Wallenpaupack Area School District
Planned Course Curriculum Guide

Science

Biomechanics in Sport and Movement

Course Description:
Biomechanics looks at the application of mechanical principles in the study of living organisms, specifically human movement. This course uses the physics of mechanics – the description of motion and how forces cause motion – to analyze all kinds of motion of the human body. Applications to these ideas are heavily applicable to careers in athletic training, physical therapy, or athletics, but can be applied to any situation in which the human body is moving due to forces.

Revision Date:
This curriculum was completed in the Summer of 2022 by Ryan Neenan. Completion Date: 07/01/22
This curriculum was updated in February of 2023 by Ryan Neenan.

Unit Breakdown (90 Blocks):

1) Introduction to Biomechanics (~7 blocks)
2) Forces and Vectors (~8 blocks)
3) Torque, Center of Mass, and Stability (~8 blocks)
4) Mechanics of Biological Materials (~12 blocks)
5) Linear Kinematics (~10 blocks)

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6) Angular Kinematics, Planes, and Joints (~10 blocks)
7) Linear Kinetics (~8 blocks)
8) Angular Kinetics (~8 blocks)
9) Work, Energy, and Conservation (~8 blocks)
10) Fluid Dynamics (~7 blocks)

** Any remaining days are devoted to the Final Exam

PA COMMON CORE APPLICABLE TO ALL UNITS:
CC.3.5.11-12.A. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
CC.3.5.11-12.B. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.3.5.11-12.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
CC.3.5.11-12.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.
CC.3.5.11-12.E. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
CC.3.5.11-12.G. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CC.3.6.11-12.A. Write arguments focused on discipline-specific content.
CC.3.6.11-12.B. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
CC.3.6.11-12.C. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

SCIENCE ED PA STANDARD APPLICATION TO ALL UNITS:
3.2.10.B6. PATTERNS SCALE MODELS CONSTANCY/ CHANGE Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.
3.4.10.E1. Assess how medical technologies over time have impacted prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, and genetic engineering.

HEALTH/PHYSICAL ED PA STANDARD APPLICATION TO ALL UNITS:
10.5.12.E. Evaluate movement forms for appropriate application of scientific and biomechanical principles. • efficiency of movement • mechanical advantage • kinetic energy • potential energy • inertia • safety

Online Resources that apply to all units:

1) ESPN Sport Science: http://www.espn.com/espn/sportscience/index
   http://www.espn.com/video/archive/_/channel/sport-science
   https://www.youtube.com/playlist?list=PLn3nHXu50t5xqHW67LKFhUB_C2Y9C0IwC
2) PHET Simulations: https://phet.colorado.edu/
3) Selected You Tube Clips from: @PhysicsGirl, @Veritasium, and @CuriousDoc

Textbook Resources:
Main Textbook (Expected Formal Adoption Fall 2023)
Biomechanics of Sport and Exercise, Peter M. McGinnis, 4th Edition. © 2020 by Human Kinetics
Reference Textbooks
- Basic Biomechanics, Susan J. Hall
- Fundamentals of Biomechanics, Duane Knudson
- Biomechanics, Sean P. Flanagan

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 1: Introduction to Biomechanics	**TIMEFRAME: ~7 Days**

PA COMMON CORE/NATIONAL STANDARDS:

3.1.10.A8. Investigate the spatial relationships of organisms' anatomical features using specimens, models, or computer programs.

UNIT OBJECTIVES:

Students will be able to:

1) Describe the basic ideas and methods behind the study of Biomechanics.
2) Identify the applications Biomechanics has to careers and everyday life.
3) Understand where biomechanics fits into a college curriculum.
4) Differentiate between the qualitative and quantitative approaches to studying biomechanical problems.
5) Outline the differences between the Imperial and SI (Metric) systems of measurement.
6) Identify the proper units for the three base measurements.
7) Convert between the systems of measurements.
8) Define the ideas of accuracy, precision, and uncertainty in measurements.
9) Understand the process of creating a graph in excel.
10) Recognize the application of Cartesian Coordinate systems.
11) List the basic structure and function of bone, muscle, tendons, ligaments, and cartilage.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Lab activities on graph making.
3) Worksheets on Problem Solving, Graph Making, basic vocabulary, and Unit Conversion

ANCHOR VOCABULARY:

Biomechanics, mechanics, statics, dynamics, kinematics, kinetics, kinesiology, quantitative, qualitative, metric system, linear, nonlinear, metric system, accuracy, precision, uncertainty, bone, cortical, trabecular, collagen, muscle, articular cartilage, tendon, ligament, friction, tension

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Due to varied level of experience in prior math and science classes, students may need DI on basic algebra concepts and/or unit conversions. Worksheets/quizzes may be modified to show learning goals. One on one instruction or extra practice may be used if necessary.

