NEW MILFORD BOARD OF EDUCATION
New Milford Public Schools
25 Sunny Valley Road, Suite A
New Milford, Connecticut 06776

COMMITTEE ON LEARNING SUB-COMMITTEE
MEETING NOTICE

DATE: June 6, 2023
TIME: 7:30 P.M.
PLACE: Sarah Noble Intermediate School Library Media Center

AGENDA

New Milford Public Schools Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family, and community is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

1. Call to Order

2. Public Comment

An individual may address the Board concerning any item on the agenda for the meeting subject to the following provisions:

A. A three-minute time limit may be allocated to each speaker with a maximum of twenty minutes being set aside per meeting. The Board may, by a majority vote, cancel or adjust these time limits.

B. If a member of the public comments about the performance of an employee or a Board member, whether positive, negative, or neutral, and whether named or not, the Board shall not respond to such comments unless the topic is an explicit item on the agenda and the employee or the Board member has been provided with the requisite notice and due process required by law. Similarly, in accordance with federal law pertaining to student confidentiality, the Board shall not respond to or otherwise discuss any comments that might be made pertaining to students.

3. Items for Discussion and Approval

A. Curriculum:
   1. AP Microeconomics
   2. CP Chemistry
   3. Honors Chemistry
   4. Advanced Algebra and Trigonometry
   5. Honors Statistics
   6. CP Geometry
   7. Honors Geometry
   8. Business and Personal Law
   9. Algebra III
   10. Modern America
   11. CP Economics
   12. Chorus Grade 6
   13. Chorus Grade 7

14. Chorus Grade 8

4. Items of Information

A. Science of Reading Update
B. I-Ready Data Share

5. Public Comment

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6. Adjourn

Sub-Committee Members:	**Tammy McInerney Chairperson**
	Brian McCauley
	Leslie Sarich
	Sarah Herring
Alternates:	**Olga I. Rella**
	Pete Helmus

NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut

Revision

AP Microeconomics

April 2023

Do Not Distribute Not BOE Approved

New Milford Board of Education

Pete Helmus, Chairperson

Wendy Faulenbach, Vice Chairperson

Leslie Sarich, Secretary

Tammy McInerney, Assistant Secretary

Eric Hansell

Sarah Herring

Brian McCauley

Tom O'Brien

Olga Rella

Superintendent of Schools

Dr. Janet Parlato

Assistant Superintendent

Ms. Holly Hollander

Authors of Course Guide

Cara Abraham

New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

AP Microeconomics

Grades 11-12

The AP Microeconomics course is equivalent to an introductory college-level microeconomics course. It is organized into units which comprise the content and skills colleges and universities typically expect students to master to qualify for college credit and/or placement. The combination of big ideas and course skills prepare students to think like economists by using principles and models to describe economic situations and predict and explain outcomes. Microeconomics applies to the functions of individual economic decision-makers, such as consumers and individual firms. The course develops students' familiarity with scarcity, cost benefit analysis, marginal analysis, the laws of supply and demand, the operation of product and factor markets, market failure, and the role of government in promoting greater efficiency and equity in the economy. Students learn to use graphs, charts, and data to analyze, describe, and explain economic concepts.

Key for College Board Standards

Big Ideas

1. **Scarcity and Markets (MKT)** - Limited resources and unlimited wants result in the need to make choices. In a market economy, the choices of buyers and sellers determine market prices and the allocation of scarce resources.
2. **Costs, Benefits, and Marginal Analysis (CBA)** - There are trade-offs associated with any decision. Making optimal decisions requires evaluating the additional costs and benefits of possible actions.
3. **Production Choices and Behavior (PRD)** - Firms seek to minimize costs and maximize profits, which influences their production decisions in the short run and long run.
4. **Market Inefficiency and Public Policy (POL)** - Private markets can fail to allocate resources efficiently, and well-designed public policy can endeavor to promote greater efficiency and equity in the economy..

Economics Skills

1. Define economic principles and models.
2. Explain given economic outcomes.
3. Determine outcomes of specific economic situations.
4. Model economic situations using graphs or visual representations.

Connection to the Vision of a Graduate (communication, critical thinking, creativity, problem solving, positive relationships and social awareness, self-knowledge and management, and growth mindset)

AP Microeconomics contributes to the vision of a graduate of New Milford High School in the following ways:

- Students communicate with classmates, build positive relationships, and develop social awareness when working in informal small groups during in class discussions and problem-solving sessions. We build a strong classroom community in this AP class to provide students with collaborators with whom they may turn to for out-of-class support. Students also create content and skill specific study guides for each other so they can see the immediate impact their contributions have on an authentic audience. They communicate more deeply with partners to complete performance-based assessments which in turn are formally presented to the class as a whole. Students also learn how to communicate symbolically with models of economic situations using graphs.
- Students engage in critical thinking and problem solving when considering opportunity costs in pursuing post-secondary plans and entrepreneurial pursuits, in bringing a product to market, and in deciding when and how much to spend on personal entertainment as opposed to saving and/or investing for the future. Students frequently practice free-response questions which prompt students to consider the possible outcomes of many different economic situations.
- Students develop self-knowledge, self-management, and a growth mindset with a rigorous independent work schedule. Students are responsible for meeting due dates and for peer assessing their classmates' presentations. Students are asked to present practice problems on the board so that their thinking is made visible for all. In this way they learn from each other that mistakes are an opportunity to learn from multiple sources. Students are given cumulative tests and are also encouraged to redo assignments and make corrections to quizzes and tests to show that their learning is an on-going process.

Pacing Guide

Include a list of the units and the approximate number of days/weeks it will take to teach the unit.

1. Basic Economic Concepts — 7-79 minute block periods

2. Supply and Demand — 17-79 minute block periods
    a. Supply & Demand (12 periods)
    b. Consumer Choice Theory (5 periods)

3. Production, Cost, and the Perfect Competition Model — 15-79 minute block periods
    a. Production and Cost Analysis (6 periods)
    b. Perfect Competition (9 periods)

Midterm Exam

4. Imperfect Competition — 12-79 minute block periods
    a. Monopolies (6 periods)
    b. Monopolistic Competitors (3 periods)
    c. Oligopolies (3 periods)

5. Factor/Resource Markets — 10-79 minute block periods

6. Market Failure & Role of Government — 9-79 minute block periods

In class Review — 5-79 minute block periods

AP Exam

AP Microeconomics Unit 1 Basic Economic Concepts

ESTABLISHED GOALS

From C3 Framework for Social Studies

ECO 9-12.1 Analyze how incentives influence choices that may result in policies with a range of costs and benefits for different groups.

ECO 9-12.2 Use marginal benefits and marginal costs to construct an argument for or against an approach or solution to an economic issue.

ECO 9-12.13 Explain why advancements in technology and investments in capital goods and human capital increase economic growth and standards of living.

ECO 9-12.14 Analyze the role of comparative advantage in international trade of goods and services.

CCSS ELA RH 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in

Transfer

Students will be able to independently use their learning to…

1. Apply the concept of trade-offs in many aspects of their lives.
2. Recognize how different economies produce and supply goods and services.
3. Identify when trade is advantageous.

Meaning

UNDERSTANDINGS

Students will understand that…

1. Resources are finite, so that in any economy, the existence of limited resources along with unlimited wants results in the need to make choices.
2. People and governments choose different types of economies to determine what types of goods and services to produce and distribute.
3. Opportunity costs can be illustrated graphically.
4. Countries can engage in mutually advantageous trade.

ESSENTIAL QUESTIONS

Students will keep considering…

1. What information is necessary to make educated choices?
2. What cultural values impact what type of economy a society chooses?
3. How can tables and graphs be used and refined to illustrate key economic concepts?
4. How can a country be incentivized to participate in international trade?

words) in order to address a question or solve a problem.	***Acquisition***	
	Students will know…	*Students will be skilled at…*
	• economics • economic systems (command and market) • scarcity • opportunity costs • marginal analysis • production possibilities tables and graphs • optimal allocation of resources • economic growth • private property rights • incentives • specialization • circular flow model • absolute and comparative advantage	• Constructing and interpreting graphs as models of economic relationships. • Describing the nature of the economizing problem for an individual and for society. • Constructing, interpreting and analyzing production possibilities tables and graphs and calculating rising opportunity costs and optimal allocation of resources. • Differentiating between command and market systems and explaining how each determines which goods and services to produce, how to produce them, and to whom to distribute them. • Explaining how and why specialization and trade/exchange increase the total output of goods and services. • Describing and manipulating the mechanics of the circular flow model, including how households, businesses and government all buy and sell, produce and consume. • Calculating comparative advantage from differences in opportunity costs in order to determine the basis under which mutually advantageous trade can take place between countries.

Code	Evaluative Criteria	Assessment Evidence
T, M, A	School-wide Communication Rubric contextualized for role play.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* *The major types of economic systems (market, command, mixed) in how each answers the key economic questions of which goods and services to produce, how to produce them, and to whom to distribute them through a role play.* A. Economic Systems Role Play Goal: Present a skit (5 min) that portrays how either a market, command, or mixed economy determines which goods and services to produce, how those goods and services will be produced, and to whom the goods and services will be distributed. Role: Students are workers (labor or management) in each economy. Audience: Classmates. Situation: Students are stranded in an isolated community and must rely on resources and people in their immediate area. Product/Performance and Purpose: Each student plays (at least) one distinct role portraying how (at least) one good or service is produced and distributed. The decision-making process is embedded within the action and dialogue among actors keeping expository narrative to a minimum. Standards/criteria for success: Actions and dialogue drive the clear and obvious description of each type of economy so that the audience can easily differentiate among the three skits/economies. *A production possibilities curve reflects a country's opportunity*

		costs in producing consumer and capital goods, and how investment or underemployment leads to economic growth or recession.
M, A	AP free response rubric	B. AP Free-Response Style Question: This table provides 6 possible production combinations that Northville can produce from its available resources and technology during this year. Assume that Northville only produces bicycles and tents from its available resources. Combination / Bicycles / Tents A / 100 / 0 B / 90 / 10 C / 70 / 25 D / 40 / 36 E / 10 / 42 F / 0 / 44 1. Graph Northville's PPC. Include all labels. 2. Assume Northville is currently producing at Combination C. If it chooses to produce at Combination B, what is the OC of moving from C to B? 3. Assume Northville is currently producing at Combination C. If it chooses to produce at Combination D, what is the OC of moving from C to D? 4. Northville's PPC is not linear. Explain. *Calculating comparative advantage allows a country to engage in mutually advantageous trade.*

M, A	AP free response rubric	C. AP Free-Response Style Question: American and Japanese workers can each produce 4 cars in one year. An American worker can produce 10 tons of grain a year, whereas a Japanese worker can produce 5 tons of grain a year. To keep things simple, assume that each country has 100 million workers. • Construct a table for this situation. • Construct side-by-side graphs of both countries' PPC. • For the U.S., what is the OC of a car? OC of grain? Add to your table. • For Japan, what is the OC of a car? OC of grain? Add to your table. • Which country has the absolute advantage in producing cars? In producing grains? • Which country has the comparative advantage in producing cars? In producing grains? • Without trade, ½ of each country's workers produce cars and ½ produce grain. What quantities of cars and grain does each country produce? • Starting from a position without trade, give an example in which trade makes each country better off.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
A	Evaluation of student notebooks with these criteria for success: accuracy in content of vocabulary; precision in constructing graphs; comprehensive responses to study problems.	Guided reading and note-taking from economics textbook chapters about scarcity, market systems, circular flow, and trade.
M, A	Evaluation of student problem-solving process and/or presentation of solutions to whole class with these criteria for success: cooperative and collaborative approach; accuracy and comprehensive responses to practice problems; focused and articulate presentation of solutions.	Small group practice problem-solving for graphing, marginal analysis, opportunity costs, production possibilities curves, absolute and comparative advantage, and terms of trade.
M, A	AP rubrics for multiple choice and free response questions.	AP style multiple choice, stimulus-based, graphing, and short answer responses on quizzes and unit test.

