Name: Kim Wellington
School: Central Valley High School

Course: Introduction to Technology - CIP 210198
Unit of Instruction: CO2 Car Dragster Design

FOUNDATION COMPONENTS AND COMPETENCIES
Unit of Instruction:

1. Major Course Skills/Units of Study:

CO2 Car Dragster Design

2. Situation or Problem:

Given teacher information from lecture, word, and powerpoint documents and materials supplied, design, produce working drawings, and produce a fast CO2-powered dragster according to stated specifications and using only certain materials.

3. Project Description, Design Brief or Purpose:

The teacher will give information by lecture and powerpoint documentation. The students will demonstrate knowledge and application of the design process by documenting the process on powerpoint using the given check sheet as a page by page guide. (See following check sheet.) After documenting their process and designing a best option drawing, the students will make a design and draw a CO2 Dragster from given materials that will meet specifications. They will also complete a powerpoint presentation demonstrating their understanding of the physical elements of designing a fast car and show data to back their evaluation, conclusion, and reflection.
This assignment gives the beginning student the essentials in learning the basics in the design process, measuring, basic physics, and computer applications

4. Performance Specifications, Guidelines or Rules:

Complete the powerpoint presentation, product, and present the materials in front of the class. Correct until completed accurately meeting instructor and TSA specifications.

5. Specific Project Core Competencies:

Standards and Competencies/Components	• **Technical Skills – Basic Drafting Concepts, Computer Application – Powerpoint and Excel, Basic Tool Use** • **Academic Skills – Measuring, Lift, Weight, Drag, Acceleration, and Computing Average Speed.** • **Employment-Related Skills – The Design Process, Computer Applications, and Presentation Skills.** • **Career Transition Skills – Measuring Skills, Concepts of Basic Physics, Computer Application Skills, Presentation Skills.** Transportation Technologies Outline based on OSPI Model Curriculum Framework

Transportation Competencies

Standard DW-TT 3: Understand the role/use of energy in transportation.
DW-TT3.1 Understand and define *transportation* and *power*.
DW-TT3.2 Identify sources of energy.
DW-TT3.3 Demonstrate an understanding of energy conversion.
DW-TT3.4 Demonstrate an understanding of mechanical systems.
DW-TT3.6 Demonstrate an understanding of fluid power systems.

Standard DW-TT 4: Investigate the modes of transportation.
DW-TT4.1 Demonstrate an understanding of transportation in the world of aviation systems.
DW-TT4.3 Demonstrate an understanding of transportation in the world of land systems.

Standard DW-TT 5: Investigate the nature and meaning of *vehicular systems.*
DW-TT5.1 Demonstrate an understanding of propulsion of a vehicle.
DW-TT5.5 Demonstrate an understanding of structure of a vehicle.
DW-TT5.6 Demonstrate an understanding of support of a vehicle.
DW-TT5.7 Explore transportation technologies of the future.

Power and Energy Competencies

Standard DW-EPT 1: Develop an understanding of The Designed World to select and use energy and power technologies.
DW-EPT1.1 Energy cannot be created nor destroyed; however, it can be converted from one form to another.
DW-EPT1.2 Energy can be grouped into major forms: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.
DW-EPT1.3 It is impossible to build an engine to perform work that does not exhaust thermal energy to the surroundings.
DW-EPT1.5 Power systems must have a source of energy, a process, and loads.
DW-EPT1.6 All Energy and Power Technology Education programs need to include appropriate tool skills, health and safety, the manipulation of related materials, and the development of appropriate products (physically, digitally or virtually).

Generic Technology Education Competencies

Students will develop an understanding of The Nature of Technology. This includes acquiring knowledge of:

Standard 1: the characteristics and scope of technology.
In order to comprehend the scope of technology, students should learn that:
C1.3 Inventions and innovations in a specific area are generally driven by research to achieve a specific objective.

Standard 2: the core concepts of technology.
In order to recognize the core concepts of technology, students should learn that:
C2.1 Systems thinking involves input, process, output and feedback and applies logic and creativity with appropriate compromises in complex real-life problems.
C2.2 Technological systems interact with other systems including social, environmental, and scientific. Outputs -

