CoMPASS – Fun with Roller Coasters Work, Energy, Forces & Motion

Content, Activities, Practices & Standards (CAPS) Guide

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	Overall Challenge					
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:		
Initial Roller Coaster Ideas Page 7	All areas of the Content are addressed in the design of the roller coaster (see individual coaster sections	PS2.A; PS3.A – D; ETS1.A-C All Relevant Content Standards are Addressed by the Roller Coaster Design Process	Developing models & designing solutions	WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.10: write over extended and short time frames for discipline specific tasks		
Initial Drop Roller Coaster Ideas Check-In Page 52 Hills and Loops Roller Coaster Ideas Check-In Page 73	for details)	the Roller Coaster Design Process	Refining models, redesigning solutions & obtaining evaluating and communicating information	Integration of Knowledge and Ideas 7: combine words and text with visual representations WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.5: plan, revise, edit, rewrite and try new approach WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks		
Final Letter - Design Proposal Pages 90 - 95			Developing and using models, engaging in argument from evidence & communicating information	Integration of Knowledge and Ideas 7: combine words and text with visual representations WHST.6-8.1.A,B,C,D: write arguments focused on discipline specific content WHST.6-8.2.A,B,C,D,E,F: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.5: plan, revise, edit, rewrite and try new approach WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks		



		Unit I	Framing	
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:
Concept Map Pages 3 - 4	Eliciting students' prior knowledge and misconceptions about physics content related to roller coasters; content dependant on students' prior knowledge	PS2.A; PS3.A – D This activity provides the teacher with an understanding of students' current knowledge in relation to all relevant content standards Standards covered will depend on student prior knowledge	Determining prior knowledge	Integration of Knowledge and Ideas 7: combine words and text with visual representations
Design Challenge Introduction Page 5	Content and design expectations are identified	ETS1.A: defining a design task involves identifying constraints and relevant science concepts	Obtaining (evaluating) information, determining design constraints & determining prior knowledge	
Dream Team Page 6	Group work expectations		Collaboration	
Initial Roller Coaster Ideas Page 7	Eliciting students' prior knowledge and misconceptions about content related to roller coasters; content dependant on students' prior knowledge	PS2.A; PS3. A – D This activity provides the teacher with an understanding of students' current knowledge in relation to all relevant content standards and their application to the design task	Developing models, designing solutions, talking in the genre of science & using evidence to back up ideas	WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.10: write over extended and short time frames for discipline specific tasks
CoMPASS Introduction Page 8 - 9	Visual relationships between core science ideas important in the domain of physics through the use of concept maps in CoMPASS, content dependant on student navigation choices		Learning to use available tools and information sources & using expert maps and models of the domain of physics	



	Explorations Overview				
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:	
Activities: Car Lift Pages 10 - 31		PS2.A: if total force is not zero, motion will change; greater mass needs greater force for same change in motion; to share information with others directions of forces must be described PS3.A: potential (stored) energy depends on relative positions; raising an object increases PE PS3.B: when motion energy changes, other energy changes happen as well; friction can cause transfer to heat energy; making an object move requires energy PS3.C: objects can transfer energy between them PS3.D: machines can be more efficient by reducing friction; friction increases energy transfer through heat ETS1.A: constraints of a design include scientific principles ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; it is necessary to explain solutions to others; models, specifically computers, are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to		Key Ideas and Details 2: find central ideas of text and summarize Key Ideas and Details 3: follow multistep procedure in experiments Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.B,D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks	
		describe solutions, how they were developed, and why they work	-		



	Explorations Overview				
A skiniki s s.	Core science ideas and	Calamaa Fuansannank Standard	Science and	Common Complitation and Multipa Chandender	
Activities:	relationships addressed:	Science Framework Standard:	Engineering Practices:	Common Core Literacy and Writing Standards:	
Initial Drop	Concepts: Mass, Height,	PS2.A: if total force is not zero motion will change	Obtaining (evaluating)	Key Ideas and Details 2: find central ideas of text and summarize	
Pages 32 - 52	Velocity, Gravity,	(here force is gravity)	information, learning to	Key Ideas and Details 3: follow multistep procedure in experiments	
	Acceleration, Energy,	PS3.A: kinetic energy is energy of motion;	use available tools and	Craft and Structure 4: determine meaning of symbols, key terms and	
	Potential Energy, Kinetic	potential energy is energy of position; potential	information sources,	domain specific words and phrases	
	Energy, Friction, Law of	energy decreases when an object is lowered	integrating multiple	Integration of Knowledge and Ideas 7: integrate information from text	
	Conservation of Energy,	PS3.B: when motion of an object changes there is	sources of information,	with visual representations	
	Energy Transfer,	a change in another form of energy at the same	determining prior	Integration of Knowledge and Ideas 9: compare information from	
		time	knowledge, asking	experiments with text on the same topic	
	Relationships: Mass &	PS3.C: gravitational force allows storing of energy	questions, defining	Range of Reading and Level of Text Complexity 10: comprehend	
	Velocity, Mass & Kinetic	as potential when an object is raised; potential	problems, planning	science/technical text at 6 – 8 level	
	Energy, Height & Velocity,	energy is converted to kinetic energy as an object	investigations, carrying	WHST.6-8.1.A,B: write arguments focused on discipline specific content	
	Height & Kinetic Energy,	falls	out investigations,	WHST.6-8.2.B,D: write informative texts	
	Velocity & Acceleration,	ETS1.A: more precise constraints provide better	analyzing and interpreting	WHST.6-8.4: produce clear and coherent writing with development	
	Law of Conservation of	solutions; constraints of a design include scientific	data, engaging in	organization and style appropriate to task, purpose and audience	
	Energy & PE/KE	principles	argument from evidence,	WHST.6-8.7: research to answer a question using several sources and	
		ETS1.B: solutions need to be tested; evaluation of	developing and using	develop questions that allow for exploration	
		solutions should be done systematically;	models, constructing	WHST.6-8.8: gather information from print and digital sources; assess	
		sometimes solutions can be combined; it is	explanations and	credibility and accuracy and paraphrase	
		necessary to explain solutions to others; models of	designing solutions,	WHST.6-8.9: draw evidence from text to support analysis, reflection and	
		all kinds are helpful for testing solutions;	presenting information,	research	
		simulations allow prediction and improvements	talking in the genre of	WHST.6-8.10: write over extended and short time frames for discipline	
		ETS1.C: systematically evaluate solutions based on	science, using expert	specific tasks	
		criteria and constraints; compare designs and test	maps and models of the		
		to see which is best; promising solutions are found	domain of physics & using		
		through an iterative process; it is important to	mathematics, information		
		describe solutions, how they were developed, and	and computer technology,		
		why they work	and computational		
			thinking		