Stage 3

Code	***Pre-Assessment*** Ask students to write scenarios in which they needed to choose between two opportunities; differences between dictatorial and democratic political and command and market economic systems.	
	Summary of Key Learning Events and Instruction *Student success at transfer, meaning and acquisition depends on…*	Progress Monitoring
T, M, A	Teacher sets the purpose for learning by posting the objective(s), rationale, and learning activities on a whiteboard or the day's slideshow for all students to see and review. *For example, What: Students will be able to describe opportunity costs as the trade off between two possible choices. Why: All decisions in life involve choosing between costs and benefits. How: Daily Question; Review HW; Video with graphs; Solve & Share; Quiz or Exit Ticket*	
T, M, A	Teacher hooks and holds students' attention with daily prompts that ask provocative, open-ended questions using unit vocabulary, concepts, and skills often connected to current economic events. *For example, "Which is a more beneficial choice for your post-high school plans: college or employment?" After students respond, teacher introduces a line graph of lifelong earnings across education levels for comparison to incomes of superstars like LeBron James and Taylor Swift (who do not attend college).*	Teacher looks for engaged and varied responses from multiple students.
M, A	Teacher places students into small groups to review HW, typically, reading and taking notes from textbook chapters according to Unit Responsibility sheet focusing on acquiring domain specific vocabulary, guided practice of constructing and interpreting graphs and tables, and responding to study questions.	Teacher review of notes as students review difficult questions. May result in whole class review and discussion if the majority of students are struggling with a vocabulary term, concept, and/or skill.

A	Teacher initiates direct instruction with slideshows of key unit vocabulary, concepts, skills, and graphs during which students may rethink and revise their HW responses. *For example, opportunity costs and trade-offs.*	Teacher looks for engaged and varied responses to scaffolded questions from multiple students.
A	Teacher initiates guided practice with tutorial videos that break down steps for acquiring each concept and/or skill with scaffolded questions. *For example, ACDC EconMovies - Monty Python and the Search for the Holy Grail and discussion about using coconuts in place of horses.*	Teacher circulates to ensure that students are completing and understanding steps. Periodic pauses for students to explain steps in their own words.
M, A	Students work cooperatively to solve and share problems in small groups for peer-guided practice of each concept and/or skill. Groups then come to the board to present solutions while classmates peer assess and offer alternative strategies to find solutions.	Teacher circulates to ensure that students are completing and understanding components to practice problems and working cooperatively.
T, M, A	Students practice test-taking strategies with practice quizzes in textbook to explain why the right answer is correct and how the other choices serve as distractors. Students are purposely assigned to practice with multiple choice or free response questions, whichever is more needed based on past assessments.	Teacher looks for engaged and evidence-based responses from multiple students.

ESTABLISHED GOALS	***Transfer***
From C3 Framework for Social Studies ECO 9-12.8 Describe the	

possible consequences, both intended and unintended, of government policies to improve market outcomes.

ECO 9-12.1 Analyze how incentives influence choices that may result in policies with a range of costs and benefits for different groups.

From Council for Economic Education

CEE #2: (Demonstrate how) Effective decision making requires comparing the additional costs of alternatives with the additional benefits. Many choices involve doing a little more or a little less of something: few choices are "all or nothing" decisions.

CEE #7: (Demonstrate how) A market exists when buyers and sellers interact. This interaction determines market prices and thereby allocates scarce goods and services.

CEE #8: (Explain how) Prices send signals and provide incentives to buyers and sellers. When supply or demand changes, market prices adjust, affecting incentives.

Students will be able to independently use their learning to…

1. Recognize when a market exists.
2. Explain how price reflects competition within markets.
3. Identify how changes in consumer and producer behaviors alter markets.
4. Recognize and evaluate the effectiveness of government interventions within markets.

Meaning

UNDERSTANDINGS
Students will understand that…

1. In a free-market economy, price is a function of supply and demand.
2. Demand and supply can be illustrated graphically.
3. Behaviors by consumers and producers can change demand and supply.
4. Governments can intervene to change demand or supply of goods and services.

ESSENTIAL QUESTIONS
Students will keep considering…

1. What do price changes mean?
2. How can changes in behavior by consumers or producers alter markets?
3. How can tables and graphs be used and refined to illustrate key economic concepts?
4. When should governments intervene in a market?

Acquisition

Students will know…

- demand and supply
- normal (superior) goods
- inferior goods
- substitute goods
- complementary goods
- market equilibrium, equilibrium

Students will be skilled at…

- Describing what affects demand.
- Giving examples of normal (superior) goods, inferior goods, substitute goods, complementary goods.
- Describing what affects supply.
- Explaining how supply and demand

CEE# 9: (Analyze how) Competition among sellers usually lowers costs and prices, and encourages producers to produce what consumers are willing and able to buy. (Analyze how) Competition among buyers increases prices and allocates goods and services to those people who are willing and able to pay the most for them. CCSS ELA RH 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.	quantity, equilibrium price • productive efficiency • allocative efficiency • government-set prices: price ceilings, price floors, excise taxes, tariffs, quotas, export subsidies • product surpluses • product shortages • total revenue test • price elasticity of demand • price elasticity of supply • income elasticity • cross price elasticity • consumer surplus • producer surplus • efficiency losses	together determine market equilibrium. • Describing how productive efficiency and allocative efficiency are achieved. • Explaining and demonstrating using models how changes in supply and demand affect equilibrium prices and quantities. • Giving examples of price ceilings, price floors, excise taxes, tariffs, quotas, and export subsidies. • Explaining how government-set prices can cause product surpluses and shortages. • Describing what affects price elasticity of demand and demonstrating what it looks like using models and with real-life examples. • Applying the total revenue test to determine price elasticity of demand. • Describing what affects price elasticity of supply and demonstrating what it looks like using models and with real-life examples. • Describing cross elasticity of demand and income elasticity of demand and demonstrating what they look like using models and with real-life examples. • Demonstrating how to find consumer surplus, producer surplus and efficiency losses using models. • Applying supply and demand analysis to real life economic situations.

Code	Evaluative Criteria	Assessment Evidence
		PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* *Markets exist when buyers and sellers interact. This interaction determines market prices and thereby allocates scarce goods and services.*
T, M, A	Classroom Participation Rubric contextualized for role play	A. Cocoa Market Simulation Goal: Create a market where buyers and sellers are pursuing their self-interest while negotiating to achieve the best price for cocoa. Role: Students are either buyers or sellers of cocoa. Audience:Classmates. Situation: Students are either buyers or sellers in a market for cocoa where they actively negotiate prices over 2-3 market periods. Product/Performance and Purpose: Students play the role of either a buyer or a seller during market periods. After the market periods end they generate and use supply and demand graphs to determine the equilibrium price and quantity. Standards & Criteria for Success: Students effectively operate as buyers (buying for a price lower than directed on card) and as sellers (selling for a price higher than directed on card) *Equilibrium quantity and price change when there is a shift of the demand and/or supply curves. Shifts occur through changes in consumer and producer behavior according to specific determinants.*
M, A	Classroom Participation Rubric contextualized for peer teaching	B. Poster of Supply and Demand Shifters

		Goal: Students create posters that list several examples of real world determinants that shift the demand and supply curves. Role: Student is a generator of a good or service and a real world example of a determinant that shifts the demand or supply curve. Student is also an evaluator of classmates' generated examples to foster discussion. Audience: Classmates as evaluators. Situation: Students are creating classroom resources for immediate discussion and as ongoing reference guides for the duration of the course. Product/Performance and Purpose: Posters as classroom resources Standards/criteria for success: Accurate determinants; humor a plus *Real world competition influences price and quantity in the marketplace.*
T, M, A	Classroom Presentation Rubric contextualized for peer teaching	C. Market Research and Analysis Project Goal: Synthesize information acquired from public media sources about a current market of goods or services experiencing fluctuations in supply and demand. Role: Students serve as experts in a market for a particular good or service. Audience: Classmates. Situation: Students are in a peer teaching situation using real world markets to reinforce key vocabulary, concepts, and skills.

		Product/Performance and Purpose: Each pair of students creates an audio-visual presentation for their peers to see and hear how the forces of supply and demand interact to set prices in a market; how government may intervene in a market; and how consumer elasticity of demand influences producer and consumer behaviors. Each pair of students writes an analytical summary describing the forces of change in a market. Standards & Criteria for Success: Presentations clearly demonstrate expertise in style of presentation and substance of content.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
A	Evaluation of student notebooks with these criteria for success: accuracy in content of vocabulary; precision in constructing graphs; comprehensive responses to study problems.	Guided reading and note-taking from economics textbook chapters about supply, demand, equilibrium, elasticity, consumer and producer surplus
M, A	Evaluation of student problem-solving process and/or presentation of solutions to whole class with these criteria for success: cooperative and collaborative approach; accuracy and comprehensive responses to practice problems; focused and articulate presentation of solutions.	Small group practice problem-solving for graphing, market equilibrium, determinants of demand and supply, government-set prices, efficiency, consumer and producer surpluses, and elasticity of demand and supply.
M, A	AP rubrics for multiple choice and free response questions.	AP style multiple choice, stimulus-based, graphing, and short answer responses on quizzes and unit test.

Code	***Pre-Assessment*** Ask students to write scenarios that use supply and demand; give examples of when government intervenes in markets; predict what happens when goods, services, and resources become scarce or abundant and when income increases.	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T, M, A	Teacher sets the purpose for learning by posting the objective(s), rationale, and learning activities on a whiteboard or the day's slideshow for all students to see and review. *For example, What: Students will be able to explain what happens in markets when governments set prices. Why: Government intervention in markets has unintended consequences. How: Daily Question; Review HW; Video with graphs; Solve & Share; Quiz or Exit Ticket*	
T, M, A	Teacher hooks and holds students' attention with daily prompts that ask provocative, open-ended questions using unit vocabulary, concepts, and skills often connected to current economic events. *For example, "Should the government set a maximum price for gasoline?" After students respond, teacher displays a price ceiling graph showing the resulting shortage of gasoline supply.*	Teacher looks for engaged and varied responses from multiple students.
M, A	Teacher places students into small groups to review HW, typically, reading and taking notes from textbook chapters according to Unit Responsibility sheet focusing on acquiring domain specific vocabulary, guided practice of constructing and interpreting graphs and tables, and responding to study questions.	Teacher review of notes as students review difficult questions. May result in whole class review and discussion if the majority of students are struggling with a vocabulary term, concept, and/or skill.

A	Teacher initiates direct instruction with slideshows of key unit vocabulary, concepts, skills, and graphs during which students may rethink and revise their HW responses. *For example, price ceiling - supply shortage; price floors - supply surplus.*	Teacher looks for engaged and varied responses to scaffolded questions from multiple students.
A	Teacher initiates guided practice with tutorial videos that break down steps for acquiring each concept and/or skill with scaffolded questions. *For example, ACDC Price Ceilings and Price Floors.*	Teacher circulates to ensure that students are completing and understanding steps. Periodic pauses for students to explain steps in their own words.
M, A	Students work cooperatively to solve and share problems in small groups for peer-guided practice of each concept and/or skill. Groups then come to the board to present solutions while classmates peer assess and offer alternative strategies to find solutions.	Teacher circulates to ensure that students are completing and understanding components to practice problems and working cooperatively.
T, M, A	Students practice test-taking strategies with practice quizzes in textbook to explain why the right answer is correct and how the other choices serve as distractors. Students are purposely assigned to practice with multiple choice or free response questions, whichever is more needed based on past assessments.	Teacher looks for engaged and evidence-based responses from multiple students.

Stage 1 Desired Results

ESTABLISHED GOALS

D2.Eco.1.9-12. Analyze how incentives influence choices that may result in policies with a range of costs and benefits for different groups.