	expected desirable, expected undesirable, unexpected desirable, unexpected undesirable. C2.3 Systems feedback is the process we use to measure and adjust a system based on the output. The stability of a technological system is influenced by all of the components in the system. C2.4 Tradeoffs result from competing values such as availability, cost, desirability, and waste within a system. C2.5 Requirements involve the identification of the criteria and constraints of a product or system. The system design is driven by the requirements. C2.6 Constraints impact the design process. C2.7 New technology creates new processes. C2.8 Quality control is a planned process to ensure that a product, service, or system meets established criteria and is embedded in the feedback loop. C2.9 Management is the process of planning, organizing, and controlling work. C2.10 Complex systems have many layers of control and feedback loops to provide information. Standard 3: the relationships among technologies and the connections between technology and other fields of study. In order to appreciate the relationships among technologies, as well as other fields of study, students should learn that: C3.1 Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function; al technical systems are interrelated. C3.2 Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields. C3.3 Technological ideas are sometimes protected through the patent process. C3.4 Technological progress promotes the understanding and relevance of science, mathematics, reading, writing and oral communications. ***Students will develop an understanding of Technology and Society. This includes learning about:*** Standard 4: the cultural, social, economics, and political effects of technology. *In order to recognize the changes in society caused by the use of technology, students should learn that:* C4.1 Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious. C4.2 Making decisions about the use of technology involves understanding the impacts. C4.3 Ethical considerations are important in the development, selection, and use of technologies (should we do it just because we can?). C4.4 The transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees; desirable impacts in one society may be undesirable in another. DP = DESIGN PROCESS Standards 8-13 (Design, Abilities for a Technological World) ***Students will develop an understanding of Design. This includes knowing about:*** Standard 8: the attributes of design. In order to recognize the attributes of design, students should learn that: DP8.1 Design problems are seldom presented in a clearly defined form; the best results are often based on the clarity of the design problem. DP8.2 The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved; the best results are often achieved when the process in non-linear.

	DP8.3 Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. Standard 9: design process In order to comprehend engineering design, students should learn that: DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes. DP9.2 The design process is influenced by personal characteristics, such as creativity, teamwork, resourcefulness, and the ability to visualize and think abstractly. DP9.3 A prototype is a working model used to test a design concept by making actual observations and necessary adjustments. DP9.4 The design process takes into account a number of factors, including safety, reliability, economic considerations, manufacturability, maintenance and repairs, and human factors engineering; the design process can't be complete without a prototype or virtual model. Standard 10: the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. In order to comprehend other problem-solving approaches, students should learn that: DP10.1 Research and development is an integral part of the design process. DP10.2 Technological problems must be researched before they can be solved. DP10.3 Not every problem can be solved using technology. DP10.4 Many technological problems require a multidisciplinary approach. ***Students will develop Abilities for a Technological World. This includes becoming able to:*** Standard 11: apply the design process. As a part of learning how to apply design processes, students should be able to: DP11.1 Identify the design problem to solve and decide whether or not to address it; differentiate between problems and solutions. DP11.2 Identify criteria and constraints and determine how these will affect the design process. DP11.3 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. DP11.4 Evaluate the design solution using conceptual, physical and mathematical models at various intervals of the design process in order to check for proper design and to note where areas of improvements are needed. DP11.5 Develop and produce a product or system using a design process. DP11.6 Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. Standard 12: use and maintain technological products and systems. As part of learning how to use and maintain technological products and systems, students should be able to: DP12.1 Document process and procedures and communicate them to different audiences using appropriate oral and written techniques; technical communications is critical to maintaining and operating a system. DP12.2 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it. DP12.3 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision. DP12.4 Operate systems so that they function in the way they were designed; management and quality control are

	necessary for the system to operate the way it was designed. DP12.5 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate. Standard 13: assess the impact of products and systems. As a part of learning how to assess the impact of products and systems, students should learn to: DP13.1 Ongoing development depends on evaluating a product or system effectiveness based the design criteria. DP13.2 Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment. DP13.3 Use assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology. DP13.4 Design forecasting techniques to evaluate the results of altering natural systems.
6. Assessments	
Written Assessment	Students will present their powerpoint presentation completing the check sheet with 100% accuracy. Students will fix document until completed and the presentation will meet industrial and teacher standard.
Production Assessment	Students will follow their technical drawing, construct the car using tools and equipment within the safety standards test the car for speed, weight, roll, and drag, and meet contest specifications with 100% accuracy.
7. Supplies/Materials and Community Resources:	Powerpoint & Excel Computer programs, Wood, Band Saw and Drill presses, Portable Drills, Roto-tools, and Sanders. Wood, wheels, CO2 Cartridges, race track, wind tunnel test, scale, and rullers.
8. Other Assessment Correlations	
Math GLEs included in unit	Math GLEs 1.1.6 Apply strategies to compute fluently with rational numbers in all forms including whole number exponents. 1.2.1 Analyze how changes in one or two dimensions of an object affect perimeter, area, surface area, and volume. 1.2.3 Understand how to convert units of measure within systems (U.S. or metric). 1.2.6 Understand and apply strategies to obtain reasonable measurements at an appropriate level of precision. 1.3.1 Understand the relationship among characteristics of one-dimensional, two-dimensional, and three-dimensional figures. 1.3.3 Apply understanding of geometric properties and location of points to figures. 1.4.3 Apply appropriate methods and technology to collect data or evaluate methods used by others for a given research questions. 1.4.6 Apply understanding of statistics to make, analyze, or evaluate a statistical argument. 1.5.2 Analyze a pattern, table, graph, or model involving repeated addition (linear) or repeated multiplication (exponential) model to write an equation or rule. 1.5.4 Apply understanding of equations, tables, or graphs to represent situations involving relationships that can be written as repeated addition (linear) or repeated multiplication (exponential). 1.5.6 Apply procedures to solve equations and systems of equations. 2.2.1 Apply strategies, concepts, and procedures to devise a plan to solve the problem. 2.2.2 Apply mathematical tools to solve the problem.

