Secondary Curriculum Maps

Cumberland Valley School District

Soaring to Greatness, Committed to Excellence

Conceptual Physics

Curriculum Map

CV Priority Standard/PA Academic Standard
3.2.P.B5. Explain how waves transfer energy without transferring matter. Explain how waves carry information from remote sources that can be detected and interpreted. Describe the causes of wave frequency, speed, and wavelength.
Taught in Unit(s)
9. Waves 10. Sound
Common Misconceptions
Waves carry matter from one location to another location. Impedance is directly proportional to wave speed. Reflections are caused when waves hit only higher impedances. Inversions can happen to a transmitted wave. Refraction is the bending of a wave rather than the change in its speed. Students misunderstand the concept of frequency.

Big Idea(s)	Essential Question(s)
Waves are used to carry energy and information in useful ways.	What are the characteristics of waves and what they travel in that can be understood to explain how they are used in practical ways?
Assessments	
Unit 9 Waves Exam (Common) Unit 10 Sound Exam (Common)	
Concepts (what students need to know)	**Skills** (what students must be able to do)
● Velocity ● Vectors ● Displacement ● Period ● Impedance ● Superposition ● Wave classifications ● Simple Harmonic Motion ● Standing Wave ● Frequency ● Wavelength	● Predict the results of wave interactions with other waves and what they travel in. ● Recognize wave types. ● Explain how Simple Harmonic Motion is the basis for all wave motion. ● Explain how standing waves are generated in a variety of situations, how they are used productively and avoided when detrimental.

Curriculum Map

CV Priority Standard/PA Academic Standard
3.2.P.B4. Explain how stationary and moving particles result in electricity and magnetism. Develop qualitative and quantitative understanding of current, voltage, resistance, and the connections among them. Explain how electrical induction is applied in technology.
Taught in Unit(s)
8. Circuits
Common Misconceptions
Students think that positive charges move. Students fail to recognize series and parallel circuits. Students do not form a concrete understanding of potential difference (voltage).

Big Idea(s)	Essential Question(s)
Circuits allow charge to flow based on differences in electric potential energy in order to power our lifestyles. Conservation Laws can be used to predict physical events.	How can basic quantities that measure electricity be used to describe the operation of circuits? How do the laws of conservation of matter and energy apply to circuits?

Assessments
Unit 8 Circuits Exam (Common)

Concepts (what students need to know)	Skills (what students must be able to do)
● Positive Charge ● Negative Charge ● Electric Field ● Potential ● Potential Difference (Voltage) ● Capacitance ● Ohm's Law ● Resistance ● Current ● Series Circuit ● Parallel Circuit ● Power ● Multimeter	● Apply Ohm's Law to understand relationships of current, voltage, and resistance. ● Explain how capacitors work. ● Recognize series and parallel circuits. ● Wire series and parallel circuits. ● Apply the laws of conservation of matter and energy to circuits.

Curriculum Map

CV Priority Standard/PA Academic Standard
Electrostatics 3.2.12.B4. Describe conceptually the attractive and repulsive forces between objects relative to their charges and the distance between them.
Taught in Unit(s)
7. Electrostatics
Common Misconceptions
Students poorly differentiate force and field Students have difficulty applying the inverse square relationship between force and distance Students misunderstand that it is always the negative charges that move

Big Idea(s)	Essential Question(s)
Electric charges create attractive and repulsive forces whose magnitude changes with distance and charge magnitude.	How can Coulomb's Law be used to predict the forces that exist between charges?

Assessments
Unit 7 Electrostatics Exam (Common)

Concepts (what students need to know)	Skills (what students must be able to do)
● Positive Charge ● Negative Charge ● Charging Methods ● Electric Force ● Electric Field ● Coulomb's Law ● Electric Field Equations	● Apply Coulomb's Law ● Convert between SI units (micro, milli, etc) ● Recognize when charges attract and repel ● Draw and direct force and electric field vectors

Curriculum Map

CV Priority Standard/PA Academic Standard
3.2.12.B2. Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.
Taught in Unit(s)
5. Work and Energy 6. Momentum
Common Misconceptions
Students do not differentiate between Force and Work. They use these concepts interchangeably. Students often treat momentum as if it is a scalar quantity.

Big Idea(s)	Essential Question(s)
Conservation Laws can be used to predict physical events. Describing how things move supports an understanding of our physical world. In an energy hungry world, understanding how it is accessed, used and lost is essential.	How can the Law of Conservation of Energy be used to predict what will happen when there are conservative forces acting versus when there are dissipative forces acting? How does energy conservation relate to momentum conservation?