CEE #2: (Demonstrate how) Effective decision making requires comparing the additional costs of alternatives with the additional benefits. Many choices involve doing a little more or a little less of something: few choices are "all or nothing" decisions.

CCSS ELA RH 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.

Transfer

Students will be able to independently use their learning to…

1. Use a cost-benefit analysis when making decisions in their life, such as choosing a path after high school or taking on debt to make a purchase.

Meaning

UNDERSTANDINGS
Students will understand that…

1. The market demand curve is derived from all the individual consumers in the market.
2. Consumers take into account income, prices, and tastes (preferences) when making purchases

ESSENTIAL QUESTIONS
Students will keep considering…

1. How can consumer choices influence the demand for a good or service?

Acquisition

Students will know…

- total utility
- marginal utility
- law of diminishing marginal utility
- utility-to-price ratios
- utility-maximization model

Students will be skilled at…

- Describing the relationship among total utility, marginal utility and the law of diminishing marginal utility.
- Explaining how rational consumers compare marginal utility-to-price ratios for products in purchasing combinations of products that maximize their utility.

		• Drawing an individual's demand curve by observing the outcomes of price changes in the utility-maximization model. • Using the utility-maximization model to highlight how incomes, prices, substitutions and tastes affect consumer purchases.

Stage 2 – Evidence

Code	Evaluative Criteria	Assessment Evidence
M, A	AP Free Response Rubric	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* *Rational consumers compare marginal utility-to-price ratios for products in purchasing combinations of products that maximize their utility.* A. AP Free Response Style Question Mark consumes ice cream and hamburgers. The following table provides information about the relationship between the quantity of ice cream and hamburgers and the total utility Mark gets from their consumption.

Utility from Ice Cream Consumption		Utility from Hamburger Consumption	
Quantity of ice cream (cones)	Total utility from ice cream (utils)	Quantity of hamburgers	Total utility of hamburgers (utils)
0	0	0	0

		1 | 20 | 1 | 15 2 | 38 | 2 | 28 3 | 53 | 3 | 39 4 | 66 | 4 | 48 5 | 77 | 5 | 53 6 | 84 | | 7 | 89 | | 8 | 92 | | 9 | 94 | | 10 | 95 | | Mark's income for expenditure on ice cream and hamburgers is $50 per month. The price of ice cream is $5 a cone and the price of hamburgers is $10 a hamburger. Calculate Mark's marginal utility for ice cream and for hamburgers at every quantity. Then calculate Mark's marginal utility per dollar for ice cream and for hamburgers at every quantity. What is Mark's optimal consumption of ice cream and hamburgers? *Economic concepts include scarcity, opportunity costs, cost benefit analysis, supply, and demand.*
T, M, A	School-wide Communication Rubric contextualized for peer teaching	B. Cumulative Review Presentation Goal: Students create a classroom community in which every member contributes to the greater good by becoming an expert in one economic concept and teaching it to others.

		Role: Students act as teachers/tutors. Audience: Classmates Performance/Product and Purpose: Students will teach a review concept from units 1 & 2 using an interactive slideshow presentation and practice problems. Standards/Criteria for Success: Presentations clearly demonstrate expertise in style of presentation and substance of content.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
A	Evaluation of student notebooks with these criteria for success: accuracy in content of vocabulary; precision in constructing graphs; comprehensive responses to study problems.	Guided reading and note-taking from economics textbook chapter about consumer behavior.
M, A	Evaluation of student problem-solving process and/or presentation of solutions to whole class with these criteria for success: cooperative and collaborative approach; accuracy and comprehensive responses to practice problems; focused and articulate presentation of solutions.	Small group practice problem-solving for marginal analysis, calculating total, marginal utility, and utility to price ratios. AP style multiple choice, stimulus-based, and short answer responses on quizzes. Cumulative Exam encompassing units 1 and 2a&b using released AP multiple choice and free response questions.
M, A	AP rubrics for multiple choice and free response questions.	
T, M, A	AP rubrics for multiple choice and free response questions.	

Stage 3 – Learning Plan		
	Pre-Assessment Ask students to write scenarios in which they needed to choose between two goods and/services; when they overindulged; when they were short on funds.	
Code	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T, M, A	Teacher sets the purpose for learning by posting the objective(s), rationale, and learning activities on a whiteboard or the day's slideshow for all students to see and review. *For example, What: Students will be able to use the total revenue test to show how elasticity of demand works in the real world. Why: Consumer demand drives market outcomes. How: Daily Question; Review HW; Role play of total revenue test; Quiz or Exit Ticket*	
T, M, A	Teacher hooks and holds students' attention with daily prompts that ask provocative, open-ended questions using unit vocabulary, concepts, and skills often connected to current economic events. *For example, "What's for dinner?" List student responses and have students vote for their 1st, 2nd, and 3rd favorite meals and their least favorite meal. Students discuss what they would be willing to pay for their favorite and least favorite meals. Teacher labels favorite meals with high prices as goods with inelastic demand and least desired meals as goods with elastic demand.*	Teacher looks for engaged and varied responses from multiple students.
M, A	Teacher places students into small groups to review HW, typically, reading and taking notes from textbook chapters according to Unit Responsibility sheet focusing on acquiring domain specific vocabulary, guided practice of constructing	Teacher review of notes as students review difficult questions. May result in whole class review and discussion if the majority of students are struggling with a vocabulary term, concept, and/or skill.

	and interpreting graphs and tables, and responding to study questions.	
A	Teacher initiates direct instruction with slideshows of key unit vocabulary, concepts, skills, and graphs during which students may rethink and revise their HW responses. *For example, elasticity and total revenue test.*	Teacher looks for engaged and varied responses to scaffolded questions from multiple students.
A	Teacher initiates guided practice *by asking students to assume the role of CEO for their Unit 2 product poster. They should demonstrate with a graph and explain verbally/physically if the demand for their good is elastic or inelastic using the total revenue test (includes arm movements that show increase price with increase total revenue for inelastic and decrease price and increase total revenue for elastic).*	Teacher circulates to ensure that students are completing and understanding steps. Periodic pauses for students to explain steps in their own words.
T, M, A	Students practice test-taking strategies with practice quizzes in textbook to explain why the right answer is correct and how the other choices serve as distractors. Students are purposely assigned to practice with multiple choice or free response questions, whichever is more needed based on past assessments.	Teacher looks for engaged and evidence-based responses from multiple students.

ESTABLISHED GOALS

ECO 9–12.2 Evaluate the extent to which competition among sellers and among buyers exists in specific markets.

ECO 9-12.3 Analyze the ways in which incentives influence what is produced and distributed in a market system.

CEE #2: Effective decision making requires comparing the additional costs of alternatives with the additional benefits. Many choices involve doing a little more or a little less of something: few choices are "all or nothing" decisions.

CCSS ELA RH 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.

Transfer

Students will be able to independently use their learning to…

1. Calculate the true costs of bringing a product to market.

Meaning

UNDERSTANDINGS

Students will understand that…

1. Producers must take into account many types of costs.

ESSENTIAL QUESTIONS

Students will keep considering…

1. What can determine if a firm is economically successful?

Acquisition

Students will know…

- explicit and implicit costs
- fixed and variable costs
- total, average and marginal costs
- normal profit, accounting profit and economic profit
- law of diminishing returns
- economies of scale
- diseconomies of scale
- returns to scale

Students will be skilled at…

- Giving examples of explicit and implicit costs.
- Differentiating among normal profit, accounting profit and economic profit.
- Explaining the relationship between the law of diminishing returns and a firm's short-run production costs.
- Making distinctions between fixed and variable costs and among total, average and marginal costs.
- Calculating and constructing cost curves

		and explaining how they shift. • Describing the link between a firm's size and its average costs in the long run. • Describing economies and diseconomies of scale and returns to scale.

Code	Evaluative Criteria	Assessment Evidence
		PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* *All of the costs included in bringing a product or service to market.*
T, M, A	Teacher created rubric	A. Thanksgiving Dinner for Ten Goal: Inform potential investors and dinner guests about how you are able to prepare an amazing Thanksgiving dinner for 10 and keep your costs lower than your competitors. Role: Producers (shoppers, cooks, servers) of a Thanksgiving meal for ten. Audience: Potential investors and dinner guests. Situation: Students need to shop for, prepare, and serve an appetizing Thanksgiving dinner for ten for the least cost among their competitors. Product and Purpose: Each group submits a written prospectus that includes all costs (fixed, variable, explicit, implicit) and a menu for a Thanksgiving dinner for ten which is both lower cost and most appetizing. Standards/criteria for success: Student groups account for all costs (including estimates for implicit costs) and make appetizing menu choices that set them apart from their competitors.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
A	Evaluation of student notebooks with these criteria for success: accuracy in content of vocabulary; precision in constructing graphs; comprehensive responses to study problems.	Guided reading and note-taking from economics textbook chapter about the costs of production.
M, A	Evaluation of student problem-solving process and/or presentation of solutions to whole class with these criteria for success: cooperative and collaborative approach; accuracy and comprehensive responses to practice problems; focused and articulate presentation of solutions.	Small group practice problem-solving for total revenue, average revenue, marginal revenue, total costs, fixed costs, variable costs, average total costs, average fixed costs, average variable costs, and marginal costs.
M, A	AP rubrics for multiple choice and free response questions.	AP style multiple choice, stimulus-based, and short answer responses on quizzes and unit test.

Code	***Pre-Assessment*** Ask students to write scenarios for a student-run business venture (lemonade stand to computer fixer); recall differences in production of goods and services before and after the industrial revolution (between home/cottage production and industrial production).	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T, M, A	Teacher sets the purpose for learning by posting the objective(s), rationale, and learning activities on a whiteboard or the day's slideshow for all students to see and review. *For example, What: Students will be able to differentiate between accounting and economic profit. Why: Good decision-making depends on taking into account all your costs. How: Daily Question; Review HW; Would You Rather discussion; Quiz or Exit Ticket*	
T, M, A	Teacher hooks and holds students' attention with daily prompts that ask provocative, open-ended questions using unit vocabulary, concepts, and skills often connected to current economic events. *For example, "Estimate the profit you will make with your product." Then ask "What costs should you take into account to make your profit?"*	Teacher looks for engaged and varied responses from multiple students.
M, A	Teacher places students into small groups to review HW, typically, reading and taking notes from textbook chapters according to Unit Responsibility sheet focusing on acquiring domain specific vocabulary, guided practice of constructing and interpreting graphs and tables, and responding to study questions.	Teacher review of notes as students review difficult questions. May result in whole class review and discussion if the majority of students are struggling with a vocabulary term, concept, and/or skill.
A	Teacher initiates guided practice *by distributing to students*	Teacher circulates to ensure that students are

	envelopes with business plans. Students open their envelopes and use the given business plans to calculate accounting and economic profit or loss. Each student should report out to the whole class emphasizing the differences in their two types of profits by taking into account their intrinsic costs.	completing and understanding calculations. Periodic pauses for students to explain steps in their own words.
T, M, A	Teacher initiates *a Would You Rather discussion of which businesses that would like to own and why.*	Teacher looks for engaged and varied responses from multiple students.
T, M, A	Students practice test-taking strategies with practice quizzes in textbook to explain why the right answer is correct and how the other choices serve as distractors. Students are purposely assigned to practice with multiple choice or free response questions, whichever is more needed based on past assessments.	Teacher looks for engaged and evidence-based responses from multiple students.

Stage 1 Desired Results

ESTABLISHED GOALS

D2.Eco.4.9-12. Evaluate the extent to which competition among sellers and among buyers exists in specific markets.

CEE #3: (Describe how) Different methods can be used to allocate goods and services. People acting individually or collectively must choose which methods to use to allocate different kinds of goods and services.

CEE #9: (Analyze how) Competition among sellers usually lowers costs and prices, and encourages producers to produce what consumers are willing and able to buy. (Analyze how) Competition among buyers increases prices and allocates goods and services to those people who are willing and able to pay the most for them.

