Physics Unit 2 – Mechanics

Unit Overview: In this unit students will learn to represent forces and motions with vectors. They will be able to draw vectors to scale, determine resultants, find the components of vectors and find the maximum and minimum effect from given vectors. Students will be able to determine and represent the equilibrant to scale. Students will be able to distinguish between vector and scalar quantities. Students will learn to use the first five equations on the reference table to solve problems and interpret graphs of this information. Students will learn about parabolic motion and be able to solve problems algebraically and graphically. Students will learn about freefall and the equations associated with it. Students will lern Newton's Laws of motion and solve problems dealing with centripetal motion and momentum.

Essential Questions:

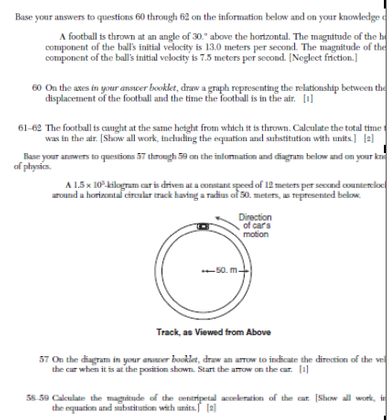
- How do we analyze vector relationships?
- What is the difference between a scalar and a vector?
- What variables, equations and graphs can be used to describe one dimensional motion?
- How can we algebraically and graphically describe the trajectory of a projectile? How are the variables of force mass and acceleration connected?
- How do forces affect objects?
- How can we describe the attractive force between two masses? What happens to the variables of motion when an object moves in a circular path?
- What is momentum and how is it transferred?

MST Standard 4 - Science

Key Idea 5

Energy and matter interact through forces that result in changes in motion

Time Frame	Skills, Practices or Expectations	Specific Standards / Performance Indicators	Resources	Content Vocabulary	Measurement of Student Learning
1 week **9.26.22- 9.30.22**	**Vector Operations** ● Resolve vector into perpendicular components ● Calculate Resultant / Equilibrant ● Establish frame of reference ● Draw scale diagrams and perform graphical analysis of the vectors ● Predict minimum and maximum of concurrent vectors	5.1a,b,c 5.1d,e 5.1f,g,h 5.1i,j,k,q,o,l,s,t,u 5.1n 5.1p,r	Castle Learning Interactive Simulations: http://phet.colorado.edu Holt Textbook Chapter2,3,4,7 Appendix D, Appendix I	scalar vector mass resultant components horizontal and vertical components projectile motion frame of reference displacement average velocity acceleration free fall force inertia net force equilibrium equilibrant weight normal force static friction kinetic friction coefficient of friction momentum impulse inelastic collision elastic collision centripetal acceleration gravitational force tangential velocity centripetal force apparent weight	Ticket out the door Formative assessment using Castle Learning Unit test Weekly quizzes Homework using Castle Learning
2 weeks **10.03.22-** **10.07.22**	**Kinematics** ● Differentiate scalar and vector quantities including distance vs. displacement, speed vs. velocity ● Define, calculate, and graphically represent the first five kinematic equations from the Reference Table. ● Use context clues to assign conditions, e.g., starts from rest, comes to a stop, etc. ● Recognize and use variables associated with an object in free fall including g				
2 weeks **10.17.22 -** **10.28.22**	**Projectile Motion** ● Distinguish and analyze horizontal and vertical components of 2-dimensional motion. ● Recognize the independence of horizontal and vertical components. ● Vertical component determines ● time of flight. ● Horizontal component and time determine range. ● Describe the effects of varying launch angle. ● Sketch the theoretical path				
3 weeks **10.31.22 -** **11.18.22**	**Newton's Laws** ● Define force ● Distinguish between weight and mass and describe weight as a force produced by gravitational attraction.				

1 week **11.21.22 - 11.25.22** **1 week** **11.28.22 - 12.02.22**	• Identify and represent all forces acting on a body in a free body diagram, including friction, applied, weight and normal. • Calculate and resolve forces from a free body diagram into a net force, including equilibrium. • Define inertia and its relationship to mass • Calculate acceleration from a net force. • Identify action reaction pairs. • Analyze scenarios involving friction, including calculation of coefficients of friction. • Evaluate problems involving an inclined plane. • Analyze and apply Newton's law of universal gravitation emphasizing inverse square relationship and attractive nature. • Qualitatively analyze apparent weightlessness. **<u>Uniform Circular Motion</u>** • Identify direction and significance of tangential velocity and centripetal acceleration vectors. • Calculate centripetal force and acceleration. **<u>Momentum</u>** • Calculate momentum of an object describing it as a vector. • Describe the effect of impulse on an object. • Differentiate between open and closed systems. • Qualitatively and quantitatively explain conservation of momentum.			**Higher Level Questions**  Base your answers to questions 60 through 62 on the information below and on your knowledge A football is thrown at an angle of 30.° above the horizontal. The magnitude of the h component of the ball's initial velocity is 13.0 meters per second. The magnitude of the component of the ball's initial velocity is 7.5 meters per second. [Neglect friction.] 60 On the axes *in your answer booklet*, draw a graph representing the relationship between the displacement of the football and the time the football is in the air. [1] 61–62 The football is caught at the same height from which it is thrown. Calculate the total time was in the air. [Show all work, including the equation and substitution with units.] [2] Base your answers to questions 57 through 59 on the information and diagram below and on your kn of physics. A 1.5×10^3-kilogram car is driven at a constant speed of 12 meters per second counterclo around a horizontal circular track having a radius of 50. meters, as represented below. Direction of car's motion 50. m Track, as Viewed from Above 57 On the diagram *in your answer booklet*, draw an arrow to indicate the direction of the ve the car when it is at the position shown. Start the arrow on the car. [1] 58–59 Calculate the magnitude of the centripetal acceleration of the car. [Show all work, i the equation and substitution with units.] [2]	