	3.2.1 Apply skill of conjecturing and analyze conjectures by formulating a proof or constructing a counter example. 3.2.2 Analyze information to draw conclusions and support them using inductive and deductive reasoning. 3.2.3 Analyze procedures to determine appropriateness of claims and arguments. 3.3.1 Analyze results using inductive and deductive reasoning. 3.3.2 Analyze thinking and mathematical ideas using models, known facts, patterns, relationships, counter examples, or proportional reasoning. 4.2.1 Analyze mathematical information to organize, clarify, and refine an argument. 5.2.1 Analyze mathematical patterns and ideas to extend mathematical thinking and modeling in other disciplines. 5.3.2 Understand the mathematical knowledge and training requirements for occupational/career areas of interest.
Reading GLEs included in unit	Reading GLEs 1.2.2 Apply strategies to comprehend words and ideas. 1.3.2 Understand and apply content/academic vocabulary critical to the meaning of the text, including vocabularies relevant to different contexts, cultures, and communities 2.2.2 Apply understanding of complex organizational features of printed text and electronic sources. 2.3.4 Synthesize information from a variety of sources. 2.4.3 Analyze and evaluate text for validity and accuracy. 2.4.6 Analyze and evaluate the presentation and development of ideas and concepts within, among, and beyond multiple texts. 2.4.7 Analyze and evaluate the reasoning and ideas underlying author's beliefs and assumptions within multiple texts. 3.1.1 Analyze web-based and other resource materials (including primary sources and secondary sources) for relevance in answering research questions. 3.2.2 Apply understanding of complex information, including functional documents, to perform a task. 3.3.1 Apply appropriate reading strategies for interpreting technical and non-technical documents used in job-related settings.
Science GLEs included in unit	Science GLEs 1.1.2 Apply an understanding of direction, speed, and acceleration when describing the linear motion of objects. 1.1.4 Analyze the forms of energy in a system, subsystems, or parts of a system. 1.2.1 Analyze how systems function, including the inputs, outputs, transfers, transformations, and feedback of a system and its subsystems. 1.2.2 Analyze energy transfers and transformations within a system, including energy conservation. 1.3.1 Analyze the forces acting on objects. 1.3.2 Analyze the effects of balanced and unbalanced forces on the motion of an object. 1.3.3 Analyze the factors that affect physical, chemical, and nuclear changes and understand that matter and energy are conserved. 2.1.1 Understand how to generate and evaluate questions that can be answered through scientific investigations. 2.1.2 Understand how to plan and conduct systematic and complex scientific investigations.

