Westbury High School
Science Department Lesson Plan

A merger of Madeline Hunter's Lesson Cycle and the 5-E Method of Instruction

Teacher: *C. Williams* ***Subject:*** *Physics*

Date: *01/26 - 01/30/2015* ***Lesson:*** *Energy & Momentum Conservation*

Defining Success

LESSON OBJECTIVE: What will your students be able to do by the end of the class?

Students will investigate and calculate with the work-energy theorem in various situations and investigate examples of kinetic and potential energy and their transformations. After calculating momentum and energy in various situations, students demonstrate and apply the laws of conservation of energy and momentum.

ESSENTIAL UNDERSTANDING/GUIDING QUESTIONS:

- Mechanical energy can be transformed from one form into another, transferred from one object to another, or redistributed between the objects of the system by means of mechanical work done by the forces within or from outside the system.
  1. How do gravitational and elastic forces change the mechanical energy of the system?
  2. How do frictional forces change the mechanical energy of the system?
  3. What is the work-energy theorem and why is it related to kinetic energy?
- The sum of the kinetic and potential energy of an object results in mechanical energy.
  1. What are examples of the different forms of kinetic and potential energy?
  2. What is mechanical energy and why is it related to the law of conservation of energy?
- The law of conservation of momentum states that if no external force is acting on a system, the total momentum of the system remains unchanged.
  1. What is the law of conservation of momentum and how is it expressed mathematically?
  2. What is the difference between an elastic collision and an inelastic collision?
  3. Why does the total momentum of a system remain unchanged?
- The law of conservation of energy states that the total energy of a closed system remains constant.
  1. How is energy conserved in a closed system?
  2. Why is conservation of energy related to conservation of momentum?

STANDARDS ADDRESSED: TEKS, ELPs and CCRS's.	**MISCELLANEOUS INFORMATION** Marzano's Strategies, key concepts or questions

READINESS AND SUPPORTING STANDARDS

Ⓡ **PHYS.6A** Investigate and calculate with the work-energy theorem in various situations.

Ⓡ **PHYS.6B** Investigate examples of kinetic and potential energy and their transformations.

Ⓡ **PHYS.6C** Calculate the mechanical energy of, power generated within, impulse applied to, and momentum of a physical system.

Ⓡ **PHYS.6D** Demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension.

PROCESS SKILLS

Ⓕⓢ **PHYS.2E** Design and implement investigative procedures including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness.

Ⓕⓢ **PHYS.2F** Demonstrate the use of course apparatus, equipment, techniques, and procedures.

Ⓕⓢ **PHYS.2G** Use a wide variety of additional course apparatuses, equipment, techniques, materials, and procedures as appropriate.

Ⓕⓢ **PHYS.2H** Make measurements with accuracy and precision and record data using scientific notation and International System (SI) units.

Ⓕⓢ **PHYS.2J** Organize and evaluate data and make inferences from data including the use of tables, charts, and graphs.

Ⓕⓢ **PHYS.2K** Communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

Ⓕⓢ **PHYS.2L** Express and manipulate relationships among physical variables quantitatively including the use of graphs, charts, and equations.

ENGLISH LANGUAGE PROFICIENCY STANDARDS

ELPS C.1.a Use prior knowledge and experiences to understand meanings in English.

ELPS C.2.f Listen to and derive meaning from a variety of media such as audio, video, DVD, and CD-ROM to build and reinforce concept and language attainment.

ELPS C.3.f Ask and give information ranging from using a very limited bank of high-frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts, to using abstract and content-based vocabulary during extended speaking assignments.

ELPS C.1.d Speak using learning strategies such as requesting assistance, employing non-verbal cues, and using synonyms and circumlocution (conveying ideas by defining or describing when exact English words are not known).

ELPS C.2.g Understand the general meaning, main points, and important details of spoken language ranging from situations in which topics, language, and contexts are familiar to unfamiliar.

ELPS C.3.g Express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics.

COLLEGE AND CAREER READINESS STANDARDS

CCRS VIII.D.1 Understand potential and kinetic energy.

CCRS VIII.D.2 Understand conservation of energy.

CCRS VIII.D.3 Understand the relationship of work and mechanical energy.

CCRS VIII.C.3 Understand the concept of momentum

Collaborative Grouping

Making hypothesizes

How do I measure physical quantities to be able to calculate the distance traveled, displacement, speed and velocity of a moving object?