RESOURCES:

- Biomechanics, McGinnis, Introductory Chapter, 13-15
- Basic Biomechanics, Susan J. Hall: Chapters 1+2
- Fundamentals of Biomechanics, Duane Knudson: Chapters 1+2
- Biomechanics, Sean P. Flanagan: Chapter 1

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 2: Forces and Vectors	**TIMEFRAME: ~8 Days**

PA COMMON CORE/NATIONAL STANDARDS:

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.
3.2.10.B6. PATTERNS SCALE MODELS CONSTANCY/ CHANGE Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.
3.2.12.B6. CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

UNIT OBJECTIVES:

Students will be able to:

1) Differentiate between different kinds of forces.
2) Solve for the total force on an object.
3) Label forces in a free body diagram
4) Understand the role of friction in various situations.
5) Apply vector algebra to solve for components of forces and a total of multiple forces.
6) Recognize equilibrium situations.
7) Apply the idea of total force to biomechanical situations.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct Instruction on content
2) Lab exercises on Forces (Friction) and Force Components (Vector Addition)
3) Exercises on Force Components, Friction, and Total Force

ANCHOR VOCABULARY:

Force, Newton, Vector, Scalar, Internal, External, Field Force, Contact Force, Gravity, Normal Force, Tension, Friction, Static and Dynamic, Free Body Diagram, Net Force, Equilibrium, Components

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Due to varied levels of math ability, extra help on basic trig functions may be needed. More individual help, practice, or varied ways of using trig functions will be presented.

RESOURCES:

- Biomechanics, McGinnis, Chapter 1

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 3: Torque, Stability, and Center of Mass	**TIMEFRAME: ~8 Days**

PA COMMON CORE/NATIONAL STANDARDS:

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.
3.2.12.B1. Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.
3.2.10.B6. PATTERNS SCALE MODELS CONSTANCY/ CHANGE Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.

UNIT OBJECTIVES:

Students will be able to:

1) Differentiate between the ideas of weight and mass.
2) Summarize the conceptual idea of center of mass.
3) Demonstrate how to find an object's center of mass.
4) Relate the idea of stability to biomechanical situations in sport and exercise.
5) Differentiate between linear force and torque.
6) Recognize the application of torque in everyday situations.
7) Calculate torque in variety of situations, including situations in the human body.
8) Identify where natural levers are in the human body.
9) Relate the idea of rotational equilibrium to translational equilibrium.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Labs/Demos on Center of Mass and Torque
3) Exercises and practice on Torque Equations

ANCHOR VOCABULARY:

Symmetry, Center of Mass, Center of Gravity, balance, stability, pivot, fulcrum, torque, radius, rotational equilibrium, axis of rotation, lever, lever arm, angular motion, net torque

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Differentiation in math exercises can include expansion of equations to reduce algebra and model handouts with graphic organizers to use equations.

RESOURCES:

- Biomechanics, McGinnis, Chapter 5

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 4: Mechanics of Biological Materials	**TIMEFRAME: ~12 Days**

PA COMMON CORE/NATIONAL STANDARDS:

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.
3.2.12.B1. Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.
3.1.12.A5. Analyze how structure is related to function at all levels of biological organization from molecules to organisms.
3.1.10.A8. Investigate the spatial relationships of organisms' anatomical features using specimens, models, or computer programs.

UNIT OBJECTIVES:

Students will be able to:

1) Hypothesize how loads affect the human body.
2) Define the mechanical idea of stress.
3) Differentiate between the different kinds of stress.
4) Compare the ideas of linear and shear strain.
5) Solve for stress, strain, Elastic Modulus, and Poisson's Ratio
6) Analyze stress/strain curves of various objects, along with the relationship to "strength" and "toughness."
7) Identify parts of the stress/strain curve of various objects.
8) Explain the major mechanical properties of bone, muscle, cartilage, tendons, and ligaments.
9) Recognize the general mechanics of injury.
10) Understand the factors that affect muscle/tendon mechanics

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Labs/Demos on Stress and Strain
3) Exercises and practice on stress and strain.
4) Investigations into injury mechanics

ANCHOR VOCABULARY:

Load, Stress, Pascal, Cross-Sectional, Compression, Tension, Sheer, Bending, Torsion, linear strain, shear strain, Poisson's Ratio, elasticity, elastic modulus, plastic behavior, elastic limit, yield strength, failure, ultimate strength, deformation, failure strength, failure strain, ductile, brittle, toughness, collagen, elastin, creep, stress relaxation, hysteresis, lubrication, wear, failure tolerance, margin of safety, fracture, sprains, Muscle-tendon complex (MTC)

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- This unit is large and will be broken into two parts. There is a large amount of vocabulary in this unit, possibly necessitating DI in the form of reduction of terms or test aides.