CCSS ELA RH 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a

Transfer

Students will be able to independently use their learning to…

1. Recognize and evaluate markets for their level of competitiveness.
2. Explain why entrepreneurs start businesses, and why some businesses fail.
3. Assess the relationship between competition and economic efficiency.

Meaning

UNDERSTANDINGS

Students will understand that…

1. Perfect competitors produce standardized products that become perfect substitutes for each other.
2. Perfect competitors produce and sell products that meet consumer demand to maximize both consumer and producer surplus.
3. Perfect competitors maximize their profits by producing what consumers demand.

ESSENTIAL QUESTIONS

Students will keep considering…

1. Should consumers pay attention to different producers of standardized products?
2. Why are perfect competitors efficient?
3. How do firms with several competitors maximize their profits?

Acquisition

Students will know…

- purely/perfectly competitive markets

Students will be skilled at…

- Describing the conditions required for

question or solve a problem.	• total revenue, average revenue, and marginal revenue • maximizing profit rule • marginal cost curve • side by side models • short-run equilibrium • long-run equilibrium • efficiency • constant cost, increasing cost, and decreasing cost industries	purely competitive markets. • Describing how revenues are calculated in a purely competitive market. • Explaining how purely competitive firms maximize profits or minimize losses. • Explaining and demonstrating with models why the marginal-cost curve and supply curve of competitive firms are identical. • Comparing firm and market supply and market demand and constructing side-by-side models to show short-run competitive equilibrium. • Explaining how industry entry and exit produce economic efficiency. • Explaining how long-run competitive equilibrium results in economic efficiency. • Differentiating among constant-cost, increasing-cost, and decreasing-cost industries.

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
		PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* *Perfect competitors differ from other producers by producing identical, standardized products and as such cannot set the market price.*
T, M, A	Classroom Participation Rubric contextualized for role play	A. Eraser Market Goal:Students compete to sell their eraser more often than any other students. Some students are allowed to communicate with others, while some students are not. Role: Students are sellers of a mixed variety of erasers; some are identical, some are differentiated. Students are divided into 4 groups (#1 = 1 person; #2 = 3 people; #3 = 6-8 people; #4 = 10+ (must be clear majority of classmates) Audience: Classmates Performance and Purpose: Students will offer their erasers for sale in multiple rounds of a market with the teacher at a price ($.05 - $.25) most likely to make the sale. Students should observe the products for sale and the prices offered and ultimately paid by the consumer (teacher). Standards/Criteria for Success: Students accurately offer a competitive price that reflects their group, recognizing that student groups represent 4 different market structures: perfect competitors ($.05 for identical products); monopolistic competitors (lowest price offered within group without collusion); oligopolies (price set through collusion, however a producer might "cheat" his conspirators and sell for $.01 less); monopoly (price set at $.25). *A perfectly competitive market in long-run equilibrium is allocatively*

M, A	AP Free Response Rubric	*and productively efficient.* B. AP Free Response Style Question Suppose that roses are produced in a perfectly competitive, increasing-cost industry in long-run equilibrium with identical firms. A. Draw correctly labeled side by side graphs for the rose industry and a typical firm and show each of the following. a. Industry equilibrium price and quantity, labeled PM and QM, respectively. b. The firm's equilibrium price and quantity, labeled PF and QF, respectively. B. Is PM larger than, smaller than or equal to PF? C. Assume that there is a decrease in the demand for roses. On your graphs in Part (A), show each of the following. a. The new short-run industry equilibrium price and quantity, labeled PM2 and QM2, respectively. b. The new short-run profit-maximizing price and quantity for the typical firm, labeled PF2 and QF2, respectively. D. As the industry adjusts to a new long-run equilibrium, a. What will happen to the number of firms in the industry? Explain. b. Will the firm's average total cost curve shift upward, shift downward, or remain unchanged? E. In the long run, compare the firm's profit-maximizing price to each of the following. a. PF in Part (A) (b) b. PF2 in Part (C) (b)

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
A	Evaluation of student notebooks with these criteria for success: accuracy in content of vocabulary; precision in constructing graphs; comprehensive responses to study problems.	Guided reading and note-taking from economics textbook chapter about pure competition.
M, A	Evaluation of student problem-solving process and/or presentation of solutions to whole class with these criteria for success: cooperative and collaborative approach; accuracy and comprehensive responses to practice problems; focused and articulate presentation of solutions.	Small group practice problem-solving for average revenue, total revenue, marginal revenue, MR = DARP, maximizing profits, minimizing losses, shut down point, side by side market and firm graphs for perfect competitors, entry/exit of firms, productive and allocative efficiency, constant, increasing and decreasing cost industries.
M, A	AP rubrics for multiple choice and free response questions.	AP style multiple choice, stimulus-based, and short answer responses on quizzes and unit test.
M, A	AP rubrics for multiple choice and free response questions.	Midterm Exam encompassing units 1, 2, and 3 using released AP multiple choice and free response questions.

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** Ask students to give examples of identical and differentiated products or try to differentiate between agricultural goods such as bananas, avocados, popcorn.	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T, M, A	Teacher sets the purpose for learning by posting the objective(s), rationale, and learning activities on a whiteboard or the day's slideshow for all students to see and review. *For example, What: Students will be able to defend why the demand curve for perfect competitors is perfectly elastic. Why: Consumers and producers benefit most when competition is perfect. How: Simulation; Review HW; Video with graphs; Solve & Share; Quiz or Exit Ticket*	
T, M, A	Teacher hooks and holds students' attention with daily prompts that ask provocative, open-ended questions using unit vocabulary, concepts, and skills often connected to current economic events. *For example, Set up a cola war simulation by having students eat samples of the same food (apple/orange slices) without knowing their origins (local farm/organic/imported). Since most students will not be able to differentiate among samples, teacher initiates discussion on perfect substitutes.*	Teacher looks for engaged and varied responses from multiple students.
M, A	Teacher places students into small groups to review HW, typically, reading and taking notes from textbook chapters according to Unit Responsibility sheet focusing on acquiring domain specific vocabulary, guided practice of constructing and interpreting graphs and tables, and responding to study questions.	Teacher review of notes as students review difficult questions. May result in whole class review and discussion if the majority of students are struggling with a vocabulary term, concept, and/or skill.

A	Teacher initiates direct instruction with slideshows of key unit vocabulary, concepts, skills, and graphs during which students may rethink and revise their HW responses. *For example, perfect competition, market equilibrium price, price taker, perfectly elastic demand curve.*	Teacher looks for engaged and varied responses to scaffolded questions from multiple students.
A	Teacher initiates guided practice with tutorial videos that break down steps for acquiring each concept and/or skill with scaffolded questions. *For example, ACDC Perfect Competitors and discussion about benefits for consumers and producers.*	Teacher circulates to ensure that students are completing and understanding steps. Periodic pauses for students to explain steps in their own words.
M, A	Students work cooperatively to solve and share problems in small groups for peer-guided practice of each concept and/or skill. Groups then come to the board to present solutions while classmates peer assess and offer alternative strategies to find solutions.	Teacher circulates to ensure that students are completing and understanding components to practice problems and working cooperatively.
T, M, A	Students practice test-taking strategies with practice quizzes in textbook to explain why the right answer is correct and how the other choices serve as distractors. Students are purposely assigned to practice with multiple choice or free response questions, whichever is more needed based on past assessments.	Teacher looks for engaged and evidence-based responses from multiple students.

AP Microeconomics Unit 4 Imperfect Competition (Monopolies, Monopolistic Competitors, Oligopolies

ESTABLISHED GOALS

ECO 9-12.4 Evaluate the extent to which competition among sellers and among buyers exists in specific markets.

CEE #3: (Describe how) Different methods can be used to allocate goods and services. People acting individually or collectively must choose which methods to use to allocate different kinds of goods and services.

CEE #9: (Analyze how) Competition among sellers usually lowers costs and prices, and encourages producers to produce what consumers are willing and able to buy. (Analyze how) Competition among buyers increases prices and allocates goods and services to those people who are willing and able to pay the most for them.

CSSF: ECO 9–12.3 Describe the possible consequences, both intended and unintended, of government policies to improve market outcomes.

Transfer

Students will be able to independently use their learning to…

1. Judge a business that inflates its price for its own benefit.
2. Evaluate the effectiveness of advertising for common retail goods and services.
3. Use strategic behavior when negotiating with others.

Meaning

UNDERSTANDINGS

Students will understand that…

1. Monopolies exert tremendous control over price, extent of competition, and supply in a market.
2. Governments can implement policies to decrease the power of monopolies and improve market outcomes for consumers.
3. Advertising, brand names, patents, and trademarks are used by imperfect competitors to differentiate them from others.
4. Monopolies and oligopolies use several methods to control price and competition to increase their economic

ESSENTIAL QUESTIONS

Students will keep considering…

1. Why do we love to hate monopolies?
2. How effective is government in regulating monopolies, monopolistic competitors, and oligopolies.
3. What really differentiates most products?
4. How do firms with few to no competitors maximize their profits?

CCSS ELA RH 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.	profits.	
	Acquisition	
	Students will know… • perfect competitor • pure monopoly • natural monopoly • monopolistic competitor • oligopoly • price maker • barriers to entry • profit-maximization • marginal revenue curve • fair return price • socially optimal price • inefficiency/deadweight loss • price discriminating monopoly • anti-trust laws • Herfindahl Index • four firm concentration model • price fixing • vertical and horizontal integration • public, industrial, cartel and social regulation • price matrix • strategic behavior • game theory • mutual interdependence • dominant strategy • Nash equilibrium	*Students will be skilled at…* • Differentiating among the characteristics of perfect competition, pure monopoly, monopolistic competition, and oligopoly. • Explaining how a pure monopoly sets its profit-maximizing output and price. • Evaluating the economic effects of monopoly. • Explaining why a monopolist might prefer to charge different prices in different markets. • Describing and evaluating how and why government can regulate monopolies. • Explaining why monopolistic competitors earn only a normal profit in the long run. • Using game theory strategies. • Describing three oligopoly models and explaining how incentives and obstacles to collusion influence their behaviors. • Determining the potential positive and negative effects of advertising for oligopolists.

STAGE 2

Code	Evaluative Criteria	Assessment Evidence
T, M, A	Classroom Presentation Rubric contextualized for peer teaching	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* *Real world barriers to competition influences price and quantity in the marketplace.* A. Imperfect Competitors Research and Analysis Project Goal: Synthesize information acquired from public media sources about a contemporary firm operating as an imperfect competitor (monopoly, monopolistic competitor, or oligopoly). Role: Students serve as experts about a business operating as an imperfect competitor. Audience: Classmates. Situation: Students are in a peer teaching situation using real world firms to reinforce key vocabulary, concepts, and skills. Product/Performance and Purpose: Each pair of students creates an audio-visual presentation for their peers to see and hear how the imperfect competitor acts to set prices and quantities in a market and how government may intervene in a market to achieve efficiency. Each pair of students writes an analytical summary describing the behavior and structure of the imperfect competitor. Standards & Criteria for Success: Presentations clearly demonstrate expertise in style of presentation and substance of content. *Market structure constrains and influences prices, output, and efficiency.*

M, A	AP Free Response Rubric	B. AP Free Response Style Question Rachel's hair salon is a monopoly in a small town and is currently earning an economic profit. A. Draw a correctly labeled graph for Rachel and include the curves that are necessary to identify the following: a. The profit maximizing price and quantity of haircuts, labeled P_m and Q_m b. The area representing economic profits, shaded completely. B. Does Rachel's hair salon produce the allocatively efficient quantity? Explain. C. Assume that Rachel signs a new lease with an increase in rent, a fixed cost. Will the price of haircuts provided by Rachel increase, decrease, or stay the same in the short run? Explain. D. Assume that new hair salons enter the market and that the market becomes monopolistically competitive. Answer each of the following. a. The entry of new hair salons creates close substitutes for each salon's services. As a result, will the demand for Rachel's hair salon become more elastic or become less elastic, or will there be no change in elasticity? b. Will the entry cause the demand curve for Rachel's hair salon to shift to the left, shift to the right, or stay the same? c. In long run equilibrium, will Rachel's hair salon produce the productively efficient quantity? Explain. *Oligopolies use strategies of game theory wherein the payoff for each firm depends directly on both the firm's own choice and the*