	2.1.3 Synthesize a revised scientific explanation using evidence, data, and inferential logic. 2.1.4 Analyze how physical, conceptual, and mathematical models represent and are used to investigate objects, events, systems, and processes. 2.2.1 Analyze why curiosity, honesty, cooperation, openness, and skepticism are important to scientific explanations and investigations. 2.2.2 Analyze scientific theories for logic, consistency, historical and current evidence, limitations, and capacity to be investigated and modified. 2.2.3 Evaluate inconsistent or unexpected results from scientific investigations using scientific explanations. 2.2.4 Analyze scientific investigations for validity of method and reliability of results. 3.1.2 Evaluate the scientific design process used to develop and implement solutions to problems or challenges. 3.1.3 Evaluate consequences, constraints, and applications of solutions to a problem or challenge. 3.2.3 Analyze the scientific, mathematical, and technological knowledge, training, and experience needed for occupational/career areas of interest.
Arts EALRs and Frameworks included in unit	Art GLEs
Writing GLEs included in unit	Writing GLEs 1.1.1 Analyzes and selects effective strategies for generating ideas and planning writing 1.3.1 Revises text, including changes in words, sentences, paragraphs, and ideas 1.4.1 Edits for conventions (see 3.3) 1.5.1 Publishes in formats that are appropriate for specific audiences and purposes 1.6.2 Uses collaborative skills to adapt writing process 1.6.3 Uses knowledge of time constraints to adjust writing process 2.4.1 Produces documents used in a career setting 3.1.1 Analyzes ideas, selects a manageable topic, and elaborates using specific, relevant details and/or examples 3.3.2 Spells accurately in final draft 3.3.3 Applies capitalization rules 3.3.4 Applies punctuation rules 3.3.5 Applies usage rules 3.3.8 Applies conventional forms for citations
Communication GLEs in unit	Communication GLEs 1.2.2 Evaluates the effect of bias and persuasive techniques in mass media. 2.2.2 Applies skills to contribute responsibly in a group setting. 3.1.1 Applies skills to plan for effective oral communication and presentation. 3.3.1 Applies skills and strategies for the delivery of effective oral communication and presentations.
Leadership & Employability Skills	Leadership GLEs

	1.1.1 The student will analyze, refine, and apply decision-making skills through classroom, family, community, and business and industry (work-related) experiences. 1.1.3 The student will demonstrate oral, interpersonal, written, and electronic communication and presentation skills and understand how to apply those skills. 1.1.5 The student will be involved in activities that require applying theory, problem-solving, and using critical and creative thinking skills while understanding outcomes of related decisions. 1.1.7 The student will conduct self in a professional manner in practical career applications, organizational forums, and decision-making bodies 1.2.7 The student will demonstrate the ability to train others to understand the established rules and expectations, rationale, and consequences and to follow those rules and expectations. 2.1.1 The student will demonstrate the ability to identify, organize, plan, and allocate resources. This means that the student is able to demonstrate allocating time, money, materials, space, and staff. 2.1.4 The student will demonstrate an ability to work with a variety of technologies, identify or solve problems with equipment, including computers and other technologies. This means that the student can select equipment and tools, apply technology to specific tasks, and maintain and troubleshoot equipment.
Analytical, Logical & Creative Thinking Skills	Thinking Skills GLEs 1.1.1 Observe 1.1.2 Patterns 1.1.3 Sequence 1.1.5 Compare/Contrast 1.1.6 Predict 1.1.7 Cause/Effect 1.1.8 Fact/Opinion 1.1.12 Analysis 1.1.13 Finding Evidence 1.1.14 Evaluation 1.1.15 Detect Bias 1.1.17 Conclusion 3.1.1 Problem Solving 3.1.2 Decision Making 3.1.3 Goal Setting 4.1.2 Elaboration 4.1.3 Flexibility 4.1.4 Originality 5.1.1 Risking 5.1.2 Inquisitiveness 5.1.3 Attending 5.1.4 Persistence

TSA DRAGSTER DESIGN

OVERVIEW

Participants design, produce working drawings, and produce a fast CO_2-powered dragster according to stated specifications and using only certain materials.

Dragster body

DB1. One-piece, all-wood construction. Any type of lamination results in disqualification. No add-ons such as body strengtheners, fenders, plastic canopy, exhausts, or air foils may be attached to or enclosed within the vehicle. Fiberglass and shrink wrap are considered body strengtheners and cannot be used on the car body for any reason. Decals may be used for decoration only. They may not be used to gain an aerodynamic advantage, i.e., decals can not cover the exterior axle holes or be used to cover open areas of the body.
Two (2) or more like or unlike pieces of wood glued together are not considered one-piece, all-wood construction.

	MINIMUM	MAXIMUM
DB2. Body length	200mm	305mm
DB3. Body height with wheels		75mm
DB4. Body mass (completed car without CO_2)		(2005) 60g (2006) 45g
DB5. Body width at axles, front and back	35mm	42mm
DB6. Vehicle total width (including wheels)		90mm

Axles/axle holes/wheelbase

A1. Dragsters must have two (2) axles per car, no more.		
A2. Bottom of axle bearing above bottom of car	5mm	10mm
A3. Rear axle hole from rear of car	9mm	100mm
A4. Wheelbase (axle distance apart at farthest points)	105mm	270mm

A5. Bearings, bushings and lubricants may be used.
A6. Glue may be used to secure bearings to body.