RESOURCES:

- Biomechanics, McGinnis, Chapter 9
- Biomechanics, Flanagan, Chapter 10+11

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 5: Linear Kinematics	**TIMEFRAME: ~10 Days**

PA COMMON CORE/NATIONAL STANDARDS:

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.
3.2.10.B6. PATTERNS SCALE MODELS CONSTANCY/ CHANGE Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.

UNIT OBJECTIVES:

Students will be able to:

1) Differentiate between distance and displacement and speed and velocity.
2) Explain the concept of acceleration.
3) Solve for the quantities of displacement, velocity, and acceleration.
4) Apply the concepts of constant acceleration to both horizontal and vertical movement.
5) Describe the difference between instantaneous and average kinematic measures.
6) Analyze the effect of gravity on vertical motion.
7) Describe what mechanical principles govern projectile motion and provide optimal projection.
8) Describe situations when velocity is more important than acceleration, and vice versa.
9) Apply linear kinematics to problems involving the human body.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Labs on horizontal kinematics
3) Labs on vertical kinematics
4) Labs/Applications focused on the lower extremity, specifically foot, ankle, and hip with focus on gait and walking.

ANCHOR VOCABULARY:

Kinematics, rectilinear motion, curvilinear motion, angular motion, position, distance, displacement, scalar, vector, speed, velocity, average, instantaneous, acceleration, projectile, symmetry, gravity, air resistance, trajectory, angle of projection, range, gait

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Some differentiation in learning math may be needed including expansion of equations to reduce algebra and model handouts with graphic organizers on how to use equations.

RESOURCES:

- Biomechanics, McGinnis, Chapter 2

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 6: Angular Kinematics, Planes, and Joints	**TIMEFRAME: ~10 Days**

PA COMMON CORE/NATIONAL STANDARDS:

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.

UNIT OBJECTIVES:

Students will be able to:

1) Differentiate between angular and linear movements.
2) Differentiate between angular speed and linear speed, and angular acceleration and linear acceleration.
3) Understand the difference between angular, tangential, and radial (Centripetal) acceleration.
4) Solve for angular quantities using constant acceleration.
5) Solve for angular quantities using linear quantities, and vice versa.
6) Apply the use of tools to measure angles.
7) Apply angular kinematics to problems involving the biology of the human body.
8) Identify the standard reference terminology for directional terms, anatomical reference planes and axes, and joint movements.
9) Recognize the application of Cartesian Coordinate systems.
10) Differentiate between different types of joints, as well as different subtypes of synovial joints.
11) Identify the major anatomical parts of a synovial joint.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Labs/Activities on Angular Kinematics
3) PASCO Labs involving angles and use of a goniometer.
4) Exercises focused on planes of motion terminology.

ANCHOR VOCABULARY:

Angular position, angular displacement, radians, degrees, arc length, angular velocity, tangential velocity, angular acceleration, centripetal acceleration, joint, anatomical position, sagittal, frontal, transverse, anterior, posterior, superior, inferior, medial, lateral, proximal, distal, flexion, extension, hyperextension, dorsiflexion, plantar flexion, abduction, adduction, deviation, inversion, eversion, elevation, depression, rotation, pronation, supination, circumduction, fibrous, cartilaginous, synovial, articular capsule, synovial layer, synovial fluid, articular cartilage

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Due to varied levels of experiences in prior classes, students may need DI on multiple vocabulary terms associated with anatomical reference planes and motions. Worksheets/quizzes may be

modified to show learning goals. One on one instruction or extra practice with physical moving to demonstrate the vocabulary terms will be used.
RESOURCES: - Biomechanics, McGinnis, Chapter 6

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 7: Linear Kinetics	**TIMEFRAME: ~8 Days**

PA COMMON CORE/NATIONAL STANDARDS:

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.

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.

3.2.P.B2. Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum. Describe the rotational motion of objects using the conservation of energy and conservation of angular momentum. Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.

3.2.P.B6. PATTERNS SCALE MODELS CONSTANCY/CHANGE Use Newton's laws of motion and gravitation to describe and predict the motion of objects ranging from atoms to the galaxies.

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.

3.2.12.B6. CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

UNIT OBJECTIVES:

Students will be able to:

1) Apply Newton's Laws to various situations of human motion.
2) Describe the idea of inertia.
3) Identify the conditions that create the production of a maximum force.
4) Define the ideas of momentum and impulse.
5) Summarize the importance of the differences of time and force in decreasing momentum.
6) Demonstrate that movement usually occurs in the direction opposite that of an applied force.
7) Solve for a variety of variables using conservation of momentum.
8) Differentiate between elastic and inelastic collisions.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Labs/Activities on Newton's Laws
3) Labs/Activities on momentum and impulse

ANCHOR VOCABULARY:

Inertia, Newton's 1st Law, Newton's 2nd Law, Momentum, Impulse, Newton's 3rd Law, Conservation of Momentum, Elastic, Inelastic

ASSESSMENTS :

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.

