CCPS Science Unit Plan

Grade	8th	**Subject**	PhysicalScience	**Unit #**	5
Unit Name	Force and Motion		**Timeline**	5-6 weeks	
How to use the Framework	This Framework should be used to implement daily science instruction. The resources and instructional strategies reflected in the Framework will provide a foundation for effective implementation and student mastery of standards. Please see the hyperlinked abbreviation document to ensure understanding of all abbreviations used with this framework.				
Unit Overview	This unit will focus on students' development of conceptual understanding of the nature of matter, the relationship between force, mass, and the motion of objects, and energy transformations as seen in sports, activities, or movies common to middle school students. Students will develop an understanding that all objects and substances (i.e., cars, crash test dummies, etc.) in the natural world are composed of matter, which is influenced by forces. They will explore the relationship between velocity and acceleration by creating and analyzing graphical representations that describe the motion of objects. This unit will further facilitate a qualitative understanding of the Universal Laws of Motion using a number of activities in which forces act through direct physical contact between objects (friction) and examples in which forces act on objects at a distance (gravitational force). Finally, students will apply their understanding of the Universal laws of Motion to predict and explain how simple machines can make work easier.				
Lesson Plan guidance document and template	CCPS Lesson Plan Template Day View Lesson Plan Template Week View Department of Science Guidance Document Science SBC Instructional Framework.pdf				

3Dimensional Instruction

GSE	Science and Engineering Practices	Crosscutting Concepts
S8P3. Obtain, evaluate, and communicate information about cause and effect relationships between force, mass, and the motion of objects. a. Analyze and interpret data to identify patterns in the relationships between speed and distance, and velocity and acceleration. (Clarification statement: Students should be able to analyze motion graphs, but students should not be expected to calculate velocity or acceleration.) b. Construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object. c. Construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).	• Develop and use Models • Engage in Arguments from Evidence • Asking Questions and Defining Problems • Planning and Carrying out Investigations • Analyzing and Interpreting Data • Using Mathematics and Computational Thinking • Constructing Explanations and Designing Solutions	• Cause and Effect • Energy and Matter • Structure and Function • Patterns

		• Obtaining, Evaluating and Communicating Information	

NGSS Alignment	NGSS Alignment to Disciplinary Core Ideas • **MS-PS2-2.** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

The Phenomenon Protocol

Anchoring Phenomena

Forces and Motion-Row Your Boat

Position and Motion- Get Moving!

Force and Acceleration- Pulled Away

Gravitational Force-Skydiving

Weekly Lesson Tasks

Week 1

GSE: **S8P3.** Obtain, evaluate, and communicate information about cause and effect relationships between force, mass, and the motion of objects. **S8P3.A.** Analyze and interpret data to identify patterns in the relationships between speed and distance, and velocity and acceleration. (Clarification statement: Students should be able to analyze motion graphs, but students should not be expected to calculate velocity or acceleration.)	**Focused Concept:** • Speed, Velocity, Distance, and Acceleration
SEP: • Obtain, evaluate, and communicate information • Analyze and interpret data	**CCC:** • Cause and Effect
Phenomenon: How can you describe the position and motion of the train outside the window?	**DQ:** How do units and direction describe position and motion?