	Explorations Overview				
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:	
Hills Pages 53 - 73	Concepts: Newton's 1st Law, Newton's 2nd Law, Newton's 3rd Law, Height, Direction, Force, Acceleration, Velocity, Potential Energy, Kinetic Energy Relationships: Newton's 1st Law & Acceleration (change in direction), Newton's 2nd Law & Acceleration, Velocity & Acceleration, Acceleration & Force, Direction & Velocity, Direction & Force	PS2.A: Newton's 3rd law; changes in motion are determined by the sum of forces (net force); a larger net force causes a larger change in motion; forces can change direction; information about positions and forces must be described to share with others PS3.A: kinetic energy is energy of motion; potential energy is energy of position; potential energy decreases when an object is lowered PS3.B: when motion of an object changes there is a change in another form of energy at the same time ETS1.A: more precise constraints provide better solutions; constraints of a design include scientific principles ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions; how they were developed and why they work	Obtaining (evaluating) information, learning to use available tools and information sources, integrating multiple sources of information, determining prior knowledge, asking questions, defining problems, planning investigations, carrying out investigations, analyzing and interpreting data, engaging in argument from evidence, developing and using models, constructing explanations and designing solutions, presenting information, using and comparing multiple models and representations, talking in the genre of science, using expert maps and models of the domain of physics & using mathematics, information and computer technology, and computational thinking	Key Ideas and Details 2: find central ideas of text and summarize Key Ideas and Details 3: follow multistep procedure in experiments Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 7: integrate information from text with visual representations Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.B,D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks	



	Explorations Overview				
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:	
Stop That Car Pages 74 - 86	relationships addressed: Concepts: Newton's 1st Law, Newton's 2nd Law, Mass, Height, Force, Acceleration, Velocity, Potential Energy, Kinetic Energy, Law of Conservation of Energy, Energy Transfer, Friction Relationships: Force & Acceleration in both 1st and 2nd law, KE & Velocity, Mass & Force, Height &	PS2.A: motion is determined by total forces; heavier objects require greater force for same change in motion; larger forces cause larger changes in motion; information about positions and forces must be described to share with others PS3.A: kinetic energy is energy of motion; potential energy is energy of position; potential energy decreases when an object is lowered PS3.B: when motion changes there is some other change in energy; friction causes transfer of energy to heat; friction causes slowing by transferring energy away PS3.C: when two objects interact forces can	Engineering Practices: Obtaining (evaluating) information, learning to use available tools and information sources, integrating multiple sources of information, determining prior knowledge, asking questions, defining problems, planning investigations, carrying out investigations, analyzing and interpreting	Key Ideas and Details 2: find central ideas of text and summarize Key Ideas and Details 3: follow multistep procedure in experiments Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 7: integrate information from text with visual representations Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.B,D: write informative texts WHST.6-8.4: produce clear and coherent writing with development	
	Velocity, Velocity & Acceleration, Velocity & Stopping Distance, Height & PE, PE & Velocity	transfer energy between them ETS1.A: more precise constraints provide better solutions; constraints of a design include scientific principles ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions; how they were developed and why they work	data, engaging in argument from evidence, developing and using models, constructing explanations and designing solutions, presenting information, talking in the genre of science, using expert maps and models of the domain of physics & using mathematics, information and computer technology, and computational thinking	organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks	



	Final Design					
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:		
Final Design Hands On Fun Experiment Page 87 - 88	Exploration of physics ideas learned in the unit by checking designs and adding additional elements for fun	PS2.A; PS3.A – D; ETS1.A-C All Relevant Content Standards are Addressed by the Final Design Process	Designing and evaluating solutions, carrying out investigations, analyzing and interpreting data, engaging in argument from evidence, talking in the genre of science, using models of the domain of physics & developing, refining and using models	Key Ideas and Details 3: follow multistep procedure in experiments Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience		
Final Design Whole Class Discussion Page 89	Eliciting students' final understanding of physics content related to roller coasters and the relationship between different models		Presenting information, asking questions, defining problems, engaging in argument from evidence, talking in the genre of science & evaluating the affordances of different models	WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks		
Final Design Proposal Framing and Instructions Page 90	Content and design expectations are reiterated		Obtaining (evaluating) information, determining design constraints & determining prior knowledge			
Final Design Proposal Diagram Page 91	Eliciting students' final understanding of physics content related to roller coasters and the relationship between the content and the design task		Developing and using models, engaging in argument from evidence, communicating information, using visual representations, talking in	Integration of Knowledge and Ideas 7: combine words and text with visual representations		
Engineer Proofs Pages 92 - 93	Eliciting students' final understanding of physics content related to roller coasters and the relationship between the content and the design task		the genre of science & using models of the domain of physics	Integration of Knowledge and Ideas 7: combine words and text with visual representations WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.A,B,D: write informative texts WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks		



Written Design Proposal Pages 94 - 95	Eliciting students' final understanding of physics content related to roller coasters and the relationship between the content and the design task		WHST.6-8.1.A,B,C,D: write arguments focused on discipline specific content WHST.6-8.2.A,B,C,D,E,F: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.5: plan, revise, edit, rewrite and try new approach WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and
			research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Final Concept Map Page 96	Eliciting students' final understanding of physics content related to roller coasters	Communicating understanding of science concepts, using visual representations & using maps and models of the domain of physics	Integration of Knowledge and Ideas 7: combine words and text with visual representations; Integration of Knowledge and Ideas 9 WHST.6-8.2: write informative texts