Resources

http://ngss.nsta.org/Classroom-Resources.aspx

http://newyorksciencteacher.com/sci/

English Language Learners (ELL) Enhancements To access hyperlinked material, you must be logged into your BPS Google Drive	**Listening** • **Cross- Linguistic Practices:** Gives students opportunities to make connections between what they hear and their home language (For example, allow students to listen to a passage and identify cognates.) • **Build background knowledge** • **Activating Prior Knowledge** Activating prior knowledge means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content • **Activating Prior Knowledge** • **Visuals** - GIFs, pictures- will assist students in understanding what they are listening to. Use **visual thinking strategies** to set the lens for learning. • Video to review or introduce a topic – use **closed captioning** to help students see the words and pronunciations while they listen to the content. • **Word stretching / Vowel stretching** when instructing allows student to listen closely to the pronunciation of the word • **Performance Level Descriptors** this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of listening Scroll for grades 9-12.	**Speaking** • **Sentence Frames** - to begin a sentence - such as *Evolution is…* or *I think that evolution is…* • **Academic Conversation Starters:** Have a visual of a list of academic sentence starters that students can refer to in a discussion. Examples include- I expect ____ to happen. My data shows that… This helps students have a more science focused dialogue. • **Choral Reading** - To build fluency, self-confidence and motivation with reading/speaking • Create **movement** to go with the word. Movement can be a motivating factor, as well as a kinesthetic tool for conceptualizing the rhythm and flow of fluent reading while triggering brain function for optimal learning • **Performance Level Descriptors** This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of speaking. Scroll for grades 9-12	**Reading** • **Supplementary Text** to help reinforce concepts. If necessarily, use lower Lexile levels to ensure comprehension. • **Visual Aids** - Pictures or models to support vocabulary words and concepts • Video to review or introduce a topic - use **closed captioning** to help students read along while they listen to the content • **4 Square / Frayer models** to help students gain a deeper understanding of vocabulary. • **Highlighting** important text to assist students in answering questions after the reading. • **Chunking**-Break reading of text into chunks or paragraphs • **Performance Level Descriptors** this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of reading. Scroll for grades 9-12. • **Vocabulary Morphology**- Morphology relates to the segmenting of words into affixes (prefixes and suffixes) and roots or base words, and the origins of words. Understanding that words connected by meaning can be connected by spelling can be critical to expanding a student's vocabulary.	**Writing** • **Sentence Frames** - to begin a sentence- such as *Biodiversity is…* or *An example of competition is….* • **Cloze passages** with word banks • **Word banks** • **Graphic Organizers** to help break down the writing process and organize thoughts • **Standards-based sentence stems** • **Performance Level Descriptors** this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of writing. Scroll for grades 9-12.	**Instructional Accommodations (depending on the student's needs)** • **Extended time** for tests in class, projects and assignments • **Directions read.** Broken down as necessary • **Model** how to complete the activity in the lesson • **Oral simplification** of directions or questions • **Translated version** of test when available. Student may have both version English and native language version • Use of **approved bilingual glossaries** from NYS in each subject

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<td>Special Education Modifications

Special Education students must have accommodations as per Individual Educational Plan (IEP)</td>
<td><u>Instructional</u>
• Pre-teach vocabulary
• Use picture vocabulary
• Scaffold Depth of Knowledge questions
• Provide copy of notes/notes in “cloze” form
• Use of Think, Pair, and Share strategy to help process information
• Scaffold written assignments with the use of graphic organizers
• Allow for multiple ways to respond (verbal, written, response board)
• Provide model of performance task
• Modify informational text to fit the needs of the students
• Provide a digital or paper interactive notebook
• Present complex tasks in multiple ways
• Provide mnemonic strategies for Physics concepts</td>
<td><u>Technology:</u>
• Audio reading of text
• Text to type functions
• Videos to clarify/visualize Physics concepts
• Record class lecture/discussions and make accessible to student
• Nearpod- interactive presentations of notes
• Playposit - show a video clip about the topic and add your own questions for them to answer as they watch
• Allow students to type answers in chat on Teams

<u>Other:</u>
• Arrange seating for maximum engagement and minimum distraction
• Accessible lab space (counter level)</td>
<td><u>In Class Assessments</u>

• Provide review packet or review sheet of concepts covered on the test
• Practice similar questions prior to the test
• Provide multiple options for projects
• Give a timeline of when things are due and remind them of the process often.
• Use of timer in class
• Break all complex tasks into chunks</td>
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<td>BPS Science K-12 Schoology Group Resources
Grades 9-12 Resources
Physics Physics Curriculum Materials</td>
<td colspan="3"><u>SUTW Strategies</u>
• Informal Outline
• Color-Coding – Informative/Explanatory Text
• Two-column notes
• I-V-F Topic Sentence progressing to Four Step Summary Paragraph
• CUPS – Capitalization, Usage, Punctuation, Spelling
• Transitions</td>
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