	Day 1	Day 2	Day 3	Day 4	Day 5

Learning Targets	SWBAT recognize patterns in the relationships between speed and distance and velocity and acceleration. SWBAT analyze and interpret data to identify patterns in the relationships between speed and distance and velocity and acceleration.	SWBAT recognize patterns in the relationships between speed and distance and velocity and acceleration. SWBAT analyze and interpret data to identify patterns in the relationships between speed and distance and velocity and acceleration.	SWBAT recognize patterns in the relationships between speed and distance and velocity and acceleration. SWBAT analyze and interpret data to identify patterns in the relationships between speed and distance and velocity and acceleration.	SWBAT recognize patterns in the relationships between speed and distance and velocity and acceleration. SWBAT analyze and interpret data to identify patterns in the relationships between speed and distance and velocity and acceleration.	SWBAT recognize patterns in the relationships between speed and distance and velocity and acceleration. SWBAT analyze and interpret data to identify patterns in the relationships between speed and distance and velocity and acceleration.
Opening	**Teacher will use this science probe to assess students' prior knowledge of the lesson content and to identify possible preconceptions about graphs. Science Probe:** Train Ride Inspire Science: Energy and Motion Textbook Pg.5 Students will complete Lesson 1 Launch	**The teacher will show video: Get Moving again** **Teacher will ask:** What are some other factors that you think would be important in describing the motion of the train?	**Teacher will ask:** What are some ways of describing how fast something is?	**Teacher will say:** **"**A graph can show the relationship between distance and time for an object.**"** **Teacher will ask:** How does slope relate to the graph of Distance versus Time?	**Teacher will say:** **"**A straight line on a distance-time graph indicates a constant speed because it has a constant slope. A change in the slope of the line indicates a change in speed.**"** **Teacher will ask:** What can you tell about the object's motion if the slope of the line on the distance-time graph decreases?
Guided Practice/ Transition	**Students will:** Watch the video Get Moving! from teacher edition **C-E-R:** Make a claim about the most accurate way to describe a train's position and motion.	Students will form groups of 3 and create a Flipgrid video explaining the difference between speed, velocity, and acceleration. As a class, we will watch a few Flipgrid videos to get an idea of where everyone is**.** **The teacher will not give feedback in the sense of what is right or wrong but will ask students what some commonalities are in the answers or what aspects we forget to think	Teacher will introduce speed/time/acceleration graphs. Breaking down components of how to read a graph. Teacher will go over the common misconceptions with axis titles and the difference between constant speed and no motion. **Motion Graphs by …**	Discuss and review slopes that are positive, negative, constant, and change in velocity (going back) from the Motion Graphs PowerPoint (slide 10) Students practice slopes with given scenarios. **Interpreting Graphs.…**	**Review:** Speed, Velocity, and Acceleration. Also, slopes for specific graphs. Emphasize the axis on graphs to determine what type of graph and what units may be utilized.

		about.			
Independent Practice	edpuzzle video: speed, velocity, and acceleration **Vocabulary terms students should know: Speed, velocity, acceleration, distance, and displacement.** **Speed, Velocity,&A…** **Have students categorize units in the correct column** **Categorize Distance…**	Students will do an investigation that will challenge their thoughts about speed. Students will do multiple tasks and describe the speed. **Speed Challenge L…**	Students will practice reading distance/time graphs with the following worksheet. *The worksheet relates to the students because they are familiar with the story of Little Red Riding Hood and the Big Bad Wolf. Little Red Riding H… May have to explain the term steep.	Students will work on Gizmo Distance_Time to better understand and interpret slopes. **Gizmo_DistanceTi…** If students need further clarification and visuals, you may also explore PHET Simulation: The Moving Man moving man phet	Have students complete Lesson 1 Review: Summarize It! Module: Forces and Motion textbook, page 30
Assessment Summary	TOTD: If a car has a constant speed going around a curve, will it be accelerating? Why or Why not?	As a whole group, we will discuss the results of the investigation.	TOTD: How do the distances that a slow and a fast object cover in the same amount of time compare?	As a group, discuss observations from the gizmo or phet.	Peer Review with elbow neighbor Lesson 1 Review.
Small Group Tasks (TBA)					

Week 2	
GSE: **S8P3.** Obtain, evaluate, and communicate information about cause and effect relationships between force, mass, and the motion of objects. **S8P3.B.** Construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	**Focused Concept:** ● Balanced and unbalanced and Newton's Laws of Motion
SEP: ● Obtain, evaluate, and communicate information ● Construct and explanation	**CCC:** ● Cause and Effect
Phenomenon: What happens to the motion of the water tube when it's pushed or pulled?	**DQ:** How does a push or a pull affect motion?