	Car Lift – Detail					
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:		
Reading Excursion #1 Pages 10 - 13	Concepts: Mass, Weight, Mass vs. Weight, Speed, Velocity, Speed vs. Velocity, Force, Types of Forces, Force Vectors, Net Force, Work, Energy	PS2.A: to share information with others directions of forces must be described PS3.C: objects exert forces on each other	Obtaining (evaluating) information & learning to use available tools and information sources	Key Ideas and Details 2: find central ideas of text and summarize Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research		
Car Lift Introduction and Brainstorming Page 14	Eliciting students' initial understanding of and misconceptions about physics content relevant to the Car Lift	ETS1.A: defining a design task involves identifying constraints and relevant science concepts	Obtaining (evaluating) information, determining design constraints, determining prior knowledge, talking in the genre of science & using evidence to back up ideas	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience		
Car Lift Brain Warm Up Page 15	Eliciting students' initial understanding of and misconceptions about physics content relevant to Car Lift, introduction to concepts and relationships relevant for the Car Lift.	PS2.A: greater mass needs greater force for same change in motion PS3.A: potential (stored) energy depends on relative positions; raising an object increases PE PS3.B: when motion energy changes, other energy changes happen as well; friction can cause transfer to heat energy; making an object move requires energy PS3.C: objects can transfer energy between them PS3.D: machines can be more efficient by reducing friction; friction increases energy transfer through heat	Determining prior knowledge			
Car Lift Questions Page 16	Eliciting students' initial understanding of and misconceptions about physics content relevant to Car Lift	Standards covered will be based on student choices	Asking questions, defining problems & talking in the genre of science	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.10: write over extended and short time frames for discipline specific tasks		



Car Lift CoMPASS Research Page 17 - 18	Visual relationships between core science ideas in the domain of physics important to the design of the Car Lift through the use of concept maps in CoMPASS, content dependant on student navigation choices	Standards covered will be based on student choices	Obtaining (evaluating) information & using expert maps and models of the domain of physics	Key Ideas and Details 2: find central ideas of text and summarize Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Car Lift Mass Hypothesis Page 19	Concepts: Mass, Applied Force, Work, Potential Energy Relationships: Mass & Applied Force, Mass & Work, Mass & Potential Energy, Work & Potential Energy	PS2.A: if total force is not zero motion will change; greater mass needs greater force for same change in motion; to share information with others directions of forces must be described PS3.A: potential (stored) energy depends on relative positions; raising an object increases PE PS3.B: making an object move requires energy ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; it is necessary to explain solutions to others; models,	Planning investigations	WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Car Lift Mass Simulation Experiment Page 20 - 22		specifically computers, are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Carrying out investigations, talking in the genre of science, using expert models of the domain of physics, analyzing and interpreting data, engaging in argument from evidence & using mathematics, information and computer technology, and computational thinking	Key Ideas and Details 3: follow multistep procedure in experiments Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks



Car Lift Height Hypothesis Page 23	Concepts: Height, Applied Force, Work, Potential Energy Relationships: Height & Work, Height & Potential Energy, Work & Potential Energy	PS2.A: if total force is not zero motion will change; and to share information with others directions of forces must be described PS3.A: potential energy depends on relative positions; raising an object increases PE PS3.B: making an object move requires energy ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; it is necessary to explain solutions to others; models, specifically computers, are helpful for testing	Planning investigations	WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Car Lift Height Simulation		solutions; simulations allow prediction and improvements	Carrying out investigations, talking in	Key Ideas and Details 3: follow multistep procedure in experiments Integration of Knowledge and Ideas 9: compare information from
Experiment		ETS1.C: systematically evaluate solutions based on	the genre of science,	experiments with text on the same topic
Pages 24 - 25		criteria and constraints; compare designs and test	using expert models of	WHST.6-8.1.A,B: write arguments focused on discipline specific content
1 ugc3 2 + 23		to see which is best; promising solutions are found	the domain of physics,	WHST.6-8.2.D: write informative texts
1		through an iterative process; it is important to	analyzing and interpreting	WHST.6-8.4: produce clear and coherent writing with development
1		describe solutions, how they were developed, and	data, engaging in	organization and style appropriate to task, purpose and audience
1		why they work	argument from evidence	WHST.6-8.7: research to answer a question using several sources and
1			& using mathematics,	develop questions that allow for exploration
1			information and computer	WHST.6-8.9: draw evidence from text to support analysis, reflection and
1			technology, and	research
1			computational thinking	WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Car Lift Surface	Concepts: Friction, Applied	PS2.A: if total force is not zero motion will change;	Planning investigations	WHST.6-8.1.A,B: write arguments focused on discipline specific content
Hypothesis	Force, Work, Potential	and to share information with others directions of	Fidining investigations	WHST.6-8.2.D: write informative texts
Page 25 (at end	Energy, Efficiency	forces must be described		WHST.6-8.4: produce clear and coherent writing with development
of "Thinking	<i>517</i>	PS3.B: when motion energy changes other energy		organization and style appropriate to task, purpose and audience
about Roller	Relationships: Friction &	changes happen as well; friction can cause transfer		WHST.6-8.7: research to answer a question using several sources and
Coaster Ramp	Applied Force, Friction &	to heat energy; making an object move requires		develop questions that allow for exploration
Height")	Work; Friction & Potential	energy		WHST.6-8.9: draw evidence from text to support analysis, reflection and
1	Energy, Friction &	PS3.C: objects can transfer energy between them		research
1	Efficiency, Work &	PS3.D: machines can be more efficient by reducing		WHST.6-8.10: write over extended and short time frames for discipline
Car Lift Surface	Potential Energy	friction; friction increases energy transfer through heat	Committee and	specific tasks Key Ideas and Details 3: follow multistep procedure in experiments
Simulation		ETS1.B: solutions need to be tested; evaluation of	Carrying out investigations, talking in	Integration of Knowledge and Ideas 9: compare information from
Experiment		solutions should be done systematically; it is	the genre of science,	experiments with text on the same topic
Pages 26 - 27		necessary to explain solutions to others; models,	using expert models of	WHST.6-8.1.A,B: write arguments focused on discipline specific content
		specifically computers, are helpful for testing	the domain of physics,	WHST.6-8.2.D: write informative texts
		solutions; simulations allow prediction and	analyzing and interpreting	WHST.6-8.4: produce clear and coherent writing with development
		improvements	data, engaging in	organization and style appropriate to task, purpose and audience
		ETS1.C: systematically evaluate solutions based on	argument from evidence	WHST.6-8.7: research to answer a question using several sources and
1		criteria and constraints; compare designs and test	& using mathematics,	develop questions that allow for exploration
·				
		to see which is best; promising solutions are found	information and computer	WHST.6-8.9: draw evidence from text to support analysis, reflection and
		to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and	information and computer technology, and computational thinking	WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline



Reading Excursion #2 Page 28	Concepts: Efficiency, Friction, Energy Transfer, Force, Work, Potential Energy Relationships: Efficiency & Friction, Efficiency & Energy Transfer, Efficiency & Force, Efficiency & Work, Efficiency & Potential Energy; Work & Potential Energy	PS3.B: when motion energy changes other energy changes happen as well; for example friction can cause transfer to heat energy; also making an object move requires energy PS3.C: objects can transfer energy between them PS3.D: machines can be more efficient by reducing friction; friction increases energy transfer through heat	Obtaining (evaluating) information, analyzing and interpreting data, engaging in argument from evidence & using mathematics, information and computer technology, and computational thinking	Key Ideas and Details 2: find central ideas of text and summarize Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research
Car Lift What did we Learn Page 29	Concepts: Height, Mass, Friction, Potential Energy, Work, Efficiency Relationships: Height & Potential Energy, Mass & Potential Energy, Friction & Work, Friction & Potential Energy, Efficiency & Friction	PS3.A: potential (stored) energy depends on relative positions; raising an object increases PE PS3.B: when motion energy changes, other energy changes happen as well; friction can cause transfer to heat energy; making an object move requires energy PS3.C: objects can transfer energy between them PS3.D: machines can be more efficient by reducing friction; friction increases energy transfer through heat	Analyzing and interpreting data, engaging in argument from evidence, talking in the genre of science & using mathematics, information and computer technology, and computational thinking	Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1: write arguments focused on discipline specific content WHST.6-8.2: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research
Design Specification Statement Page 29 (at end of What did we Learn)	Eliciting students' current understanding of and misconceptions about physics content relevant to the Car Lift and its relationship to the design task	ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process	Developing and using models, constructing explanations, designing solutions, talking in the genre of science & using evidence to back up ideas	
Car Lift Whole Class Discussion Page 30 - 31	Eliciting students' current understanding of and misconceptions about physics content relevant to the Car Lift	Standards covered will be guided by student input; please refer to the above standards for ideas on content that can be addressed during the whole class discussion	Presenting information, asking questions, defining problems, engaging in argument from evidence & talking in the genre of science	Key Ideas and Details 2: find central ideas of text and summarize Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.8: assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks



		Initial Di	op – Detail	
Activities:	Core science ideas and relationships addressed	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:
Initial Drop Introduction and Brainstorming Page 32	Eliciting students' developing understanding of and misconceptions about physics content relevant to the Initial Drop	ETS1.A: defining a design task involves identifying constraints and relevant science concepts	Obtaining (evaluating) information, determining design constraints, determining prior knowledge, talking in the genre of science & using evidence to back up ideas	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience
Initial Drop Brain Warm Up Page 33	Eliciting students' developing understanding of and misconceptions about physics content relevant to the Initial Drop, introduction to concepts and relationships relevant for the Initial Drop	PS2.A: if total force is not zero motion will change (here force is gravity) PS3.A: kinetic energy is energy of motion; potential energy is energy of position; potential energy decreases when an object is lowered PS3.B: when motion of an object changes there is a change in another form of energy at the same time PS3.C: gravitational force allows storing of energy as potential when an object is raised; potential energy is converted to kinetic energy as an object falls	Determining prior knowledge	
Initial Drop Questions Page 34	Eliciting students' developing understanding of and misconceptions about physics content relevant to the Initial Drop	Standards covered will be based on student choices	Asking questions, defining problems & talking in the genre of science	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Initial Drop CoMPASS Research Pages 35 - 36	Visual relationships between core science ideas in the domain of physics important to the design of the Initial Drop through the use of concept maps in CoMPASS, content dependant on student navigation choices	Standards covered will be based on student choices	Obtaining (evaluating) information & using expert maps and models of the domain of physics	Key Ideas and Details 2: find central ideas of text and summarize Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks



Initial Drop	Concepts: Height, Velocity,	PS2.A: if total force is not zero motion will change	Planning investigations	WHST.6-8.1.A,B: write arguments focused on discipline specific content
Height	Gravity, Acceleration,	(here force is gravity)	The state of the s	WHST.6-8.2.D: write informative texts
Hypothesis	Energy, Potential Energy,	PS3.A: kinetic energy is energy of motion;		WHST.6-8.4: produce clear and coherent writing with development
Page 37	Kinetic Energy, Law of	potential energy is energy of position; potential		organization and style appropriate to task, purpose and audience
	Conservation of Energy,	energy decreases when an object is lowered		WHST.6-8.7: research to answer a question using several sources and
	Energy Transfer	PS3.B: when motion of an object changes there is		develop questions that allow for exploration
		a change in another form of energy at the same		WHST.6-8.9: draw evidence from text to support analysis, reflection and
	Relationships: Height &	time		research
	Velocity, Height & Kinetic	PS3.C: gravitational force allows storing of energy		WHST.6-8.10: write over extended and short time frames for discipline
	Energy, Velocity &	as potential when an object is raised; potential		specific tasks
Initial Drop	Acceleration, Law of	energy is converted to kinetic energy as an object	Carrying out	Key Ideas and Details 3: follow multistep procedure in experiments
Height	Conservation of Energy &	falls	investigations, talking in	Integration of Knowledge and Ideas 9: compare information from
Simulation	PE/KE	ETS1.B: solutions need to be tested; evaluation of	the genre of science,	experiments with text on the same topic
Experiment		solutions should be done systematically;	using expert models of	WHST.6-8.1.A,B: write arguments focused on discipline specific content
Pages 38 - 40		sometimes solutions can be combined; it is	the domain of physics,	WHST.6-8.2.D: write informative texts
		necessary to explain solutions to others; models of	analyzing and interpreting	WHST.6-8.4: produce clear and coherent writing with development
		all kinds are helpful for testing solutions;	data, engaging in	organization and style appropriate to task, purpose and audience
		simulations allow prediction and improvements	arguments from evidence	WHST.6-8.7: research to answer a question using several sources and
		ETS1.C: systematically evaluate solutions based on	& using mathematics,	develop questions that allow for exploration
		criteria and constraints; compare designs and test	information and computer	WHST.6-8.9: draw evidence from text to support analysis, reflection and
		to see which is best; promising solutions are found	technology, and	research
		through an iterative process; it is important to	computational thinking,	WHST.6-8.10: write over extended and short time frames for discipline
		describe solutions, how they were developed, and		specific tasks
Lateral David	Consense Mana Valentin	why they work	Diam're town time time	WHIST COAA P. William and S. Coard and Brainline and S. Coard
Initial Drop	Concepts: Mass, Velocity,	PS3.A: kinetic energy is energy of motion;	Planning Investigations	WHST.6-8.1.A,B: write arguments focused on discipline specific content
Mass	Energy, Potential Energy,	potential energy is energy of position; potential		WHST.6-8.2.D: write informative texts
Hypothesis	Kinetic Energy, Law of	energy decreases when an object is lowered		WHST.6-8.4: produce clear and coherent writing with development
Page 41	Conservation of Energy,	PS3.B: when motion of an object changes there is		organization and style appropriate to task, purpose and audience
	Energy Transfer	a change in another form of energy at the same time		WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration
	Relationships: Mass &	PS3.C: gravitational force allows storing of energy		WHST.6-8.9: draw evidence from text to support analysis, reflection and
	Velocity, Mass & Kinetic	as potential when an object is raised; potential		research
	Energy, Law of	energy is converted to kinetic energy as an object		WHST.6-8.10: write over extended and short time frames for discipline
	Conservation of Energy &	falls		specific tasks
Initial Drop	PE/KE	ETS1.B: solutions need to be tested; evaluation of	Carrying out	Key Ideas and Details 3: follow multistep procedure in experiments
Mass	T L/ KL	solutions should be done systematically;	investigations, talking in	Integration of Knowledge and Ideas 9: compare information from
Simulation		sometimes solutions can be combined; it is	the genre of science,	experiments with text on the same topic
Experiment		necessary to explain solutions to others; models of	using expert models of	WHST.6-8.1.A,B: write arguments focused on discipline specific content
Lxperiment				
Page 12 - 11		I all kinds are helpful for testing solutions:	I the domain of physics	I WHST 6-8 2 D. write intormative texts
Page 42 - 44		all kinds are helpful for testing solutions;	the domain of physics,	WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development
Page 42 - 44		simulations allow prediction and improvements	analyzing and interpreting	WHST.6-8.4: produce clear and coherent writing with development
Page 42 - 44		simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on	analyzing and interpreting data, engaging in	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience
Page 42 - 44		simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test	analyzing and interpreting data, engaging in arguments from evidence	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and
Page 42 - 44		simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found	analyzing and interpreting data, engaging in arguments from evidence & using mathematics,	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration
Page 42 - 44		simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to	analyzing and interpreting data, engaging in arguments from evidence & using mathematics, information and computer	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and
Page 42 - 44		simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found	analyzing and interpreting data, engaging in arguments from evidence & using mathematics,	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration



Initial Drop Hands On Fun Experiment Pages 44 - 46	Concepts: Mass, Height, Velocity, Gravity, Acceleration, Energy, Potential Energy, Kinetic Energy, Friction, Law of Conservation of Energy, Energy Transfer, Relationships: Mass & Velocity, Mass & Kinetic Energy, Height & Velocity, Height & Kinetic Energy, Velocity & Acceleration, Law of Conservation of Energy & PE/KE Note: They will not be able to make quantitative evaluations of velocity, acceleration or kinetic energy, however they	PS2.A: if total force is not zero motion will change (here force is gravity) PS3.A: kinetic energy is energy of motion; potential energy is energy of position; potential energy decreases when an object is lowered PS3.B: when motion of an object changes there is a change in another form of energy at the same time PS3.C: gravitational force allows storing of energy as potential when an object is raised; potential energy is converted to kinetic energy as an object falls ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found	Planning and carrying out investigations, comparing models, talking in the genre of science, using evidence to back up ideas, using models of the domain of physics & designing models	Key Ideas and Details 3: follow multistep procedure in experiments Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research
Reading Excursion #3 Pages 47 - 48	should be able to make qualitative observations Content: Law of Conservation of Energy, Energy Transfer, Potential Energy, Kinetic Energy Relationships: Law of Conservation of Energy & PE/KE, Energy Transfer & PE/KE	through an iterative process; it is important to describe solutions, how they were developed, and why they work PS3.A: kinetic energy is energy of motion; potential energy is energy of position; potential energy decreases when an object is lowered PS3.B: when motion of an object changes there is a change in another form of energy at the same time PS3.C: gravitational force allows storing of energy as potential when an object is raised; potential energy is converted to kinetic energy as an object falls		Key Ideas and Details 2: find central ideas of text and summarize Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research