Lesson Cycle

ANTICIPATORY SET: ***(ENGAGE):*** A "hook" to get the students interest and attention. *(A question, picture, 2-3 minute long video clip, a demonstration).*

M/T: **Do Now** (Connected to previous homework - designed to engage incoming students quickly with today's academic content.)

W/Th: **Do Now** (Connected to previous homework - designed to engage incoming students quickly with today's academic content.)

Fr: **Do Now** (Connected to previous homework - designed to engage incoming students quickly with today's academic content.)

Checks for Understanding		
Oral / Written Debrief	Connect Correct Collect	Student Leadership

TEACHING/INSTRUCTIONAL PROCESS: ***(EXPLORE/EXPLAIN)*****:** *Provide students with a common experience (Labs, hands on activities). Debrief activity, teach concept.*

M/T: **Activity** - Students begin to explore essential question (In pairs, triads and quads, students debrief/teach concept facilitated by teacher)

W/Th: **Activity** - Students begin to explore essential question (In pairs, triads and quads, students debrief/teach concept facilitated by teacher)

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Checks for Understanding		
Oral / Written Debrief	Guiding / Essential Questions	Student Leadership

GUIDED PRACTICE AND MONITORING: (EXPLAIN). Interactive discussions between teacher and students. Guide/help students as they solve problems and/or answer questions. Clarify misconceptions and check for understanding.

M/T: **Mini Lesson** – Interactive Teacher-Student *open discussion* (facilitated by multimedia, worksheets, and educational technology tools) that validates student knowledge and skill and uncovers and clarifies misconceptions and misunderstandings. (Prepares students to produce products)

W/Th: **Mini Lesson** – Interactive Teacher-Student *open discussion* (facilitated by multimedia, worksheets, and educational technology tools) that validates student knowledge and skill and uncovers and clarifies misconceptions and misunderstandings. (Prepares students to produce products)

Fr: **Mini Lesson** – Interactive Teacher-Student *open discussion* (facilitated by, multimedia. worksheets, and educational technology tools) that validates student knowledge and skill and uncovers and clarifies misconceptions and misunderstandings. (Prepares students to produce products)

Checks for Understanding		
Student Products	Connect Correct Collect	Student Leadership

INDEPENDENT PRACTICE: ***(ELABORATE)*** Students apply the information learned in the Explain to answer questions or solve problems.

MATERIALS

SmartBoard™

Constant velocity cars (Tumble Buggies)

Meter sticks

Stopwatches

Masking tape

Graph paper

Camera

Tennis ball

Logger Pro™

PPT

Whiteboards

Dry Erase Marker

Launcher
Water Balloons
Tape Measure

	M/T: **Student Product** - Students apply knowledge and skills to an authentic task. (In pairs, triads and quads, students support each others learning – products are informally/formally assessed by teacher) **W/Th:** **Student Product** - Students apply knowledge and skills to an authentic task. (In pairs, triads and quads, students support each others learning – products are informally/formally assessed by teacher) **Fr:** **Student Product** - Students apply knowledge and skills to an authentic task. (In pairs, triads and quads, students support each others learning.	
	EVALUATE: Assess student mastery. (Quizzes, Lab Reports, Unit tests)	
	M/T: **Assessment** - Students products are assessed for mastery informally and formally by teacher (Completion of activity sheet, presentation, and/or exit ticket) **W/Th:** **Assessment** - Students products are assessed for mastery informally and formally by teacher (Completion of activity sheet, presentation, and/or exit ticket) **Fr:** **Assessment** - Students products are assessed for mastery informally and formally by teacher (Completion of activity sheet, presentation, and/or exit ticket)	

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Science Department Lesson Plan

A merger of Madeline Hunter's Lesson Cycle and the 5-E Method of Instruction

Teacher: *C. Williams* ***Subject:*** *Physics*

Date: *02/02 -06/2015* ***Lesson:*** *Conservation of Momentum & Energy & Thermodynamics*

Defining Success

LESSON OBJECTIVE: What will your students be able to do by the end of the class?

Students continue calculating momentum and energy in various situations, students demonstrate and apply the laws of conservation of energy and momentum. Students also investigate thermodynamic systems, give examples of different types of thermal energy transfer, and analyze and explain examples that illustrate the first and second laws of thermodynamics.