	Day 6	Day 7	Day 8	Day 9	Day 10
Learning Targets	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.
Opening	**Watch the video:** Pulled Away from teacher edition. **While watching the video, Students will:** -Record their observations and the ways they see the motion of objects changing. **Students will:** Think about what causes the change in motion of the water tube. Students will record their thoughts on why the phenomenon occurs.	**Teacher will say:** **"**A change of motion can result from a force applied to the object**."** **Teacher will ask:** What kinds of changes in motion can you think of? Inspire Science: Energy and Motion **Textbook pg. 38**	**Teacher will play video with no sound.** **Ask students:** " What they observed about the crash dummy's body." **Crash test dummy in…** **Ask:** What can happen with or without a seatbelt?	**Students will complete the bellringer question:** How can someone or something overcome inertia?	**Teacher will say:** "Newton's Second Law of Motion states that the acceleration of an object can vary because of the object's mass." **Teacher will ask:** " What does Newton's second law predict about the acceleration if the net force acting on an object increases?"
Guided Practice/Transition	**C-E-R:** Make a claim about how a push or pull affects the motion of a water tube. Lesson 2 Module: Forces and Motion Textbook pages 36-37	**Teacher will discuss what is balanced or unbalanced.** Thinking about tug-o-war, what would be balanced or unbalanced? **Practice worksheets:** identifying if items are balanced or unbalanced and in which direction the object will travel.	**Teachers will introduce by using the following video:** **Newton's First Law of Motion** **or** **Teachers can play the following YouTube video** **Newton's First Law …** **Students will:** Summarize (in notebook)	Students will be introduced to Newton's Second Law of Motion Newton's Second La… Students will do the following in their notebooks: Summarize how Newton's Second Law of Motion relates to the video you watched.	Students will be introduced to Newton's Third Law of Motion Newton's Third Law… Students will do the following in their notebooks: Summarize how Newton's Third Law of Motion relates to the video you watched.

		Practice_Identifying…	how Newton's First Law of Motion relates to the video they watched.		
Independent Practice	To open the lesson, students will compete with another class in tug-of-war to model balanced and unbalanced forces. Students will work on a worksheet after tug-o-war. **Tug of War Discussi…**	**Investigation: When push Comes to Shove.** Inspire Science: Energy and Motion Textbook page 41 Explore the PhET interactive simulation Forces and Motion: Basics. **Ask questions:** What happened when you applied 50N of force? Ask questions applying different amounts of force	Students will do an investigation on Newton's First Law of Motion **PennyInACup-1.pdf**	**Science Probe:** Constant Mowing Inspire Science: Energy and Motion textbook page 33 Lesson 2: Force and Acceleration pg 44	Ask: How does the force of your feet on the floor compare with the force of the floor on your feet? Students will work with a partner or in groups with the Lab: Pulling Your Weight Inspire Science: Energy and Motion Textbook page 62-63 Mini review of Newton's Laws of Motion **Newton's Laws _Wh…**
Assessment/Summary	TOTD: How do forces affect motion?	Review what is force. A push or a pull.	What is inertia?	Why do large cars and trucks get bad gas mileage?	What is meant by "action-reaction?"
Small Group Tasks (TBA)					

Week 3					
GSE: **S8P3.** Obtain, evaluate, and communicate information about cause and effect relationships between force, mass, and the motion of objects. **S8P3.B.** Construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	**Focused Concept:** • Forces, Newton's Laws of Motion, and Free Fall				
SEP: • Obtain, evaluate, and communicate information • Construct an explanation			**CCC:** • Cause and Effect		
Phenomenon: World's Biggest Vacuum			**DQ:** How does mass affect how long it takes for an object to fall to the ground?		
	Day 11	**Day 12**	**Day 13**	**Day 14**	**Day 15**

Learning Targets	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.	SWBAT identify balanced and unbalanced forces. SWBAT summarize Newton's Three Laws of Motion SWBAT construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object.
Opening	Review Newton's Laws of Motion from the previous week.	Watch video: World Biggest Vacuum to introduce free fall. Brian Cox visits the …	What do you wonder about the experiment that you observed? How could a bowling ball and feather fall at the same time?	Students will complete C-E-R from ADI Lab 7: Mass and Free Fall	How confident are you that your claim is valid? What could you do to increase your confidence?
Guided Practice/Transition	Kahoot or Blookit reviewing Forces, speed, acceleration, velocity, and Newton's Laws of Motions	See_Think_Wonder What did you see? What do you think? What do you wonder? see_think_wonder_t…	ADI:Lab 7: Mass and Free Fall Annotate the ADI lab handout. Gather materials, review lab safety and protocols, and put students in groups according to your data from Formative Assessments or exit tickets.	Argument presentation on whiteboard. With Guiding Question, claim, evidence, and justification of evidence on whiteboard	Students will finish presenting and argument session
Independent Practice	Formative Assessment on S8P3 A/B using illuminate questions	Students will work on free fall tower Gizmo Freefall Lesson	Students will create a claim from the guiding question: How does mass affect the amount of time it takes for an object to fall to the ground? Students will begin the lab and collect their data.	Argument Session: The argumentation session allows all of the groups to share their arguments. One member of each group will stay at the lab station to share that group's argument, while the other members of the group go to the other lab stations to listen to and critique the arguments developed by their classmates.	Complete Lab ADI Lab Report (w… Report