Initial Drop What did we Learn Pages 49	Eliciting students' current understanding of and misconceptions about physics content relevant to the Car Lift and the Initial Drop and its relationship to the design task	ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Constructing explanations, designing and redesigning solutions, talking in the genre of science, using evidence to back up ideas & developing, refining and using models,	WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Initial Drop Whole Class Discussion Pages 50 - 51	Eliciting students' current understanding of and misconceptions about physics content relevant to the Initial Drop	Standards covered will be guided by student input; please refer to the above standards for ideas on content that can be addressed during the whole class discussion	Presenting information, asking questions, defining problems, engaging in argument from evidence & talking in the genre of science	Key Ideas and Details 2: find central ideas of text and summarize Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.8: assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Roller Coaster Ideas Check-In Page 52	Eliciting students' current understanding and misconceptions about content related to the Car Lift and the Initial Drop, and about the relationship between the content and the design task; content dependant on students' prior knowledge	ETS1.A: more precise constraints provide better solutions; constraints of a design include scientific principles ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Developing and refining models, designing and redesigning solutions, obtaining evaluating and communicating information, using visual representations, talking in the genre of science, using evidence to back up ideas & using models of the domain of physics	Integration of Knowledge and Ideas 7: integrate information from text with visual representations Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.5: plan, revise, edit, rewrite and try new approach WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks



		Hill -	- Detail	
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:
Reading Excursion #4 Pages 53 - 54	Concepts: Newton's 1st Law, Newton's 2nd Law, Newton's 3rd Law, Force, Acceleration Relationships: Newton's 2nd Law & Acceleration, Acceleration & Force	PS2.A: Newton's 3rd law; changes in motion are determined by the sum of forces (net force); a larger net force causes a larger change in motion		Key Ideas and Details 2: find central ideas of text and summarize Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research
Our Hill Introduction and KWL Brainstorm Page 55 and 56	Eliciting students' developing understanding of and misconceptions about physics content relevant to the Hill, introduction to concepts and relationships relevant for the Hill	PS2.A: Changes in motion are determined by sum of forces (net force); larger net force causes larger change in motion; forces can change direction PS3.A: kinetic energy is energy of motion; potential energy is energy of position; potential energy decreases when an object is lowered PS3.B: when motion of an object changes there is a change in another form of energy at the same time	Obtaining (evaluating information, determining design constraints, determining prior knowledge & talking in the genre of science	WHST.6-8.1.A: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research
Our Hill CoMPASS Research Pages 57 - 58	Visual relationships between core science ideas in the domain of physics important to the design of the Hill through the use of concept maps in CoMPASS, content dependant on student navigation choices	Standards covered will be based on student choices	Obtaining (relevant) information & using expert maps and models of the domain of physics	Key Ideas and Details 2: find central ideas of text and summarize Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks



Hill Height Hypothesis Page 59 - 60	Concepts: Newton's 1st Law, Newton's 2nd Law, Height, Force, Acceleration, Velocity, Potential Energy, Kinetic Energy, Law of Conservation of Energy Relationships: Newton's 2nd Law & Acceleration, Velocity & Acceleration,	PS2.A: changes in motion are determined by the sum of forces (net force); a larger net force causes a larger change in motion; forces can change direction; information about positions and forces must be described to share with others PS3.A: kinetic energy is energy of motion; potential energy is energy of position; potential energy decreases when an object is lowered PS3.B: when motion of an object changes there is a change in another form of energy at the same	Planning investigations	WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Hill Height Simulation Experiment Pages 61 - 62	Acceleration & Force	time ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best, promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Carrying out investigations, talking in the genre of science, analyzing and interpreting data, engaging in argument from evidence, using expert models of the domain of physics & using mathematics, information and computer technology, and computational thinking	Key Ideas and Details 3: follow multistep procedure in experiments Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Hill Shape Hypothesis Page 63	Concepts: Newton's 1st Law, Newton's 2nd Law, Direction, Shape, Force, Acceleration, Velocity, Potential Energy, Kinetic Energy Relationships: Newton's 1st Law & Acceleration (change in direction),	PS2.A: change in motion determined by sum of forces; a larger force causes a larger change in motion; forces can change direction; information about positions and forces must be described to share with others PS3.A: kinetic energy is energy of motion; potential energy is energy of position; potential energy decreases when an object is lowered PS3.B: when motion of an object changes there is a change in another form of energy at the same	Planning investigations	WHST.6-8.1: write arguments focused on discipline specific content WHST.6-8.2: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Hill Shape Simulation Experiment Page 64 - 65	Newton's 2nd Law & Acceleration, Velocity & Acceleration, Acceleration & Force, Shape & Direction, Direction & Acceleration, Direction & Velocity	time ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Planning and carrying out investigations, talking in the genre of science, using expert models of the domain of physics, analyzing and interpreting data, engaging in argument from evidence & using mathematics, information and computer technology, and computational thinking	Key Ideas and Details 3: follow multistep procedure in experiments Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks



Our Hill What did we Learn Pages 66	Eliciting students' current understanding of and misconceptions about physics content relevant to the Car Lift, Initial Drop and the Hill, and its relationship to the design task	ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Constructing explanations, designing and redesigning solutions, talking in the genre of science, using evidence to back up ideas & developing, refining and using models,	WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Hill Hands On Fun Experiment Pages 67 - 68	Concepts: Height, Shape, Force, Acceleration, Velocity, Potential Energy, Kinetic Energy, Friction Relationships: Newton's 1st Law & Acceleration (change in direction), Newton's 2nd Law & Acceleration, Velocity & Acceleration, Acceleration & Force Note: They will not be able to make quantitative evaluations of velocity, acceleration or kinetic energy, however they should be able to make qualitative observations	PS2.A: forces can change direction PS3.B: when motion of an object changes there is a change in another form of energy at the same time ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Planning and carrying out investigations, comparing models, talking in the genre of science, using models of the domain of physics & designing models	Key Ideas and Details 3: follow multistep procedure in experiments Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research
Optional Loop Hands On Fun Experiment Pages 69 - 70	Concepts: Circular Motion and Experimentation with Loops in General, Friction Note: They will not be able to make quantitative evaluations of velocity, acceleration or kinetic energy, however they should be able to make qualitative observations	PS2.A: forces can change direction PS3.B: when motion of an object changes there is a change in another form of energy at the same time ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Planning and carrying out investigations, comparing models, talking in the genre of science, using models of the domain of physics & designing models	Key Ideas and Details 3: follow multistep procedure in experiments Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1: write arguments focused on discipline specific content WHST.6-8.2: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research