Spacer washers/clips

S1. Spacer washers	8
S2. Axle clips	8

S3. Silicone or any other type of glue/adhesive may not be used in place of wheel clips to hold wheels or axles in place.

Power plant (CO_2 cartridge hole)
P1. The power plant hole must be at the farthest point at the rear of the car and must be drilled parallel to the racing surface to assure proper puncture of the CO_2 cartridge. A minimum of 3mm thickness around the entire power plant hole must be maintained on the dragster for safety. The inside of the power plant hole must not be painted.

P2. Hole depth	50mm	52mm
P3. Safety zone thickness	3mm	
P4. Chamber diameter	19mm	20mm
P5. Lowest point of chamber diameter to race surface (with wheels)	26mm	40mm

Eye screws

ES1. Dragsters must have two screw eyes per car that meet tolerances, no more. Screw eyes must not make contact with the racing surface. The track string must pass through both screw eyelets, which are located on the center line of the bottom of the car. Glue may be used to reinforce the screw eyes. It is the responsibility of the car designer/engineer to see that the eye screw holes are tightly closed to prevent the track string from slipping out. As with all adjustments, this must be done prior to event check-in.
ES2. Inside diameter ..... 3mm.....5mm
ES3. Distance apart (at farthest points) ..... 150mm..... 270mm

Wheels
W1. A dragster must have four (4) wheels, no more. Two (2) wheels must meet rules W2 and W3. The other two must meet rules W4 and W5. All four wheels must touch the racing surface at the same time. All wheels must roll.
Wheels must be made entirely from plastic. Dimensions must be consistent for the full circumference of the wheel.
W2. Front diameter..... 32mm.....37mm
W3. Front width (at surface contact point)..... 2mm.....5mm
W4. Rear diameter ..... 30mm.....40mm
W5. Rear width (at surface contact point) ..... 15mm.....18mm

CO^2 Car Evaluation Criteria Completed on Powerpoint

NAME _____ **PERIOD** _____
PROJECT PRESENTATION TITLE _____

OK or EXTRA	(Fix This) (Text	Picture)	Not Complete or Do Over	Assignment Sections
____	____	____	____	Title Page
____	____	____	____	Table of Contents (Hyperlinked to Each Section)

Note: All of the following pages must have a Previous and Next Button, and a Home Button Linked to the Table of Contents.

DEFINE THE PROBLEM				**DEFINE THE PROBLEM**
____	____	____	____	Define the Problem
RESEARCH				**RESEARCH**
____	____	____	____	Average Speed Calculation
____	____	____	____	Action Reaction
____	____	____	____	Work
____	____	____	____	Friction
____	____	____	____	Lift
____	____	____	____	Drag
BRAINSTORM				**BRAINSTORM**
____	____	____	____	4 Brainstorm Pictures
BEST OPTION				**BEST OPTION**
				Two Sets of Best Option Pictures:
____	____	____	____	Full Scale Paper Drawing – Top and Side Orthographic Projections (All Dimensions Must Be Included as on the Specification Sheet)
____	____	____	____	Computer Drawings - Orthographic and Isometric Hyperlinked to this Page (All Dimensions Must Be Included as it appears on the Paper Drawing)
____	____	____	____	Best Option Description (Why did you pick it? List At least 3 Reasons)
PROTOTYPE				**PROTOTYPE**
____	____	____	____	Excel Cost Sheet – (Hyperlinked to this Page)
____	____	____	____	Show the Car (or remains) that raced. Use Digital Photograph.
EVALUATION				**EVALUATION**
____	____	____	____	Roll Test Recorded _____ Meters
____	____	____	____	Car Weight Recorded _____ Grams
____	____	____	____	Race Time Recorded _____ Seconds
____	____	____	____	Your Car's Average Speed Calculation - _____ KPH, and _____ MPH

	CONCLUSION			**CONCLUSION**
____	____	____	____	Explain Why Your Car Went as Fast as it Did. (Note: Use the Results of the Above Tests as Evidence.)
____	____	____	____	Which Test Element Effected the Speed the Most? Explain.
____	____	____	____	Show and Explain the Good Points of Your Design
____	____	____	____	Show and Explain the Design Points that need Improvement
	REFLECTION			**REFLECTION**
____	____	____	____	Picture of Future Design
____	____	____	____	Description of Future Design

____	____	____	____	Five Tools Passed
____	**FINAL SCORE**	**____**		**FINAL SCORE -- PASS or FIX (Instructor: _____ Date _____)**