Assessment/Summary	Data talk/Data tracker and goals for next assessment.	What is a vacuum (physical science)? Misconception: Vacuum that we use in the home.	How did you collect your data?	Why did your group decide to present your evidence in that way?	Reflect on Lab: What worked?What didn't work? What can we do differently next time?
Small Group Tasks (TBA)					

Week 4					
GSE: **S8P3.** Obtain, evaluate, and communicate information about cause and effect relationships between force, mass, and the motion of objects. **S8P3.C.** Construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).		**Focused Concept:** ● Force, Mass, and Acceleration			
SEP: ● Obtain, evaluate, and communicate information ● Construct an argument from evidence			**CCC:** ● Cause and Effect ● Scale, Proportion, and Quantity		
Phenomenon: Pulled Away			**DQ:** Why do babies need car seats?		
	Day 16	**Day 17**	**Day 18**	**Day 19**	**Day 20**
Learning Targets	SWBAT construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).	SWBAT construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).	SWBAT construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).	SWBAT construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).	SWBAT construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).
Opening	Teacher will start class with a discussion on car crashes. Students will be asked first, do you remember sitting in a car seat? Why did you need one? What happens in a car crash? They will eventually say that a body will fly forward and then we talk about why by	Students will create a family of 3 with modeling clay; a mom, a dad, and a baby. Students will be prompted to think about the sizing of each person in the family by the teacher. The teacher will ask them to make	Ask: What adjustments can you make if a family member does not eject from the car?	Students will complete C-E-R from ADI Lab: Why do babies need car seats?	Students will finish presenting and argument session

	relating it back to Newton's first law. In the end we would have related different parts to all of Newton's Laws.	sure they are aware that their family members must fit in their toy car.			
Guided Practice/Transition	Teachers will place students in groups based on data. Teachers will have a small group with students that need more assistance with close reading. Students will read and annotate the guiding handout for their ADI investigation using close reading strategies. Students will then start to answer the guiding question "Why do babies need car seats?"	Teachers will have a tool talk with the students to ensure that they understand how to use their materials. The materials that will be discussed are • Textbooks • Modeling Clay • Toy Car • LongBoard • Scale/Balance • Block • Measuring Tape	continue with lab with new adjustments	Argument presentation on whiteboard. With Guiding Question, claim, evidence, and justification of evidence on whiteboard	Complete Lab Report **ADI Lab Report (w…**
Independent Practice	Students will plan an investigation with their groups that will help them answer the guiding question "Why do babies need car seats?" using the following document. ADI investigation proposal	Students will begin by finding the mass of each member by using a scale and record in their data table the masses. Then they will use the family that they created out of modeling clay to test what happens in a car crash. They will begin by putting each of their individual family members in their toy cars and letting them ride down the long board in which they will crash into some textbooks, thus simulating a car crash. As they are going through the investigation, they will	continue with lab with new adjustments	Argument Session: The argumentation session allows all of the groups to share their arguments. One member of each group will stay at the lab station to share that group's argument, while the other members of the group go to the other lab stations to listen to and critique the arguments developed by their classmates.	continue lab report

		record how far each member of the family flew and how long it took for the member to get down the ramp. They will lastly be required to calculate the speed for each member.			
Assessment/Summary	We will end the class by discussing what they read and how they plan on investigating to answer the guiding question.	As a group we will discuss the results so far. Teacher will probe students to think why they are getting such results? In the end students need to understand the relationship between mass, force and acceleration /speed.	Class discussion: did you make mass adjustments to any of the family members or the height of the ramp?	Why did your group decide to present your evidence in that way?	Reflect on Lab: What worked?What didn't work? What can we do differently next time?
Small Group Tasks (TBA)					

Assessment Prep

Unit 5_Teacher Edition.pdf

Unit 5 Assessment Prep_Force.pdf

Prepare students for assessment by reviewing the following Assessment Prep Presentation.