Hills Whole Class Discussion Pages 71 - 72	Eliciting students' current understanding of and misconceptions about physics content relevant to the Hill	Standards covered will be guided by student input; please refer to the above standards for ideas on content that can be addressed during the whole class discussion	Presenting information, asking questions, defining problems, engaging in argument from evidence & talking in the genre of science	Key Ideas and Details 2: find central ideas of text and summarize Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.8: assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Roller Coaster Ideas Check-In Page 73	Eliciting students' current understanding and misconceptions about content related to the Car Lift, the Initial Drop and the hill, and about the relationship between the content and the design task; content dependant on students' prior knowledge	ETS1.A: more precise constraints provide better solutions; constraints of a design include scientific principles ETS1.B: solutions need to be tested; evaluation of solutions should be done systematically; sometimes solutions can be combined; it is necessary to explain solutions to others; models of all kinds are helpful for testing solutions; simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on criteria and constraints; compare designs and test to see which is best; promising solutions are found through an iterative process; it is important to describe solutions, how they were developed, and why they work	Developing and refining models, designing and redesigning solutions, obtaining evaluating and communicating information, using visual representations, talking in the genre of science, using evidence to back up ideas & using models of the domain of physics	Integration of Knowledge and Ideas 7: integrate information from text with visual representations Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic WHST.6-8.1.A,B: write arguments focused on discipline specific content WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.5: plan, revise, edit, rewrite and try new approach WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks



		Stop That	Car	
Activities:	Core science ideas and relationships addressed:	Science Framework Standard:	Science and Engineering Practices:	Common Core Literacy and Writing Standards:
Stop That Car Introduction and Brainstorming Page 74	Eliciting students' developing understanding of and misconceptions about physics content relevant to Stop That Car	ETS1.A: defining a design task involves identifying constraints and relevant science concepts	Obtaining (evaluating) information, determining design constraints, determining prior knowledge & talking in the genre of science	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Stop That Car Questions Page 75	Eliciting students' developing understanding of and misconceptions about physics content relevant to Stop That Car	Standards covered will be based on student choices	Asking questions, defining problems & talking in the genre of science	WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.10: write over extended and short time frames for discipline specific tasks
Stop That Car CoMPASS Research Page 76 - 77	Visual relationships between core science ideas in the domain of physics important to the design of Stop That Car through the use of concept maps in CoMPASS, content dependant on student navigation choices	Standards covered will be based on student choices	Obtaining (evaluating) information & using expert maps and models of the domain of physics	Key Ideas and Details 2: find central ideas of text and summarize Craft and Structure 4: determine meaning of symbols, key terms and domain specific words and phrases Integration of Knowledge and Ideas 9: compare information from experiments with text on the same topic Range of Reading and Level of Text Complexity 10: comprehend science/technical text at 6 – 8 level WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with development organization and style appropriate to task, purpose and audience WHST.6-8.7: research to answer a question using several sources and develop questions that allow for exploration WHST.6-8.8: gather information from print and digital sources; assess credibility and accuracy and paraphrase WHST.6-8.9: draw evidence from text to support analysis, reflection and research WHST.6-8.10: write over extended and short time frames for discipline specific tasks



