UNIT FRAMEWORK

NAME	GRADE	SUBJECT
Erin Maass Megan Trombetta	6 & 7	Math

UNIT	Unit Rate Speed Challenge

ESSENTIAL QUESTION(S)/OUTCOME(S)

1.) How can you model and solve problems involving unit rates?

2.) How do you write an appropriate conversion factor as a ratio or unit rate?

3.) How can we use ratios and unit rates to prove the success of a design?

4.) How can I solve unit rate problems including those involving unit pricing and constant speed?

TARGETS

I can design and build an aerodynamic prototype to test the rate of speed.

I can be part of a team and be accountable for my responsibilities.

STANDARDS / TOPICS / SKILLS	
SCIENCE/ENGINEERING 3-PS2-2: Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	**TECHNOLOGY** 4: Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative

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 possible solutions. MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints 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. MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	solutions. 5: Computational Thinker: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.
LITERACY (READING, WRITING & SPEAKING) CCSS.ELA-LITERACY.SL.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. CCSS.ELA-LITERACY.WHST.6-8.2.D: Use precise language and domain-specific vocabulary to inform about or explain the topic. CCSS.ELA-LITERACY.WHST.6-8.2 Write informative/explanatory texts, including	**MATH** MP4: Model with mathematics to solve problems that arise in everyday life. MP6: Attend to precision in communication and problem solving. 6.RPA.2: Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. 6.RPA.3: Use ratio and rate reasoning to solve real-world and mathematical problems.

the narration of historical events, **scientific procedures**/ experiments, or technical processes. CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.	

VOCABULARY	MATERIALS / RESOURCES / TEXTS
aerodynamics: The ability of an object to cut through air (or water) efficiently constraint: Limit or restriction on solution or experiment. control: A variable that you are careful to keep the same during an experiment. dependent variable: A variable that changes in value when you change an independent variable. Usually this is the variable about which you collect data during an experiment. drag: Force acting opposite the relative motion of an object. energy efficiency: Being able to do more with less energy (energy can be a natural force). independent variable: A variable you intentionally change in an experiment. Usually, the intent of the experiment is to see how a change in this variable affects the dependent variable. inertia: resistance to change. ratio: proportional (multiplicative) relationship between two quantities. Can be written as decimal or percent. rolling resistance: The force of friction acting on a rolling object by the ground to slow it down. Speed: rate that measures movement. d/t=s unit rate: Rate that compares two quantities,	Explanation of formula for speed. Speed Challenge Worksheet Speed Computation Practice Resources provided by World of Speed for car prototypes (basal wood frame, axle and wheels, random objects to add to car (paper clips, tape, popsicle sticks, paper drinking cups, etc.)

where one of the quantities is one. "How much is there of x if you have 1 y?" variable: Something that can be changed in an experiment.	

ACTIVITIES

Day 1:
Warm Up- Review long division.
Launch- How can we prove who is faster? What do we do to compare rates? What ways can we write a rate (mph or time per mile). Students come up with speed = distance/time.
Practice with real world rate problems.
Possible additional activity: use the airplane activity from STEM camp: Students make paper planes and fly them. "What factors affect distance?"
Wrap Up conversation: what way of writing a rate makes the most sense? Should your speed by > or < 1?
Introduce project (Video WOS website What is the world of speed? How will this relate to the STEM project?).

Day 2:
Warm Up- Compare rates by turning into unit rates
Practice with Speed challenge (students gather data based on experimental rates of walking, hopping, etc. and calculate rates).
Introduce partners.
Project management mini lesson. Assign group roles.
Team building activities

Day 3:
Warm up: match the graph with the table.
Practice with Rates problems while one group at a time tests design.
Record test data, refine project. Retest.
Possible racing in cafeteria with two classes at once.

Day 4:
Warm Up: Filling in a table
Extend rates to predict future: distance in an hr, 10 hrs, etc?

Graph data. Compare lines and discuss?
Mini assessment
Practice, rubric with Self assessment (completed checklist), peer review, data collection, graph.