M, A	AP Free Response Rubric	*choices of its competitor.* C. AP Free Response Style Question Two competing retail firms, Red Shop and Blue Mart, are studying potential locations for new stores in the suburbs of a major city. Each firm must choose between a location north of the city and a location south of the city. The payoff matrix is shown below, with the first entry in each cell indicating Red Shop's daily profit and the second entry indicating Blue Mart's daily profit. Both firms know all the information in the payoff matrix. Blue Mart North / South Red Shop North: \$900, \$1,800 | \$3,000, \$3,500 South: \$5,000, \$4,000 | \$1,500, \$1,000 (a) If Red Shop chooses a location south of the city, which location is better for Blue Mart? Explain. (b)Is choosing a location to the south of the city a dominant strategy for Red Shop? Explain. (c) If the two firms cooperate in choosing locations, where will each firm locate? (d)Assume that the south suburb has enacted an incentive package to attract new business. Any firm that locates south of the city will receive a subsidy of \$2,000 per day. Redraw the payoff matrix to include the subsidy.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
A	Evaluation of student notebooks with these criteria for success: accuracy in content of vocabulary; precision in constructing graphs; comprehensive responses to study problems.	Guided reading and note-taking from economics textbook chapters about monopolies, monopolistic competition, and oligopolies.
M, A	Evaluation of student problem-solving process and/or presentation of solutions to whole class with these criteria for success: cooperative and collaborative approach; accuracy and comprehensive responses to practice problems; focused and articulate presentation of solutions.	Small group practice problem-solving for total revenue, marginal revenue, maximizing profits, minimizing losses, entry/exit of monopolistic competitors, productive and allocative efficiency, regulating monopolies, price discriminating monopolies, and game theory.
M, A	AP rubrics for multiple choice and free response questions.	AP style multiple choice, stimulus-based, and short answer responses on quizzes and unit test.

Code	Pre-Assessment Ask students to give examples of patent/license monopolies, natural monopolies, price discriminating monopolies, monopolistic competitors, and oligopolies; describe scenarios when they know they have paid more (or less) for a product than a friend or family member; predict what happens when an imperfect competitor dominates a market; describe analog and digital games wherein one's strategy is in part determined by an opponent's actions/strategies.	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T, M, A	Teacher sets the purpose for learning by posting the objective(s), rationale, and learning activities on a whiteboard or the day's slideshow for all students to see and review. *For example, What: Students will be able to use game theory to determine an oligopoly market's Nash equilibrium. Why: Many decisions in life are dependent on the actions of others. How: Daily Question; Review HW; Solve & Share with video examples; Quiz or Exit Ticket*	
T, M, A	Teacher hooks and holds students' attention with daily prompts that ask provocative, open-ended questions using unit vocabulary, concepts, and skills often connected to current economic events. *For example, "Find a partner with whom you work well and believe will make you a better test taker." After students have moved next to their partner, have them discuss with each other why they chose each other. If desired, initiate a whole class discussion on what qualities about partners informed your choice.*	Teacher looks for engaged and varied responses from multiple students.
M, A	Teacher allows students to remain in these small groups to review HW, typically, reading and taking notes from textbook chapters according to Unit Responsibility sheet focusing on acquiring domain specific vocabulary, guided practice of constructing and interpreting graphs and tables, and	Teacher review of notes as students review difficult questions. May result in whole class review and discussion if the majority of students are struggling with a vocabulary term, concept, and/or skill.

	responding to study questions.	
A	Teacher initiates direct instruction with slideshows of key unit vocabulary, concepts, skills, and graphs during which students may rethink and revise their HW responses. *For example, interdependent, dominant strategy, Nash equilibrium.*	Teacher looks for engaged and varied responses to scaffolded questions from multiple students.
M, A	Students work cooperatively to solve and share problems (*from ACDC Econ)* in small groups for peer-guided practice of each concept and/or skill. Groups then come to the board to present solutions while classmates peer assess and offer alternative strategies to find solutions.	Teacher circulates to ensure that students are completing and understanding components to practice problems and working cooperatively.
T, M, A	Students practice test-taking strategies with practice quizzes in textbook to explain why the right answer is correct and how the other choices serve as distractors. Students are purposely assigned to practice with multiple choice or free response questions, whichever is more needed based on past assessments.	Teacher looks for engaged and evidence-based responses from multiple students.

AP Microeconomics Unit 5 Factor/Resource Markets

ESTABLISHED GOALS

CEE #2: Effective decision making requires comparing the additional costs of alternatives with the additional benefits. Many choices involve doing a little more or a little less of something: few choices are "all or nothing" decisions.

CEE #3: Different methods can be used to allocate goods and services. People acting individually or collectively must choose which methods to use to allocate different kinds of goods and services.

CEE #10: Institutions evolve and are created to help individuals and groups accomplish their goals. Banks, labor unions, markets, corporations, legal systems, and not-for-profit organizations are examples of important institutions. A different kind of institution, clearly defined and enforced property rights, is essential to a market economy.

CEE #13: Income for most people is determined by the

Transfer

Students will be able to independently use their learning to…

1. Explain how price reflects competition within resource markets.
2. Apply cost benefit analysis to deciding how much of a resource to employ to achieve a desired goal.
3. Identify how changes in consumer and producer behaviors alter factor/resource markets.

Meaning

UNDERSTANDINGS

Students will understand that…

1. Prices for resources are derived from their demand in the product market.
2. Firms use marginal analysis of resource prices to make decisions about best combinations of resources.

ESSENTIAL QUESTIONS

Students will keep considering…

1. What makes one resource (i.e. capital) relatively more expensive than another resource (i.e. labor)?
2. How do firms decide when to hire more or less of one resource in relation to another resource?

Acquisition

Students will know…

- factors of production (land, labor, capital)
- resource pricing
- marginal revenue product
- marginal resource cost
- determinants of resource market shifts

Students will be skilled at…

- Explaining the significance of resource pricing.
- Explaining how the marginal revenue productivity of a resource relates to a firm's demand for that resource.

market value of the productive resources they sell. What workers earn primarily depends on the market value of what they produce. CSSF: ECO 9–12.2 Evaluate the extent to which competition among sellers and among buyers exists in specific markets. CSSF: ECO 9–12.5 Explain why advancements in technology and investments in capital goods and human capital increase economic growth and standards of living. CCSS ELA RH 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.	• elasticity of resource demand • wages • productivity • perfectly competitive resource market • monopsony • unions • wage differentials • economic rent	• Contrasting the marginal revenue product (MRP) curve of a perfect competitor with the MRP curve of an imperfect competitor (monopolist). • Describing the factors that increase or decrease resource demand. • Explaining the determinants of elasticity of resource demand. • Calculating how a competitive firm selects its optimal combination of resources. • Explaining the close relationship between wages and productivity. • Demonstrating how wage rates and employment levels are determined in competitive and monopsonistic labor markets. • Describing how unions can raise wages. • Graphing resource markets. • Explaining why economic profits occur, and how profits and losses allocate resources among alternative uses.

Code	Evaluative Criteria	Assessment Evidence
		PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* *Employers' decisions to hire resources is based on the availability, productivity, and cost of the factor of production.*
M, A	Classroom Participation Rubric contextualized for peer teaching	A. Equine Flu Simulation Goal: Students accurately describe and construct graphs that illustrate changes in both resource and product markets affected by the late 19th century outbreak of equine flu. Role: Students assume various roles of sellers and buyers of resources in the national markets for horses, other beasts of burden, canal and rail transport, construction, housing, and food after the spread of equine flu. Audience: Classmates Product/Performance and Purpose: Students will respond in character to changes in the resource and product markets and construct accurate graphs showing shifts in supply and demand curves in response to equine flu. Students will recognize the interaction among several resource and product markets. Standards/Criteria for Success: Graphs demonstrate mastery of necessary components and determinants of supply and demand shifts. *Perfect and imperfect factor markets both seek to maximize profits and minimize costs.*
M, A	AP Free Response Rubric	B. AP Free Response Style Question

Coldbox Corporation hires its workers in a perfectly competitive labor market and produces and sells frozen peas in a perfectly competitive product market. The market price for peas is $4 per bag. The table below shows Coldbox's short run production of frozen peas. Labor is the only variable input. Coldbox Corporation's fixed cost is $500.

Number of workers	Bags of Frozen Peas
0	0
1	60
2	140
3	250
4	320
5	380
6	400

(a) When Coldbox hires the second worker, does it experience diminishing returns? Explain.

(b) Calculate the average fixed cost if Coldbox hires 3 workers. Show your work.

(c) If the wage is $200 per worker, identify the profit-maximizing number of workers for Coldbox. Explain using marginal analysis

(d) If the price of frozen peas decreases by $2 per bag, would the number of workers hired by Coldbox be more than, less than, or equal to the number of workers identified in part c? Explain.

		(e) Suppose that Coldbox hires workers from a monopsonistic labor market. Would the wage be higher, lower, or equal to the equilibrium wage in a perfectly competitive labor market?
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
A	Evaluation of student notebooks with these criteria for success: accuracy in content of vocabulary; precision in constructing graphs; comprehensive responses to study problems.	Guided reading and note-taking from economics textbook chapters about the demand for resources, wage determination, rent, interest, and profits
M, A	Evaluation of student problem-solving process and/or presentation of solutions to whole class with these criteria for success: cooperative and collaborative approach; accuracy and comprehensive responses to practice problems; focused and articulate presentation of solutions.	Small group practice problem-solving for marginal revenue product, marginal revenue productivity, marginal resource cost, optimal combination of resources (labor and capital), perfectly competitive market wages, monopsonistic market wages, union wages, economic rent.
M, A	AP rubrics for multiple choice and free response questions.	AP style multiple choice, stimulus-based, and short answer responses on quizzes and unit test.

Code	***Pre-Assessment*** Ask students to describe previous/current work experience, wages; make a list of every resource necessary to produce a pencil; recall profit maximizing rule in product markets.	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T, M, A	Teacher sets the purpose for learning by posting the objective(s), rationale, and learning activities on a whiteboard or the day's slideshow for all students to see and review. *For example, What: Students will be able to detail all the factors of production or resources utilized to bring a product to market. Why: Resources drive the supply chain. How: Daily Question; Review HW; Video with discussion; Quiz or Exit Ticket*	
T, M, A	Teacher hooks and holds students' attention with daily prompts that ask provocative, open-ended questions using unit vocabulary, concepts, and skills often connected to current economic events. *For example, "How do you make pancakes? Where do you get the eggs, how did the eggs get from the farm to a store; what are other uses for eggs, who decides which eggs get used for which purposes? Ask students to join a small group, choose another product (cell phone or a movie) and discuss the questions for this new product. Finally ask students to make a list of 10 people necessary in the production process of their chosen product.*	Teacher looks for engaged and varied responses from multiple students.
M, A	Teacher allows students to remain in these small groups to review HW, typically, reading and taking notes from textbook chapters according to Unit Responsibility sheet focusing on	Teacher review of notes as students review difficult questions. May result in whole class review and discussion if the majority of students are struggling

	acquiring domain specific vocabulary, guided practice of constructing and interpreting graphs and tables, and responding to study questions.	with a vocabulary term, concept, and/or skill.
A	Teacher shows *I, Pencil: The Movie as an example of the multidimensional and complicated production process of a rather simple product.* Teacher initiates *a discussion of how market forces drive the supply chain.*	Teacher looks for engaged and varied responses to scaffolded questions from multiple students.
M, A	Teacher initiates direct instruction with slideshows of key unit vocabulary, concepts, skills, and graphs during which students may rethink and revise their HW responses. *For example, resources, factors, inputs, circular flow model*	Teacher circulates to ensure that students are completing and understanding steps. Periodic pauses for students to explain steps in their own words.
T, M, A	Students practice test-taking strategies with practice quizzes in textbook to explain why the right answer is correct and how the other choices serve as distractors. Students are purposely assigned to practice with multiple choice or free response questions, whichever is more needed based on past assessments.	Teacher looks for engaged and evidence-based responses from multiple students.

