidence shows most contribute to student readiness for college and career training. Students can study these core math areas in depth and have confidence that they will be assessed.		MESA Day Rules and Lab Book Requirement
	Critical Reading			MESA DAY Curriculum
	Mathematical Reasoning			a. Composition notebook to be used as a MESA journal exclusively for this class.
	Fluency	The Common Core standards are too lengthy to list here. However, below are the Common Core Standards for Mathematical Practice:		b. Several sharp pencils with erasers (mechanical pencils with lead refills work nicely)
	Conceptual Understanding			c. Sticky notes or book tabs
	Linear Expressions			d. Ruler and/or protractor
	Non-Linear Expressions	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.		e. Colored pencils
	Rational Expressions			
	Exponential Expressions			
	Polynomial Expressions			

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	Linear Equalities Rate Scale Inference Investigate Factors Roots Function Notation Pythagorean Theorem Arc Radian Chord Sector Trigonometric Ratio Sine Cosine Complementary Supplementary	PURPOSE: The purpose of this unit is to better prepare MESA students for the math section of the PSAT and SAT. In this MESA Day contest, students participate in an exam that simulates the math section of the redesigned SAT and measures competency in: ▪ Mastery of linear equations and systems ▪ Problem solving and data analysis ▪ Manipulation of complex equations ▪ Geometric and trigonometric skills most relevant to college and career readiness OBJECTIVES: Students will be able to: ▪ State the mathematics skills measured by the SAT ▪ State the general SAT math test taking rules ▪ Explain the format of the math section of the SAT test ▪ List the mathematics content and types of mathematical questions on the SAT test	

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	Extension – for high achieving students.	Content: All materials are provided with enrichment modalities to be utilized by the teacher as needed. Process: All lessons are constructed with enrichment embedded for high achieving students. Product: All assignments can be completed in a modified format to accommodate high achieving students.		
Evaluation	Formative Assessments (ongoing & mid-lesson): - Assessment worksheets - Solo Math contest at Pre MESA Day and Regional MESA Day			
	Summative Assessments (unit final evaluation): - MESA Notebook with rubric scoring - Final Project with rubric scoring - Video of Project construction (optional)			

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Unit 7	Length of Unit ... 6-8 Weeks			
	Key Vocabulary	Standards (referenced)	Model Tasks	Tools / Texts
<i>Speak Out</i>	Textual Evidence Search Aid Purpose Statement Central Idea Informative Speaking Tone Rate Voice Modulation	CA Common Core • CCR Anchor Standards – Reading Informational Texts - o 1, 2 • CCR Anchor Standards – Speaking and Listening - o 4, 5, 6 • Grade 9-10 - o Reading for Informational Texts Standard 1, 2, 3 - o Speaking and Listening Standard 4, 4a, 4b, 5, 6	BACKGROUND: Speaking and listening are critical to student success at any and all levels. In this unit students will draw upon the skills developed in prior units and apply these skills in the preparation of an oral presentation related to any of the PBL modules outlined above or to a topic selected from a pre-determined list. College career and readiness standards outlined in the Common Core Standards require students to read closely to determine what the text says and make logical inferences from the information as well as cite specific textual evidence when writing or speaking to support conclusions. Other skills to be fine-tuned in this unit include utilization of appropriate eye contact, adequate volume and clear pronunciation to convey meaning. Providing students with speaking opportunities throughout the course to allow them to develop their presentation skills as they relate their design process and test findings, will help them build confidence and begin to build the skills necessary to communicate effectively. PURPOSE: The purpose of the module is to prepare students to perform well on the MESA Day Speak Out contest. Students will be introduced to speaking, presentation, critical thinking and research skills. Students will also be given many opportunities to assess their presentation skills via a number of exercises, which expose students to key	<i>UC Irvine MESA Google Drive</i> <i>UC Riverside MESA Google Drive</i> <i>MESA Day Rules and Lab Book Requirement</i> <i>MESA DAY Curriculum</i> <i>a. Composition notebook to be used as a MESA journal exclusively for this class.</i> <i>b. Several sharp pencils with erasers (mechanical pencils with lead refills work nicely)</i> <i>c. Sticky notes or book tabs</i> <i>d. Ruler and/or protractor</i> <i>e. Colored pencils</i>

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			language arts standards. Students will be expected to work individually and in groups to build self-confidence and communication skills. Throughout the module, students will be learning and utilizing critical thinking and writing skills. OBJECTIVES: On completion of the course the student should have a fundamental understanding of: • Speak Up Contest Rules • Performance Responsibilities • Research • Critical Thinking Skills • Speech Evaluation • The Four Key Language Art Standards	
Differentiation	Support -- for students who are struggling with the content	Content: <i>All materials are provided with scaffolding and differentiation modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with scaffolding and differentiation embedded for English Learners and struggling learners.</i> Product: <i>All assignments can be completed in a modified format to accommodate English Learners and students who struggle with the content.</i>		
	Extension – for high achieving students.	Content: <i>All materials are provided with enrichment modalities to be utilized by the teacher as needed.</i> Process: <i>All lessons are constructed with enrichment embedded for high achieving students.</i> Product: <i>All assignments can be completed in a modified format to accommodate high achieving students.</i>		
Evaluation	Formative Assessments (ongoing & mid-lesson): • Assessments are continuous and include class participation, student performance, and Advisor evaluation.			

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	<i>Summative Assessments</i> <i>(unit final evaluation):</i> • MESA Notebook with rubric scoring • Final Project with rubric scoring • Video of Project construction (optional)
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