ESSENTIAL UNDERSTANDING / GUIDING QUESTIONS:

- The law of conservation of momentum states that if no external force is acting on a system, the total momentum of the system remains unchanged.
  1. What is the law of conservation of momentum and how is it expressed mathematically?
  2. What is the difference between an elastic collision and an inelastic collision?
  3. Why does the total momentum of a system remain unchanged?
- The law of conservation of energy states that the total energy of a closed system remains constant.
  2. How is energy conserved in a closed system?
  3. Why is conservation of energy related to conservation of momentum?
- The amount of heat energy added to a system is equal to the increase in the internal energy of the system plus the work done by the system.
  1. How is the first law of thermodynamics expressed mathematically?
  2. Why is the first law of thermodynamics related to the law of conservation of energy?
- Natural processes go in a direction that maintains or increases the total entropy of the universe.
  1. How does the second law of thermodynamics predict that heat flows spontaneously from an object of higher temperature to an object of lower temperature?
  2. Why must some energy always be transferred as heat to a system's surroundings?
- Heat energy transfers by conduction, convection, and radiation resulting in an increasing amount of disorder.
  1. How are the processes of conduction, convection, and radiation similar and how are the different?
  2. Why does transfer of heat energy result in an increasing amount of disorder?

STANDARDS ADDRESSED: TEKS, ELPs and CCRS's.	**MISCELLANEOUS INFORMATION** Marzano's Strategies, key concepts or questions

READINESS AND SUPPORTING STANDARDS

Ⓡ **PHYS.6D** Demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension.

Ⓢ **PHYS.6E** Describe how the macroscopic properties of a thermodynamic system such as temperature, specific heat, and pressure are related to the molecular level of matter including kinetic or potential energy of atoms.

Ⓢ **PHYS.6F** Contrast and give examples of different processes of thermal energy transfer including conduction, convection, and radiation.

Ⓢ **PHYS.6G** Analyze and explain everyday examples that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy.

PROCESS SKILLS

Ⓟ **PHYS.2E** Design and implement investigative procedures including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness.

Ⓟ **PHYS.2H** Make measurements with accuracy and precision and record data using scientific notation and International System (SI) units.

Ⓟ **PHYS.2J** Organize and evaluate data and make inferences from data including the use of tables, charts, and graphs.

Ⓟ **PHYS.2K** Communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

ENGLISH LANGUAGE PROFICIENCY STANDARDS

ELPS C.1.d Speak using learning strategies such as requesting assistance, employing non-verbal cues, and using synonyms and circumlocution (conveying ideas by defining or describing when exact English words are not known).

ELPS C.2.g Understand the general meaning, main points, and important details of spoken language ranging from situations in which topics, language, and contexts are familiar to unfamiliar.

ELPS C.3.g Express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics.

ELPS C.1.c Use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary.

ELPS C.4.f Use visual and contextual support and support from peers and teachers to read grade-appropriate content area text, enhance and confirm understanding, and develop vocabulary, grasp of language structures, and background knowledge needed to comprehend increasingly challenging language.

ELPS C.5.f Write using a variety of grade-appropriate sentence lengths, patterns, and connecting words to combine phrases, clauses, and sentences in increasingly accurate ways as more English is acquired.

COLLEGE AND CAREER READINESS STANDARDS

CCRS VIII.C.3 Understand the concept of momentum.

CCRS VIII.D.2 Understand conservation of energy.

CCRS VIII.A.2 Understand states of matter and their characteristics.

CCRS VIII.H.1 Understand the gain and loss of heat energy in matter.

CCRS VIII.H.2 Understand the basic laws of thermodynamics.

Collaborative Grouping

Making hypothesizes

How do I measure physical quantities to be able to calculate the distance traveled, displacement, speed and velocity of a moving object?

Lesson Cycle

ANTICIPATORY SET: ***(ENGAGE):*** A "hook" to get the students interest and attention. *(A question, picture, 2-3 minute long video clip, a demonstration).*

M/T: **Do Now** (Connected to previous homework - designed to engage incoming students quickly with today's academic content.)

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Checks for Understanding		
Oral / Written Debrief	Connect Correct Collect	Student Leadership

TEACHING/INSTRUCTIONAL PROCESS: ***(EXPLORE/EXPLAIN)*****:** *Provide students with a common experience (Labs, hands on activities). Debrief activity, teach concept.*

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Checks for Understanding		
Oral / Written Debrief	Guiding / Essential Questions	Student Leadership

GUIDED PRACTICE AND MONITORING: (EXPLAIN). Interactive discussions between teacher and students. Guide/help students as they solve problems and/or answer questions. Clarify misconceptions and check for understanding.