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Stop That Car	Concepts: Newton's 1st Law,	PS2.A: motion is determined by total forces, larger	Planning investigations	WHST.6-8.1.A,B: write arguments focused on discipline specific
Friction	Newton's 2nd Law, Force,	forces cause larger changes in motion, information		content
Hypothesis	Acceleration, Velocity, Kinetic	about positions and forces must be described to		WHST.6-8.2.D: write informative texts
Page 78	Energy, Law of Conservation of	share with others		WHST.6-8.4: produce clear and coherent writing with
	Energy, Energy Transfer	PS3.A: kinetic energy is energy of motion		development organization and style appropriate to task, purpose
		PS3.B: when motion changes, there is some other		and audience
	Relationships: Force &	change in energy, friction causes transfer of energy		WHST.6-8.7: research to answer a question using several sources
	Acceleration in both 1st and	to heat, friction causes slowing by transferring		and develop questions that allow for exploration
	2nd law, KE & Velocity,	energy away		WHST.6-8.8: gather information from print and digital sources;
	Velocity & Acceleration,	PS3.C: when two objects interact forces can		assess credibility and accuracy and paraphrase
	Velocity & Stopping Distance	transfer energy between them		WHST.6-8.9: draw evidence from text to support analysis,
		ETS1.B: solutions need to be tested; evaluation of		reflection and research
		solutions should be done systematically;		WHST.6-8.10: write over extended and short time frames for
		sometimes solutions can be combined; it is		discipline specific tasks
Stop That Car		necessary to explain solutions to others; models of	Planning investigations,	Key Ideas and Details 3: follow multistep procedure in
Friction		all kinds are helpful for testing solutions;	carrying out investigations,	experiments
Simulation		simulations allow prediction and improvements	analyzing and interpreting	Integration of Knowledge and Ideas 9: compare information
Experiment		ETS1.C: systematically evaluate solutions based on	data, engaging in argument	from experiments with text on the same topic
Page 79 - 80		criteria and constraints; compare designs and test	from evidence, talking in	WHST.6-8.1,A,B: write arguments focused on discipline specific
		to see which is best; promising solutions are found	the genre of science,	content
		through an iterative process; it is important to	constructing explanations,	WHST.6-8.2.D: write informative texts
		describe solutions, how they were developed, and	designing and redesigning	WHST.6-8.4: produce clear and coherent writing with
		why they work	solutions, using expert	development organization and style appropriate to task, purpose
			models of the domain of	and audience
			physics, developing and	WHST.6-8.7: research to answer a question using several sources
			refining models & using	and develop questions that allow for exploration
			mathematics, information	WHST.6-8.8: gather information from print and digital sources;
			and computer technology,	assess credibility and accuracy and paraphrase
			and computational thinking	WHST.6-8.9: draw evidence from text to support analysis,
			and computational trimking	reflection and research
				WHST.6-8.10: write over extended and short time frames for
				discipline specific tasks
Stop That Car	Concents: Nowton's 1st Law	PS2.A: motion is determined by total forces;	Determining prior	
Stop That Car	Concepts: Newton's 1st Law,	•		Key Ideas and Details 2: finding central ideas of text and
Mass and Height Content Review	Newton's 2nd Law, Mass,	heavier objects require greater force for same change in motion; larger forces cause larger	knowledge & talking in the genre of science	summarizing
	Height, Force, Acceleration,		genre or science	Integration of Knowledge and Ideas 9: compare information
Page 81	Velocity, Potential Energy,	changes in motion; information about positions		from experiments with text on the same topic
	Kinetic Energy, Law of	and forces must be described to share with others		WHST.6-8.2.B,D: write informative texts
	Conservation of Energy, Energy	PS3.A: kinetic energy is energy of motion;		WHST.6-8.4: produce clear and coherent writing with
	Transfer	potential energy is energy of position; potential		development organization and style appropriate to task, purpose
	Balatianahinan Farra 0	energy decreases when an object is lowered		and audience
	Relationships: Force &	PS3.B: when motion changes; there is some other		WHST.6-8.7: research to answer a question using several sources
	Acceleration in both 1st and	change in energy; friction causes transfer of		and develop questions that allow for exploration
	2nd law, KE & Velocity, Mass &	energy to heat; friction causes slowing by		WHST.6-8.8: gather information from print and digital sources;
	Force, Height & Velocity,	transferring energy away		assess credibility and accuracy and paraphrase
	Velocity & Acceleration,	PS3.C: when two objects interact forces can		WHST.6-8.9: draw evidence from text to support analysis,
	Velocity & Stopping Distance	transfer energy between them		reflection and research
		ETS1.B: solutions need to be tested; evaluation of		WHST.6-8.10: write over extended and short time frames for
				discipline specific tasks



Stop That Car		solutions should be done systematically:	Diagning investigations	WHET C 9.1 A Provisto arguments focused on discipling angelia
Mass and Height		solutions should be done systematically;	Planning investigations	WHST.6-8.1.A,B: write arguments focused on discipline specific
~		sometimes solutions can be combined; it is		content
Hypothesis Pages 82 - 83		necessary to explain solutions to others; models of all kinds are helpful for testing solutions;		WHST.6-8.2.D: write informative texts WHST.6-8.4: produce clear and coherent writing with
Pages oz - os				· · · · · · · · · · · · · · · · · · ·
		simulations allow prediction and improvements ETS1.C: systematically evaluate solutions based on		development organization and style appropriate to task, purpose and audience
		1		WHST.6-8.7: research to answer a question using several sources
		criteria and constraints; compare designs and test to see which is best; promising solutions are found		and develop questions that allow for exploration
		through an iterative process; it is important to		WHST.6-8.9: draw evidence from text to support analysis,
		describe solutions, how they were developed, and		reflection and research
		why they work		WHST.6-8.10: write over extended and short time frames for
		wily they work		discipline specific tasks
Stop That Car			Planning investigations,	Key Ideas and Details 3: follow multistep procedure in
Mass and Height				
Simulation			carrying out investigations, analyzing and interpreting	experiments Integration of Knowledge and Ideas 9: compare information
Experiment			data, engaging in argument	from experiments with text on the same topic
Pages 84 - 85			from evidence, talking in	WHST.6-8.1.A,B: write arguments focused on discipline specific
rages 04 - 05			the genre of science,	content
			constructing explanations,	WHST.6-8.2.D: write informative texts
			designing and redesigning	WHST.6-8.4: produce clear and coherent writing with
			solutions, using expert	development organization and style appropriate to task, purpose
			models of the domain of	and audience
			physics, developing and	WHST.6-8.7: research to answer a question using several sources
			refining models & using	and develop questions that allow for exploration
			mathematics, information	WHST.6-8.8: gather information from print and digital sources;
			and computer technology,	assess credibility and accuracy and paraphrase
			and computational thinking	WHST.6-8.9: draw evidence from text to support analysis,
				reflection and research
				WHST.6-8.10: write over extended and short time frames for
				discipline specific tasks
Stop That Car	Eliciting students' current	Standards covered will be guided by student input;	Presenting information,	Key Ideas and Details 2: find central ideas of text and summarize
Whole Class	understanding of and	please refer to the above standards for ideas on	asking questions, defining	Integration of Knowledge and Ideas 9: compare information
Discussion	misconceptions about physics	content that can be addressed during the whole	problems, engaging in	from experiments with text on the same topic
Page 86	content relevant to Stop That	class discussion	argument from evidence,	WHST.6-8.1.A,B: write arguments focused on discipline specific
1 486 00	Car	ciass discassion	talking in the genre of	content
			science & using models of	WHST.6-8.4: produce clear and coherent writing with
			the domain of physics	development organization and style appropriate to task, purpose
			and domain or projects	and audience
				WHST.6-8.8: assess credibility and accuracy and paraphrase
				WHST.6-8.9: draw evidence from text to support analysis,
				reflection and research
				WHST.6-8.10: write over extended and short time frames for
				discipline specific tasks