Assessments
Unit 5 Work & Energy Exam (Common) Unit 6 Momentum Exam (Common)

Concepts (what students need to know)	Skills (what students must be able to do)
● Scalar / Vector ● Work ● Energy Types ● Energy Conservation ● Linear Momentum ● Conservation of Momentum ● Friction	● Recognizes types of energy ● Calculate energies ● Apply the law of conservation of energy to predict an objects' motion ● Apply the law of conservation of momentum to predict objects' interactions ● Differentiate conservative and dissipative forces

Curriculum Map

CV Priority Standard/PA Academic Standard
Forces 3.2.10.B1. Analyze the relationships among the net forces acting on a body, the mass of the body, and the resulting acceleration using Newton's Second Law of Motion. Apply Newton's Law of Universal Gravitation to the forces between two objects. Use Newton's Third Law to explain forces as interactions between bodies. Describe how interactions between objects conserve momentum.
Taught in Unit(s)
3. Forces 4. Circular Motion 5. Work and Energy 6. Momentum 7. Electrostatics
Common Misconceptions
Students often think that two different mass objects interacting experience different forces. Newton's 3rd law says they are equal and opposite forces. Students often fail to differentiate between mass and weight. Students fail to recognize the distinctions between different forces. Students think that an object moving with a constant velocity has acceleration and requires a force to sustain that constant velocity. Students treat momentum as a scalar quantity. When applying Newton's Law of Universal Gravitation to orbits, students find the field caused by the satellite instead of the field caused by the central mass.

Big Idea(s)	Essential Question(s)
● Objects' interactions can be described using forces.	How are forces used to explain different types of motion (constant vs accelerated)? How are the properties of forces used to describe the interactions of objects? How can forces be used to explain and predict the motion of objects moving in circles? How do Newton's Laws apply to conservation of momentum?

Assessments
Unit 3 Forces Exam (Common) Unit 4 Circular Motion Exam (Common) Unit 5 Work & Energy Exam (Common) Unit 6 Momentum Exam (Common) Unit 7 Electrostatics Exam (Common)

Concepts (what students need to know)	Skills (what students must be able to do)
● Scalar / Vector	● Recognize when common forces are acting

● Common forces ● Mass ● Newton's Laws of Motion ● Newton's Law of Universal Gravitation ● Linear Momentum ● Conservation of Momentum ● Work ● Coulomb's Law	● Recognize the direction of common forces ● Recognize that centripetal forces cause circular motion ● Resolve vectors into horizontal and vertical components ● Apply Newton's Laws of Motion to situations involving forces, motion, and acceleration ● Draw force diagrams of everyday situations ● Apply Newton's Law of Universal Gravitation to a satellite's orbit ● Apply the law of conservation of momentum to predict objects' interactions

Curriculum Map

CV Priority Standard/PA Academic Standard
Motion 3.2.P.B1. Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity, and acceleration. Use force and mass to explain translational motion or simple harmonic motion of objects. Relate torque and rotational inertia to explain rotational motion.
Taught in Unit(s)
1. Motion 2. Projectile Motion 3. Forces 4. Circular Motion 5. Work & Energy 6. Momentum 10. Waves
Common Misconceptions
Students do not differentiate to concepts of velocity and acceleration. Students often read position graphs as velocity and vice versa. Students think that an object moving with a constant velocity has acceleration and requires a force to sustain that constant velocity. Students do not differentiate between Force and Work. They use these concepts interchangeably. Students think that all repetitive motion is simple harmonic motion. Students often treat momentum as if it is a scalar quantity.

Big Idea(s)	Essential Question(s)
Describing how things move supports an understanding of our physical world. Objects' interactions can be described using forces.	How can the motion of objects be described mathematically and graphically? How are horizontal and vertical motions related? How are forces used to explain different types of motion (constant vs accelerated)?

Assessments
Unit 1 Motion Exam (Common) Unit 2 Projectile Exam (Common) Unit 3 Forces Exam (Common) Unit 4 Circular Motion Exam (Common) Unit 5 Work & Energy Exam (Common) Unit 6 Momentum Exam (Common) Unit 10 Wave Exam (Common)

Concepts (what students need to know)	Skills (what students must be able to do)
● Scalar / Vector ● Distance / Displacement ● Speed / Velocity ● Acceleration ● Equations of Motion ● Gravitational Acceleration ● Common forces ● Mass	● Interpret and create motion graphs ● Recognize how and when common forces are acting ● Apply the equations of motion to real life situations in one and two dimensions ● Resolve vectors into horizontal and vertical components