Provide the following guidance:
Ask the students to use what they know about the tasks completed to answer the provided assessment prep question.

- What is the question asking you?
- What do you know about the vocabulary or concept in the question?
- Is this question similar to any investigations or tasks we've completed?
- How can what you've done help you answer this question?
- Just view the assessment question: What is the question asking you?

Guide students to think about how their experience connects to the question.
Using the answer choices provided, ask the students the following:

- Identify a wrong answer: How do I know this answer is incorrect?
- Identify the right answer: How do we know this answer is correct?

Allow the students time to discuss in collaborative groups.

TEACHER NOTE: If students struggle with the question, review it the next day. Do not rush to the next question; instructional time is the only time they have to prepare for the end-of-year assessment.

Following the Unit Test:

- Have students correct any missed test items using one of the test correction templates: Template Option 1 Template Option 2
- Have students create goals for review and remediation of material
- Have students set goals for the next unit

Labs / Investigations

Mandatory Labs	Explore Learning Gizmo	Pivot Interactives/Phet
ADI: Physical Science Lab 7: Mass and Free Fall: How Does Mass Affect the Amount of Time It Takes for an Object to Fall to the Ground? p. 132 **ADI: Physical Science Lab 9**. Required For Lab Verification Mass and Motion: How Do Changes in the Mass of an Object Affect Its Motion? p. 164 **ADI: Physical Science Lab 12:** Unbalanced Forces: How Does Surface Area Influence Friction and the Motion of an Object? p. 214	Distance-Time Graphs Free Fall Tower Free-Fall Laboratory Crumple Zones Fan Cart Physics	Force and Motion Basics-https://phet.colorado.edu/en/simulations/forces-and-motion-basics Gravity Force Lab-https://phet.colorado.edu/sims/html/gravity-force-lab/latest/gravity-force-lab_all.html Moving Man-**https://phet.colorado.edu/sims/cheerpj/moving-man/latest/moving-man.html?simulation=moving-man**

Additional Resources/Tasks

Supplemental Resources	Newton's Laws- Newton's Laws _Which+Law+Is+It.doc Identifying Forces- Practice_Identifying Forces.pdf

	Newton's Laws of Motion- Newton's Laws of Motion Newton's Laws Guided Notes Guided Notes_Newtons Laws.docx

Week 5					
GSE: S8P3. Obtain, evaluate, and communicate information about cause and effect relationships between force, mass, and the motion of objects. a. Analyze and interpret data to identify patterns in the relationships between speed and distance, and velocity and acceleration. (Clarification statement: Students should be able to analyze motion graphs, but students should not be expected to calculate velocity or acceleration.) b. Construct an explanation using Newton's Laws of Motion to describe the effects of balanced and unbalanced forces on the motion of an object. c. Construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia).	**Focused Concept: Speed, Velocity, Distance, Acceleration, Newton's Laws of Motion, Forces and Mass**				
Phenomenon:			**DQ:**		
	Day 21	**Day 22**	**Day 23**	**Day 24**	**Day 25**
Opening	Go over study guide and clarify misconceptions	Go over study guide and clarify misconceptions	Go over study guide and clarify misconceptions	Allow students to study and ask last minute clarifying questions	Review test data from Illuminate
Guided Practice/Transition	Review Speed, Acceleration, Velocity, Distance-Time Graphs, and slopes.	Review Newton's Laws of Motion	Review Forces needed to accelerate an object	Unit 5 Summative Assessment	Students will reflect and input scores in data tracker
Independent Practice	Play a kahoot, blooket, etc. to review unit concepts	Play a kahoot, blooket, etc. to review unit concepts	Play a kahoot, blooket, etc. to review unit concepts		Test Corrections
Assessment/Summary					Goals for next Assessment
Small Group Tasks (TBA)					

Overall Great Unit Plan.

-Resources are aligned to the standard
-Resources: MOST are easily accessible (Please provide links when possible)
-Resources: When listing the textbook as a resource, name the textbook that should be used

Please link any and all resources when possible, so that new teachers can easily access materials and share with students.

Overall: Great job!! 🙂