Day 5:
Field trip: history of speed scavenger hunt, test and compare designs. Add data to previous data collections/recording.
Group work reflection and self/peer assessment.

Conversation Prompts:

1. How do you find the average of a data set?
2. What does this have to do with with the formula for average speed?
3. How can speed be a kind of average?

COMMUNITY PARTNERS (industries, businesses, agencies, colleges, universities)

R. Lewis Ferguson, Director of Education at World of Speed
http://www.worldofspeed.org/school-visits/
503.563.6440

STEM ATTRIBUTES

STEM ATTRIBUTES	EVIDENCE / EXAMPLES
Integrates Science, Technology, Engineering, and Math.	Within collaborative teams, students will make observations about different Pinewood Derby race cars, discussing design, weight and shape. Students will then design and create a race car, testing the car and recording the speed on a track. Students will calculate the average speed and use the rate of speed to make predictions about longer travel distances. Students will discuss the different ways of writing rates and which makes the most sense in a specific situation. Students will use stopwatches to record the speed of the cars and share results/reflect and record data on google docs.
Develops communication and literacy skills.	Students will reflect individually, as well as participate in discussion with a peer, group and whole class. Students will write prediction, an end of unit reflection, as well as group reflection of individual participation and group

	participation.
Provides authentic, real-world experiences through contextual learning (may include active citizenship).	As part of this unit students will take a museum tour at WofS with a knowledgeable docent, looking at the design, function and form of racing vehicles and how they have changed through the decades. The tour covers the major parts of our exhibits and highlights specific race car drivers, historical events, and cars that made great strides in the field of racing.
Forms partnerships with business, industry, agencies, and nonprofits (may occur outside the school).	R. Lewis Ferguson, Director of Education at World of Speed Our students will be taking a field trip to the World of Speed location, to explore the science of racing. Students will discover the "3 Ds of Racing" experimenting with drag, downforce and drafting using a series of hands-on experiments. Students make observations about different Pinewood Derby race cars, discussing design, weight and shape, and then predict which one will finish first. After that, engineering takes center stage as students work in collaborative groups to design their own race cars.
Provides career awareness through postsecondary and career relevant connections.	Students will receive career awareness of mechanics and technical training. They will have a chance to view featured exhibits such as women in racing, the history of racing/speed and the mechanics of racing.
Fosters problem-solving, critical thinking, and argumentation skills through inquiry and design.	Derby race cars, discussing design, weight and shape, and then predict which one will finish first. After that, engineering takes center stage as

	students work in collaborative groups to design their own race cars.
Includes effective instructional strategies that develop collaboration and teamwork.	Students will work with peers and a group of four other students to create a car design and modify the design multiple times. Within these groupings, students will have group roles with specific responsibilities. Students will write a prediction, an end of unit reflection, as well as group reflection of individual participation and group participation. Students will work in collaborative groups to design their own race cars and then modify the design to create a more optimal prototype.
Uses equitable instructional practices that are inclusive to all students regardless of gender, disability, ethnicity, race, language, socioeconomic status, gender identity and sexual orientation.	Begin project with overview of project management. Follow up with team building exercises to build relationship within groups. Each group member is responsible for a group role with clearly explained and practiced tasks. At the end of the project, students will self reflect and assess peers on group work skills. At World of Speed museum, students will interact with professionals of diverse gender identities. During background knowledge lessons, students will see professionals of diverse racial, ethnic and gender identities. Teacher will acknowledge gender assumptions and stereotypes that may surround technical and automotive careers. Science and math vocabulary will be pre-assessed and taught using SIOP

	strategies. Students will self choose pairs, teacher will match pairs to create groups of 4 with varied skill levels.
Uses standards-based performance/proficiency assessments.	This project will be part of a three week unit on rates/unit rates. Students will have a pre-assessment covering the math skills. At the beginning of the STEM project, students will participate in an activity to assess their prior knowledge of science concepts. At the end of the project, students will have a post-assessment covering the math skills of the entire unit, including the practical application of the math in the STEM project. Students will be assessed on their collaboration, design, and communication skills separately; a 4 point rubric will be used to score these skills for a "project" grade.