M/T: **Mini Lesson** – Interactive Teacher-Student *open discussion* (facilitated by multimedia, worksheets, and educational technology tools) that validates student knowledge and skill and uncovers and clarifies misconceptions and misunderstandings. (Prepares students to produce products)

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Checks for Understanding		
Student Products	Connect Correct Collect	Student Leadership

INDEPENDENT PRACTICE: ***(ELABORATE)*** Students apply the information learned in the Explain to answer questions or solve problems.

MATERIALS

SmartBoard™

Constant velocity cars (Tumble Buggies)

Meter sticks

Stopwatches

Masking tape

Graph paper

Camera

Tennis ball

Logger Pro™

PPT

Whiteboards

Dry Erase Marker

Launcher
Water Balloons
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Teacher: *C. Williams* ***Subject:*** *Physics*

Date: *02/09 -13/2015* ***Lesson:*** *Thermodynamics & Wave Properties*

Defining Success

LESSON OBJECTIVE: What will your students be able to do by the end of the class?

Students continue to investigate thermodynamic systems, give examples of different types of thermal energy transfer, and analyze and explain examples that illustrate the first and second laws of thermodynamics. Students investigate and interpret a variety of waves, their characteristics, and properties such as velocity, amplitude, frequency, and wavelength. Students also calculate wavespeed, frequency, and wavelength of different types of waves.

ESSENTIAL UNDERSTANDING / GUIDING QUESTIONS:

- The amount of heat energy added to a system is equal to the increase in the internal energy of the system plus the work done by the system.
  1. How is the first law of thermodynamics expressed mathematically?
  2. Why is the first law of thermodynamics related to the law of conservation of energy?
- Natural processes go in a direction that maintains or increases the total entropy of the universe.
  3. How does the second law of thermodynamics predict that heat flows spontaneously from an object of higher temperature to an object of lower temperature?
  4. Why must some energy always be transferred as heat to a system's surroundings?
- Heat energy transfers by conduction, convection, and radiation resulting in an increasing amount of disorder.
  3. How are the processes of conduction, convection, and radiation similar and how are the different?
  4. Why does transfer of heat energy result in an increasing amount of disorder?

STANDARDS ADDRESSED: TEKS, ELPs and CCRS's.	**MISCELLANEOUS INFORMATION** Marzano's Strategies, key concepts or questions

READINESS AND SUPPORTING STANDARDS

Ⓢ **PHYS.7A** Examine and describe oscillatory motion and wave propagation in various types of media.

Ⓡ **PHYS.7B** Investigate and analyze characteristics of waves including velocity, frequency, amplitude, and wavelength and calculate using the relationship between wavespeed, frequency, and wavelength.

Ⓡ **PHYS.7D** Investigate behaviors of waves including reflection, refraction, diffraction, interference, resonance, and the Doppler effect.

Ⓢ **PHYS.6E** Describe how the macroscopic properties of a thermodynamic system such as temperature, specific heat, and pressure are related to the molecular level of matter including kinetic or potential energy of atoms.

Ⓢ **PHYS.6F** Contrast and give examples of different processes of thermal energy transfer including conduction, convection, and radiation.

Ⓢ **PHYS.6G** Analyze and explain everyday examples that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy.

PROCESS SKILLS

Ⓟ **PHYS.2E** Design and implement investigative procedures including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness.

Ⓟ **PHYS.2H** Make measurements with accuracy and precision and record data using scientific notation and International System (SI) units.

Ⓟ **PHYS.2J** Organize and evaluate data and make inferences from data including the use of tables, charts, and graphs.

Ⓟ **PHYS.2K** Communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

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ELPS C.5.f Write using a variety of grade-appropriate sentence lengths, patterns, and connecting words to combine phrases, clauses, and sentences in increasingly accurate ways as more English is acquired.

COLLEGE AND CAREER READINESS STANDARDS

CCRS VIII.A.2 Understand states of matter and their characteristics.

CCRS VIII.H.1 Understand the gain and loss of heat energy in matter.

CCRS VIII.H.2 Understand the basic laws of thermodynamics.

CCRS VIII.G.1 Understand basic oscillatory motion and simple harmonic motion.

CCRS VIII.G.2 Understand the difference between transverse and longitudinal waves.

CCRS VIII.G.3 Understand wave terminology: wavelength, period, frequency, and amplitude

Collaborative Grouping

Making hypothesizes

How do I measure physical quantities to be able to calculate the distance traveled, displacement, speed and velocity of a moving object?

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