3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Differentiation in math exercises can include expansion of equations to reduce algebra and model handouts with graphic organizers to use equations.

RESOURCES:

- Biomechanics, McGinnis, Chapter 3

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 8: Angular Kinetics	**TIMEFRAME: ~8 Days**

PA COMMON CORE/NATIONAL STANDARDS:

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.
3.2.P.B2. Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum. Describe the rotational motion of objects using the conservation of energy and conservation of angular momentum. Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.
3.2.12.B6. CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.
3.2.12.B1. Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

UNIT OBJECTIVES:

Students will be able to:

1) Differentiate between linear inertia and rotational inertia.
2) Identify, find, and solve for the rotational inertia in various situations.
3) Apply Newton's 3 Laws to Angular Motion
4) Explain various human motions using the idea of rotational inertia
5) Identify the benefits of large or small rotational inertia in various sports/exercises.
6) Differentiate between linear and angular momentum.
7) Differentiate between linear and angular impulse.
8) Apply the conservation of angular momentum to human movements.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Labs/Activities on Rotational Inertia
3) Labs/Activities on Angular Momentum and its Conservation

ANCHOR VOCABULARY:

Rotational Inertia, Moment of Inertia, radius of gyration, angular momentum, angular impulse, conservation of angular momentum

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Differentiation in math exercises can include expansion of equations to reduce algebra and model handouts with graphic organizers to use equations.

RESOURCES:

- Biomechanics, McGinnis, Chapter 7

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 9: Work and Energy	**TIMEFRAME: ~8 Days**

PA COMMON CORE/NATIONAL STANDARDS:

3.2.10.B2. Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.

3.2.P.B2. Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum. Describe the rotational motion of objects using the conservation of energy and conservation of angular momentum. Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion.

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.

3.2.12.B6. CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

UNIT OBJECTIVES:

Students will be able to:

1) Describe the relationship between work and energy.
2) Differentiate between work and power.
3) Differentiate between kinetic and potential energy.
4) Identify types of energies in different situations.
5) Solve for various quantities using the idea of conservation of energy.
6) Apply the conservation of energy to the human body.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Labs/Activities on Work and Power
3) Labs/Activities on Energy Conservation applied to areas of the body.

ANCHOR VOCABULARY:

Work, Joule, Power, Watt, Horsepower, Kinetic Energy, Gravitational Potential Energy, Elastic Potential Energy, heat energy, conservation of energy

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Conservation of energy generally comes easier mathematically. Standard reteaching, small grouping, or alternative assessments may be applicable.

RESOURCES:

- Biomechanics, McGinnis, Chapter 4

Wallenpaupack Area School District Curriculum	
COURSE: Biomechanics in Movement and Sport	**GRADE/S: 10/11/12**
UNIT 10: Fluid Dynamics	**TIMEFRAME: ~7 Days**

PA COMMON CORE/NATIONAL STANDARDS:

No additional standards

****This unit may be cut/shortened due to time constraints during the semester*

UNIT OBJECTIVES:

Students will be able to:

1) Generally describe how human movement can be influenced by fluids.
2) Define fluid.
3) Differentiate between laminar and turbulent flow.
4) Solve for various variables using the idea of buoyancy.
5) List the properties of fluids that affect the motion of a body.
6) Describe how the drag force works on a moving body in both liquids and gases.
7) List what the drag force depends on.
8) Solve for various variables using the idea of drag and lift force.
9) Describe how the lift force affects a body in motion.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

1) Direct instruction on content
2) Labs/Activities on buoyancy
3) Labs/Activities on drag force
4) Labs/Activities on lift force

ANCHOR VOCABULARY:

Fluid, relative velocity, laminar flow, turbulent flow, buoyancy, Archimedes' Principle, drag, coefficient of drag, lift, coefficient of lift, foil, Bernoulli's Principle, angle of attack, lift/drag ratio, magnus effect, propulsive drag, propulsive lift

ASSESSMENTS:

1) Formative assessment from teacher observation and checks.
2) Summative quiz at end of chapter/unit.
3) Lab Activities

DIFFERENTIATED INSTRUCTION:

- Differentiation in math exercises can include expansion of equations to reduce algebra and model handouts with graphic organizers to use equations.

RESOURCES:

- Biomechanics, McGinnis, Chapter 8