● Simple Harmonic Motion	● Apply Newton's Laws of Motion to situations involving forces and motion ● Draw force diagrams ● Describe the characteristics of different types of simple harmonic motion

Grade: 11 - 12			SUBJECT
Unit	**Timeline**	**Topics**	**Priority Standards**
1. Motion	18 days	Vectors & Scalars	3.2.P.B1
		Displacement	3.2.P.B1
		Velocity	3.2.P.B1
		Acceleration	3.2.P.B1
		Position Graphs	
		Velocity Graphs	3.2.P.B1
		Equations of Motion	3.2.P.B1
		Gravitational Acceleration	3.2.P.B1
2. Projectile Motion	16 days	Horizontal and Vertical Motion Independence	3.2.P.B1
		Velocity Components	3.2.P.B1
		Horizontally off the cliff situations	3.2.P.B1
		Ground to Ground situations	3.2.P.B1
3. Forces	18 days	Newton's Law of Inertia	3.2.10.B1, 3.2P.B1
		Newton's Law of Acceleration	3.2.10.B1, 3.2P.B1
		Newton's Law of Interaction	3.2.10.B1, 3.2P.B1
		Types of Forces	3.2.10.B1
		Force Diagrams	3.2.10.B1
		Normal Force	3.2.10.B1, 3.2P.B1
		Friction Forces	3.2.10.B1, 3.2P.B1
		Incline Planes	3.2.10.B1, 3.2P.B1
4. Circular Motion	12 days	Centripetal Force	3.2.10.B1, 3.2P.B1
		Frictional Circles (turntables)	3.2.10.B1, 3.2P.B1
		Normal Force Circles (rotors)	3.2.10.B1, 3.2P.B1
		Vertical Circles	3.2.10.B1, 3.2P.B1
		Newton's Law of Universal Gravitation	3.2.10.B1
		Orbits	3.2.10.B1, 3.2P.B1
5. Work and Energy	14 days	Work	3.2.12.B2, 3.2.10.B1
		Power	3.2.12.B2, 3.2.10.B1
		Types of Energy	3.2.12.B2
		Conservation of Energy	3.2.12.B2, 3.2.10.B1, 3.2P.B1
		Work done by Friction	3.2.12.B2, 3.2.10.B1, 3.2P.B1
6. Momentum	15 days	Impulse	3.2.12.B2, 3.2.10.B1, 3.2P.B1
		Momentum	3.2.12.B2, 3.2.10.B1, 3.2P.B1
		momentum	3.2.12.B2, 3.2.10.B1, 3.2P.B1
		(energy conservation)	3.2.12.B2, 3.2.10.B1, 3.2P.B1
		Ballistic Pendulums	3.2.12.B2, 3.2.10.B1, 3.2P.B1
		Collisions	3.2.12.B2, 3.2.10.B1, 3.2P.B1
7. Electrostatics	16 days	Charges	3.2.P.B4, 3.2.12.B4
		Charging by Friction	3.2.P.B4, 3.2.12.B4
		Charging by Conduction	3.2.P.B4, 3.2.12.B4
		Charging by Induction	3.2.P.B4, 3.2.12.B4
		Electric Field	3.2.12.B4, 3.2.12.B2
		Coulomb's Law	3.2.12.B4, 3.2.10.B1, 3.2P.B1
8. Circuits	20 days	Electric Potential	3.2.12.B2, 3.2.12.B4, 3.2.P.B4
		Capacitance	3.2.12.B2, 3.2.12.B4, 3.2.P.B4
		Ohm's Law	3.2.P.B4
		Series Circuits	3.2.12.B2, 3.2.12.B4, 3.2.P.B4
		Parallel Circuits	3.2.12.B2, 3.2.12.B4, 3.2.P.B4
		Combination Circuits	3.2.12.B2, 3.2.12.B4, 3.2.P.B4
9. Waves	20 days	Simple Harmonic Motion	3.2.P.B1, 3.2.12.B2, 3.2.P.B5
		Wave Characteristics	3.2.P.B5
		Impedance	3.2.P.B1, 3.2.12.B2, 3.2.P.B5
		Wave Properties	3.2.P.B1, 3.2.12.B2, 3.2.P.B5
10. Sound	19 days	Sound Properties	3.2.P.B5, 3.2.12.B2, 3.2.P.B1
		Stringed Instruments	3.2.P.B5, 3.2.P.B1
		(tubular instruments)	3.2.P.B5, 3.2.P.B1
		Tine Instuments	3.2.P.B5, 3.2.P.B1