ESTABLISHED GOALS	***Transfer***
ECO 9-12.1 Analyze how incentives influence choices that may result in policies with a range of costs and benefits for different groups. ECO 9-12.2 Use marginal benefits and marginal costs to	

construct an argument for or against an approach or solution to an economic issue.

ECO 9-12.7 Use benefits and costs to evaluate the effectiveness of government policies to improve market outcomes.

CEE #16 (Argue when) There is an economic role for government in a market economy whenever the benefits of a government policy outweigh its costs. Governments often provide for national defense, address environmental concerns, define and protect property rights, and attempt to make markets more competitive. Most government policies also have direct or indirect effects on peoples' incomes.

CEE #17 (Give examples of the) Costs of government policies sometimes exceed benefits. This may occur because of incentives facing voters, government officials, and government employees, because of actions by special interest groups that can impose costs on the general public, or because social goals other than economic efficiency are being pursued.

Students will be able to independently use their learning to…

1. Differentiate between public and private goods and the relative merit of each in society.
2. Recognize socially efficient and inefficient market outcomes.
3. Assess if, when, and to what extent government should intervene in markets.
4. Describe the sources, changes in, and extent of income inequality.

Meaning

UNDERSTANDINGS *Students will understand that…*	ESSENTIAL QUESTIONS *Students will keep considering…*
1. Public and private goods are valued differently. 2. Markets may create marginal social costs that are higher than marginal social benefits. Conversely, markets may create marginal social benefits that are higher than marginal social costs. 3. Governments can intervene in markets to positively increase efficiency or to negatively increase deadweight loss. 4. Income inequality varies with tax policy, human and social capital, effects of discrimination and unequal access to markets.	1. Why are public goods usually undervalued? 2. Why are consumers sometimes left with spillover costs? Why are consumers sometimes beneficiaries of spillover benefits? 3. What public policies are desirable in imperfect markets? 4. How do the values of productive resources contribute to income inequality?

Acquisition

Students will know…	*Students will be skilled at…*
• private goods	• Distinguishing between public and private

CCSS ELA RH 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.	• public goods • free-rider problem • cost-benefit analysis • MC= MB rule • positive externality • negative externality • spillover benefits • spillover costs • government failure • market failure • rent seeking behavior • progressive tax • regressive tax • proportional tax • efficiency loss of a tax • subsidies • income inequality • Lorenz Curve • Gini Ratio • equality-efficiency trade off • discrimination	goods. • Employing cost-benefit analysis as a reliable method for determining the optimal quantity of a public good. • Identifying positive and negative externalities and the methods to remedy them. • Explaining why government and market failures (public and private sector inefficiencies) occur. • Differentiating among tax philosophies and ways to distribute a nation's tax burden. • Applying the principles of tax shifting, tax incidence, and efficiency losses from taxes. • Providing evidence for and against farm subsidies. • Measuring and describing the sources, changes in and extent of income inequality in the U.S. • Providing economic arguments for and against income inequality. • Measuring and describing poverty among age, gender, ethnic, and citizenship groups. • Outlining the major components of the income-maintenance program in the U.S. • Explaining labor market discrimination and how it might affect hiring decisions and wages.

Code	Evaluative Criteria	Assessment Evidence
M, A	Classroom Participation Rubric contextualized for discussion	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* *How individuals value public and private goods.* A. Bonus Points Challenge Instructions: You have 10 tokens to divide between two boxes. When instructed by your teacher, write a number in each box, fold the paper, and give to your teacher. Name: _____ Box 1: You will receive one bonus point for every token you place in this box. Box 2: The sum of all tokens placed in this box by the entire class will be multiplied by 2 to get the total number of bonus points, which will be evenly distributed to everyone in the class. Students may discuss all scenarios of point distribution before all students commit to writing points in boxes. Once each student's bonus points have been calculated and shared, further discuss the value of points allocated as private goods versus public goods, and why some students choose private benefit over public benefit. *Market outcomes can result in income inequality.* B. Income Inequality Research

<table>
<tr>
<td>M, A</td>
<td>Teacher created rubric</td>
<td>
Go to the interactive income distribution activity. Follow the site's directions to correctly populate the 5 quintiles. Study the sum total, mean and median incomes for this fictitious country.

• What would happen to the mean and median income for this country if the highest income were increased by $20,000?

Complete this chart based on the information found in A.

• Aggregate/Total Household Income =

<table>
<tr><th>Ranking of Household Groups</th><th>Aggregate Income by Group</th><th>Percent Distribution of Aggregate Income</th></tr>
<tr><td>1st Lowest</td><td></td><td></td></tr>
<tr><td>2nd</td><td></td><td></td></tr>
<tr><td>3rd</td><td></td><td></td></tr>
<tr><td>4th</td><td></td><td></td></tr>
<tr><td>5th Highest</td><td></td><td></td></tr>
</table>

• What does this data tell you about the distribution of income for households in this fictitious country?

On a separate sheet of graph paper, draw a correctly labeled graph showing a Lorenz Curve using the information in the table above.

• Does this country seem to have low income inequality or high income inequality?

Via Classroom: Access charts of Income Distribution in U.S. from 1970-2010 (Activity 14.3)

• Looking at Table A: What has happened to the mean income within each quintile from 1970 to 2010?
</td>
</tr>
</table>

		• Looking at Table B: In 2010, what percentage of total income did households in the lowest/poorest quintile earn? • In the highest quintile? • What has happened to the percentage of aggregate income that households earned in each quintile between 1970 and 2010? • How does this data support the statement that the U.S. has an increasing income gap between wealthier households and poorer ones? Via Classroom: Access charts of Income Distribution among Population Subgroups, 2012 (Activity 14.4) • Make a generalization for each Table A subgroup across the quintiles. o Type of household o Age of householder o Number of earners o Work status o Mean income • Make a generalization about the relationship of income level to education achievement based on Table B.

		• Compare the characteristics of the lowest quintile to the highest quintile. What generalizations can you make? *Economic concepts include imperfect competitors, factor markets, market failures, and the role of government in the economy.* C. Cumulative Review Presentation Goal: Students create a classroom community in which every member contributes to the greater good by becoming an expert in one economic concept and teaching it to others. Role: Students act as teachers/tutors. Audience: Classmates Performance/Product and Purpose: Students will teach a review concept from units 4, 5, & 6 using an interactive slideshow presentation and practice problems. Standards/Criteria for Success: Presentations clearly demonstrate expertise in style of presentation and substance of content.
T, M, A	School-wide Communication Rubric contextualized for peer teaching	
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…*
A	Evaluation of student notebooks with these criteria for success: accuracy in content of vocabulary; precision in constructing graphs; comprehensive responses to study problems.	Guided reading and note-taking from economics textbook chapters about public goods, externalities, economics of taxation, agriculture policy, income inequality, and discrimination.
M, A	Evaluation of student problem-solving process and/or presentation of solutions to whole class with these criteria for success: cooperative and collaborative approach; accuracy and comprehensive responses to	Small group practice problem-solving for marginal revenue product, marginal revenue productivity, marginal resource cost, optimal combination of resources (labor and capital), perfectly competitive market wages, monopsonistic market wages, union wages,

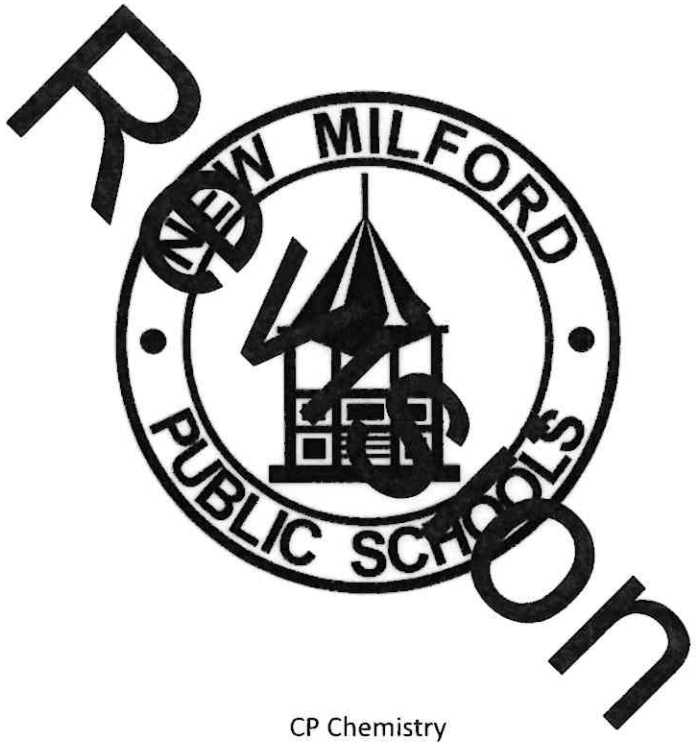
	practice problems; focused and articulate presentation of solutions.	economic rent.
M, A	AP rubrics for multiple choice and free response questions.	AP style multiple choice, stimulus-based, and short answer responses on quizzes.
M, A	AP rubrics for multiple choice and free response questions.	Cumulative Exam encompassing units 4, 5, and 6 using released AP multiple choice and free response questions.

Code	Pre-Assessment Ask students to describe scenarios when they have benefited from a show, meal, activity for which they did not pay and scenarios in which they have had to shoulder more of a burden in comparison to others participating in the same activity; give examples of government's role in the economy.	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T, M, A	Teacher sets the purpose for learning by posting the objective(s), rationale, and learning activities on a whiteboard or the day's slideshow for all students to see and review. *For example, What: Students will be able to determine when the private market does not produce the socially optimal amount of a product. Why: Sometimes the government must intervene in a free market. How: Daily Question; Review HW; Video with graphs; Quiz or Exit Ticket*	
T, M, A	Teacher hooks and holds students' attention with daily prompts that ask provocative, open-ended questions using unit vocabulary, concepts, and skills often connected to current economic events. *For example, "Who pays the healthcare costs of lung cancer patients?* Teacher initiates *a discussion on the negative spillover costs of cigarette smoke and the diversion of national income to pay healthcare costs for a preventable cancer. Alternatively ask "Who pays the cost of New Milford's July 4th Fireworks display?"* Teacher initiates *a discussion on the positive spillover benefits for many people in surrounding towns who also observe the fireworks, even though these people do not pay NM taxes.*	Teacher looks for engaged and varied responses from multiple students.
M, A	Teacher places students in small groups to review HW, typically, reading and taking notes from textbook chapters	Teacher review of notes as students review difficult questions. May result in whole class review and

	according to Unit Responsibility sheet focusing on acquiring domain specific vocabulary, guided practice of constructing and interpreting graphs and tables, and responding to study questions.	discussion if the majority of students are struggling with a vocabulary term, concept, and/or skill.
A	Teacher initiates direct instruction with slideshows of key unit vocabulary, concepts, skills, and graphs during which students may rethink and revise their HW responses. *For example, spillover costs and benefits, negative and positive externalities, socially optimal*	Teacher looks for engaged and varied responses to scaffolded questions from multiple students.
M, A	Teacher initiates guided practice with tutorial videos that break down steps for acquiring each concept and/or skill with scaffolded questions. *For example, ACDC Externalities and discussion about government interventions (taxes and subsidies) to correct externalities.*	Teacher circulates to ensure that students are completing and understanding steps. Periodic pauses for students to explain steps in their own words.
M, A	Students work cooperatively to solve and share problems (*from ACDC Econ)* in small groups for peer-guided practice of each concept and/or skill. Groups then come to the board to present solutions while classmates peer assess and offer alternative strategies to find solutions.	Teacher circulates to ensure that students are completing and understanding components to practice problems and working cooperatively.
T, M, A	Students practice test-taking strategies with practice quizzes in textbook to explain why the right answer is correct and how the other choices serve as distractors. Students are purposely assigned to practice with multiple choice or free response questions, whichever is more needed based on past assessments.	Teacher looks for engaged and evidence-based responses from multiple students.

NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut



CP Chemistry

03/2023

Do Not Distribute Not BOE Approved

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New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

CP Chemistry

Grade Levels

A brief description of the course..

Connection to the Vision of a Graduate (critical thinking, communication,creativity, problem solving, positive relationships, self-knowledge and management, growth mindset, social awareness)...

Vision of a Graduate

Throughout the CP Chemistry course students will connect with the characteristics identified in New Milford's Vision of a Graduate. Students will enhance their problem solving skills by applying critical thinking skills while developing positive relationships with their peers.

Critical Thinking: Students will make logical connections between knowledge they have and information they have gathered and be able to connect them together in order to solve a problem. Students will use their prior knowledge to determine if the results they have reached are logical answers to their questions or lab results.

Problem Solving: Students will work on understanding the questions that are posed to them and identifying the information within the question and use their prior knowledge to help them find a solution. Students then will be able to predict the correct outcomes for specific heats of metals and the amount of matter produced in a chemical reaction. Using the information gathered the students will be able to identify specific compounds, metals, and molecules created from chemical reactions. These skills will enable the student's to successfully determine the unknown compound at the end of the year.

Positive Relationships: Students will develop positive relationships with their peers by performing laboratory experiments, group work, and delivering productive criticism or encouragement while working in small groups.

Chemistry includes the study of the structure and properties of matter, chemical behavior, and energy relationships. There is strong emphasis on science processes, quantitative and laboratory skills. At the CP level, this course is more rigorous and moves at a faster pace. Additional homework may be required. In addition, Chemistry CP students must identify an unknown substance at the end of the year.

Transfer Goals (SEP)

- Make and use observations to identify and analyze relationships and patterns in order to explain phenomena, develop models, and make predictions.
- Evaluate systems, including their components and subsystems, in order to connect how form determines function and how any change to one component affects the entire system.
- Conduct investigations, individually and collaboratively, to answer questions.
- Evaluate scientific claims for validity.

Pacing Guide

Include a list of the units and the approximate number of days/weeks it will take to teach the unit.

	Units	Number of Blocks
Unit 1:	**Atomic Structure and Properties**	8 blocks
Unit 2:	**Applied Mathematics**	8 blocks
Unit 3:	**Atomic Structure and the Mole**	12 blocks
Unit 4:	**Electron Configurations**	6 blocks
Unit 5:	**Periodic Table**	8 blocks
Midterm Exam		
Unit 6:	**Chemical Bonds**	11 blocks
Unit 7:	**Chemical Reactions**	12 blocks
Unit 8:	**Stoichiometry**	11 blocks
Unit 9:	**Kinetic Molecular Theory**	6 blocks
Final Exam		

Key for National and State Standards

HS-LS = Next Generation Science Standards: Life Sciences

HS-ES = Next Generation Science Standards: Earth Sciences

HS-ETS = Next Generation Science Standards: Engineering, Technology, and Applications of Science

RST = Common Core Reading Standards for Literacy in Science 6-12

WHST = Common Core Writing Standards for Science and Technology

5E Model
E1- Engage
E2 - Explore
E3 - Explain
E4 - Extend
E5 - Evaluate

AMT Coding

A - Acquire
M - Meaning
T - Transfer

Unit 1: Atomic Structure and Properties

Phenomenon: Chemical reaction of such as Magic Rainbow Wand Chemical Reaction

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS1-6: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. [Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.]

HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to

Transfer

Students will be able to independently use their learning to…

- SEP 1 - Ask Questions and Define Problems
- SEP 3 - Plan and Carry Out Investigations
- SEP 6 - Construct Explanations
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

PS1.A: Structure and Properties of Matter

- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms

PS1-B: Chemical Reactions

- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions

ESSENTIAL QUESTIONS

Students will keep considering…

- What is matter and how is it classified?
- How can different types of matter be distinguished; mixtures vs pure substances?
- How can these materials be separated into the smallest unit?
- What are the differences between a physical change and a chemical change?
- When and where is the law of conservation of mass observed?

Acquisition

communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.]	*Students will know…* • The relationship between states of matter and their energy and their particle arrangement (CCC: Energy and Matter) • The forces and energy changes involved in changes of states of matter (CCC: Energy and Matter) • Distinguish between physical and chemical properties and use them to identify and describe physical and chemical changes. (CCC: Stability and Change) • Observations that denote a chemical change. • Energy is transferred during a physical and chemical change. • Matter is conserved during a chemical reaction. (CCC: Stability and Change)	*Students will be skilled at…* • Using models to describe the characteristics of the three common states of matter. • Classifying matter as a mixture (homogeneous or homogeneous) or pure substance (element or compound) • Giving examples of non-matter • Distinguishing between solutions, suspensions, and colloids. • Select appropriate separation techniques based on the physical properties of the components in the mixture. • Interpreting and drawing a phase diagram for a single compound system.

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Accurately describing a substance with the correct state of matter • Accurately classifying a mixture as homogeneous or heterogeneous or a pure substance as an element or compound • Accurately choosing the correct separation techniques to separate mixtures • Drawing the correct phase diagrams for a compound system • Analyze different compounds for their physical and chemical properties	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Separation of a mixture lab** - Students will be assigned various mixtures and will decide on the correct separation procedure. Examples of mixtures include coffee beans and water, borax, and pigments of a plant.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoot, Peardeck, Edpuzzle Assessments • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan		
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - what were the two things at the beginning, what was the end result? • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction	Progress Monitoring
A A, M M, T	The teacher will introduce the phenomenon (Chemical reaction such as Magic Rainbow Wand Chemical Reaction) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and acquisition depends on…* - **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3) - **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4) - **Lab work** applied to key concepts from the unit.Questions about the separation of a mixture lab. (E1, E2,	• Warm-Up / Exit tickets • Monitor progress for depth and accuracy • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment

	E3, E4, E5) Resources: All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

Unit 2: Applied Mathematics

Phenomenon: Comparison of different measurements - 1 gallon vs 1 liter, 1 foot vs 1 meter, etc.

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.]

HS-PS3-1: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.]

Transfer

Students will be able to independently use their learning to…

- SEP 1 - Ask Questions and Define Problems
- SEP 3 - Plan and Carry Out Investigations
- SEP 5 - Using Mathematics and Computational Thinking
- SEP 6 - Construct Explanations
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

PS1.A: Structure and Properties of Matter

- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.

ESSENTIAL QUESTIONS

Students will keep considering…

- How can units be converted from one to another?
- What is the difference between accuracy and precision and why are they important?
- How do significant figures determine which numbers are important in a measurement?
- Why should big and small numbers be written in scientific notation?
- How can density be used to determine what kind of material an object is?

HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.]	**PS3.A: Definitions of Energy** • Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. **PS3.B: Conservation of Energy and Energy Transfer** • Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. • Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. • The availability of energy limits what can occur in any system.	

	Acquisition	
	Students will know… • The relationships between different units and how to move between them. (CCC: Scale, Proportion, and Quantity) • That big and small numbers should be converted into scientific notation to make them more manageable. (CCC: Scale, Proportion, and Quantity) • The difference between accuracy and precision. • That the density of an object can determine the type of object it is.	*Students will be skilled at…* • Converting from one unit to another • Accurately describing the differences between accuracy and precision • Calculating the number of significant figures • Calculating the density of an object • Converting from standard notation to scientific notation • Analyzing heating and cooling curves

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Accurately converting from one unit to another. • Accurately converting from standard notation to scientific notation • Accurately describing a series of measurements as being accurate or precise or both • Accurately calculating the density of an object	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Density Lab** - Students will be given a selection of objects that have different densities and will be tasked with determining their densities and then correctly identifying the material.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoots or other active online learning activities • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan		
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - which block will melt the ice faster? Why do you think this block will melt it faster? • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction The teacher will introduce the phenomenon (Comparison of different measurements - 1 gallon vs 1 liter, 1 foot vs 1 meter, etc.) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and acquisition depends on…*	Progress Monitoring • Warm-Up / Exit tickets • Monitor progress for depth and accuracy • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment
A A, M M, T A, M	- **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3) - **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4) - **Lab work** applied to key concepts from the unit. Questions from the density lab. (E1, E2, E3, E4, E5) - **Modeling** the heat transfer of metals	

M M	using using **GIZMO, pHet** or any other approved virtual lab program (E2, E3, E4) - **Calculating** densities of different objects (E2, E3) - **Converting** units and standard notations to new units and scientific notations (E2, E3) <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

Unit 3: Atomic Structure and the Mole

Phenomenon: Mole Lab Practical, students will try to determine how much of a substance is needed to make a mole of it (ex: Aluminum, water)

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.]

HS-PS3-1: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. [Clarification Statement: Emphasis is on explaining the

Transfer

Students will be able to independently use their learning to…

- SEP 1 - Ask Questions and Define Problems
- SEP 2 - Developing and Using Models
- SEP 3 - Plan and Carry Out Investigations
- SEP 4 - Analyzing and Interpreting Data
- SEP 5 - Using Mathematics and Computational Thinking
- SEP 6 - Construct Explanations
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

PS1.A: Structure and Properties of Matter

- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as

ESSENTIAL QUESTIONS

Students will keep considering…

- How can units be converted from one to another?
- What is the mole and how can it be used in chemistry?
- What are the different parts of an atom?
- What Is Avagadro's number and hypothesis?
- How do you determine the percent composition of elements in a compound?
- How do you calculate the molar mass of a compound?

meaning of mathematical expressions used in the model.] HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. [Clarification Statement: Emphasis is on simple qualitative modes, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.]	the contact forces between material objects. **PS3.B: Conservation of Energy and Energy Transfer** • Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. • Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. • The availability of energy limits what can occur in any system. **PS1.B: Chemical Reactions** • The fact that atoms are conserved together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. **PS1.C: Nuclear Processes** • Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total	

	number of neutrons plus protons does not change in any nuclear process.	
	Acquisition	
	Students will know… • The relationships between different units and how to move between them. (CCC: Scale, Proportion, and Quantity) • The different subatomic particles in an atom. • The difference between an unstable and a stable isotope. (CCC: Energy and Matter) • How to calculate the average atomic mass of an element • How to determine the number of protons, neutrons, and electrons in an atom. • How to calculate how many moles, molecules, grams, or liters are in a substance using the mole as a base. (CCC: Scale, Proportion, and Quantity) • How to calculate the percent composition of different atoms in a compound. (CCC: Energy and Matter)	*Students will be skilled at…* • Converting from one unit to another • Calculating the number of protons, neutrons, and electrons in an atom • Determining which atoms are isotopes of each other • Calculating the average atomic mass • Calculating the correct number of moles, molecules, grams, and liters in a substance using the mole as a base • Calculating the percent composition of different atoms in a substance

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Accurately converting from one unit to another. • Accurately determining the correct number of protons, neutrons, and electrons in an atom. • Correctly determining the atoms that are isotopes of each other • Correctly calculating the average atomic mass of an element • Accurately calculating the numbers of moles, molecules, grams and liters in a substance using the mole as the base. • Accurately calculating the percent composition of different atoms in a substance.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Average Atomic Mass Lab** - Students will use either pennies or candies to calculate the average atomic mass of "Pennium" or "Candium" **Moles of Chalk Lab** - Students will calculate how many moles of chalk it takes to write their name **Percent Composition of a Hydrate Lab** - Students will be given a hydrate and will need to determine how much water by mass is trapped in each compound **Mole Project** - Students will construct a mole after an element, create an information sheet about the element and will present it to the class.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoots or other active online learning activities • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan		
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - how can you determine how many atoms you are putting into the beaker, or are folding up with the aluminum? • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction The teacher will introduce the phenomenon (Mole Lab Practical, students will try to determine how much of a substance is needed to make a mole of it (ex: Aluminum, water) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and acquisition depends on…* - **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3) - **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4)	Progress Monitoring • Warm-Up / Exit tickets • Monitor progress for depth and accuracy, specifically looking at how they are converting the units for the mole questions • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment
A A, M		

M, T A, M M M	- **Lab work** applied to key concepts from the unit. Questions from the atomic mass, moles of chalk, and percent composition labs. (E1, E2, E3, E4, E5) - **Modeling** the mole unit with the mole project (E1, E2, E3, E4, E5) - **Calculating** the number of subatomic particles, atomic mass, the number of moles, molecules, grams, and liters in a substance, and the percent composition of substances (E2, E3) - **Converting** units from moles to molecules, grams, or liters (E2, E3) <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

Unit 4: Electron Configurations

Phenomenon: Emission spectra of elements - Students will observe the light created by different elements

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.]

HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.]

HS-PS1-8: Develop models to illustrate the changes in the

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Developing and Using Models
- SEP 3 - Plan and Carry Out Investigations
- SEP 4 - Analyzing and Interpreting Data
- SEP 6 - Construct Explanations
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

PS1.A: Structure and Properties of Matter

- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states

ESSENTIAL QUESTIONS

Students will keep considering…

- How do electrons influence the light that substances produce?
- Why does the way electrons are arranged have a role in where the elements are placed on the periodic table?
- How do you create an electron configuration?
- How do you draw an orbital spin diagram?
- How do you create a noble gas configuration?

composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. [Clarification Statement: Emphasis is on simple qualitative modes, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.]	**PS2.B: Types of Interactions** • Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. **PS1.B: Chemical Reactions** • The fact that atoms are conserved together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	
	Acquisition	
	Students will know… • That electrons return to their ground state and this produces light (CCC: Energy and Matter) • That the periodic table is based on groups of elements that have similar electron configurations (CCC: Patterns) • How to create an electron configuration • How to draw an orbital spin diagram • How to create a noble gas configuration • How to determine an element based off of the flame the element creates (CCC: Patterns) • How to determine what the element is	*Students will be skilled at…* • Writing electron configurations • Drawing orbital spin diagrams • Writing noble gas configurations • Determining elements based on the flame they produce

	by the electron configuration	

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Accurately creating the correct electron configuration • Accurately drawing the correct orbital spin diagram • Accurately creating the correct noble gas configuration • Predicting what element is in an unknown solution based on the flame produced by the chemical • Solving what the element is based on the electron configuration	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Flame Test Lab** - Students will test different chloride compounds in a flame to see what colors the different compounds will turn. Then they will need to determine which element(s) are in an unknown solution.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoots or other active online learning activities • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan		
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - what is producing the different colors? What happens when the element changes? • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction The teacher will introduce the phenomenon (Emission spectra of elements - Students will observe the light created by different elements) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and acquisition depends on…* - **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3) - **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4) - **Lab work** applied to key concepts	Progress Monitoring • Warm-Up / Exit tickets • Monitor progress for depth and accuracy, specifically looking at how the students are drawing the orbital spin diagrams and making the configurations • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment
A A, M M, T		

M M M, T	from the unit. Questions about the flame test lab. (E1, E2, E3, E4, E5) - **Creating** the correct electron configurations and noble gas configurations (E2, E3) - **Drawing** the correct orbital spin diagrams (E2, E3) - **Predicting** the elements from configurations or from colors in a flame (E1, E2, E3, E4, E5) <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

Unit 5: The Periodic Table

Phenomenon: Sodium and Potassium in water - Exploring the properties of alkali metals

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.]

HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.]

HS-PS1-3. Plan and conduct an investigation to gather evidence

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Developing and Using Models
- SEP 3 - Plan and Carry Out Investigations
- SEP 4 - Analyzing and Interpreting Data
- SEP 6 - Construct Explanations
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

PS1.A: Structure and Properties of Matter

- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states

ESSENTIAL QUESTIONS

Students will keep considering…

- What is an ion?
- What is the difference between a cation and an anion?
- What are the families on the periodic table?
- How do the families show similar chemical and physical properties?
- What are some of the trends displayed on the periodic table when the elements are arranged on their increasing atomic number?
- What are the different types of elements?

to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.]	**PS1.B: Chemical Reactions** • The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	
	Acquisition	
	Students will know… • What an ion is compared to a neutral atom • The different types of elements such as metals and nonmetals • The difference between a cation and an anion • The different families found on the periodic table (CCC: Patterns) • How the periodic law determines properties and trends on the periodic table (CCC: Patterns) • Some of the chemical and physical properties of metals and nonmetals (CCC: Patterns) • The general trends for electronegativity, atomic size, ionization energy, and ionic size (CCC: Patterns)	*Students will be skilled at…* • Determining cations and anions • Identifying which family an element belongs to • Determining the trend of a group of elements for electronegativity, atomic size, ionization energy, and ionic size • Identifying elements as metals, nonmetals, or metalloids based on their properties • Using the periodic law to determine trends in a fictitious periodic table

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Accurately describing ions as cations or anions • Correctly identifying elements as metals, nonmetals or metalloids based on their properties • Accurately describing the trends seen on the periodic table such as electronegativity, atomic size, ionization energy, and ionic size • Correctly identifying which family on the periodic table an element belongs to • Creating their own periodic table with trends that the students created and matching that to the real periodic table	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Periodic Trends Lab** - Students will explore elements in group 14 and determine the properties for the missing elements in that group. **Periodic Table Project** - Students will create their own periodic table based on their interests and will show trends that they have created. The trends must follow trends seen on the periodic table (EX: least expensive item to most expensive, biggest item to smallest item, etc.).
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoots or other active online learning activities • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan		
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - why do these elements behave this way? What happens if we add a different element such as copper or lead? • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction The teacher will introduce the phenomenon (Sodium and Potassium in water - Exploring the properties of alkali metals) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and acquisition depends on…* A - **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3) A, M - **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4) M, T - **Lab work** applied to key concepts from the unit. Questions from the	Progress Monitoring • Warm-Up / Exit tickets • Monitor progress for depth and accuracy • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment

M M, T	periodic trends lab. (E1, E2, E3, E4, E5) - **Determining** the elements based on their family and properties (E3, E4) - **Predicting** the properties of elements in the same family (E1, E2, E3, E4, E5) <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

Unit 6: Chemical Bonds

Phenomenon: Rainworks -How is this possible?

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.]

HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.]

HS-PS1-3. Plan and conduct an investigation to gather evidence

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Developing and Using Models
- SEP 3 - Plan and Carry Out Investigations
- SEP 4 - Analyzing and Interpreting Data
- SEP 6 - Construct Explanations
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

PS1.A: Structure and Properties of Matter

- The types of electrical attractions in a bond within a substance influences its micro and macro chemical and physical properties.
- Communicating information about chemical concepts is highly dependent upon understanding the symbolism and conventions used to represent matter and information about the matter
- Bonding occurs in patterns related to the periodic table

ESSENTIAL QUESTIONS

Students will keep considering…

- How do atoms bond?
- What role do valence electrons play in determining the chemical properties and the type of bond formed between atoms?
- How does the type of electrical attraction create macroscale properties?
- How are the symbolic representations, chemical notation, and rules of nomenclature used in the language of chemistry?

to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.]	• Chemical bonding in matter results in the formation of new compounds with different properties.	
	Acquisition	
	Students will know… • That big and small numbers should be converted into scientific notation to make them more manageable. (CCC: Scale, Proportion, and Quantity) • The difference between accuracy and precision. • The charge an ion will likely form based on the position of the element on the periodic table and using the octet rule. • Why the properties of an ion are different from those of the neutral atom. • The process of forming an ionic and covalent bond. • Why the properties of ionic compounds depend on the electron arrangement between atoms. • The names and formulas of cations, anions, and ionic compounds. • That formulas for ionic compounds are written to show their balance of overall charge • Describe the change in energy and stability that takes place as a chemical bond is formed. • How to distinguish between nonpolar and polar covalent bonds based on differences in electronegativity.	*Students will be skilled at…* • Illustrating the process of forming a covalent bond. • Drawing Lewis structures to show the arrangement of valence electrons among atoms in molecules and polyatomic ions. • Drawing resonance structures for simple molecules and polyatomic ions. • Naming simple covalent compounds using prefixes, roots, and suffixes.

	• The differences between single, double, and triple covalent bonds.	

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Accurately predict the type of bonding which will take place between metals and nonmetals, metals and metals, and nonmetals with nonmetals. as ionic, covalent or metallic compounds • Correctly identifying the properties of both ionic and covalent compounds	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Properties of ionic and covalent compounds Lab** - Students will be given a number of compounds to test and will be tasked with determining common properties of ion or covalent compounds. Students will use these properties to identify various compounds as either ionic or covalent. **Building a Molecular Model project** - Students will build a model of a molecule and research the molecule. Students will then present their findings in a flier about the molecule.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoots or other active online learning activities • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan		
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - how does Rainart appear? Is this something anyone can create? • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction The teacher will introduce the phenomenon (Rainworks -How is this possible?) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and*	Progress Monitoring • Warm-Up / Exit tickets • Monitor progress for depth and accuracy • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment

	acquisition depends on…	
A	- **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3)	
A, M	- **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4)	
M, T	- **Lab work** applied to key concepts from the unit. Questions from the ionic and covalent lab. (E1, E2, E3, E4, E5)	
M	- **Molecular shapes with Gizmo, pHet** or any other approved virtual lab program (E2, E3, E4)	
M, T	- **Predicting** the compounds formed when different elements or ions bond and the properties of compounds in the based on the type of bonding present (E3, E4, E5)	
M	- **Determining** the formulas based on their elements present (E3, E4)	
	Resources: All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

Unit 7: Chemical Reactions

Phenomenon: What metals should we use to make jewelry?

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS 1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties

HS-PS1.B: Chemical reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions

HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional

Transfer

Students will be able to independently use their learning to…

- SEP 1 - Ask Questions and Define Problems
- SEP 2 - Developing and Using Models
- SEP 3 - Plan and Carry Out Investigations
- SEP 6 - Construct Explanations
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

PS1.A: Structure and Properties of Matter

- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states

PS1.B: Chemical Reactions

- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction

ESSENTIAL QUESTIONS

Students will keep considering…

- What are some of the chemical reactions that occur within our environment everyday?
- How are the symbolic representations, chemical notation, and rules of nomenclature used in the language of chemistry?

relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.]	determines the numbers of all types of molecules present. • The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	
	Acquisition	
	Students will know… • In a chemical reaction atoms rearrange to form new substances • The signs of a chemical reaction by observation • Interpret the meaning of symbols used in writing chemical equations • Know the steps in writing balanced chemical equations • Relate the Law of Conservation of Mass to a balanced chemical equation • In a combustion reaction a hydrocarbon reacts with oxygen to form carbon dioxide and water (CCC: Patterns) • In a synthesis reaction two reactants form a single product (CCC: Patterns) • In a decomposition reaction a single reactant forms two or more products (CCC: Patterns) • In a single replacement reaction an element replaces an element from a compound, the activity series is used to determine if a single replacement reaction will take place	*Students will be skilled at…* • Classifying reactions as belonging to one of five general types. • Balancing chemical equations • Predicting the products of a balanced chemical reaction using the general forms as a guide. • Predicting the products of and balancing single replacement reactions using the activity series. • Predicting the products of and balancing double replacement reactions

	• In a double replacement reaction the ions of two compounds switch places such that two new compounds form. One of the products must be a solid, gas, or molecular compound(such as liquid water)	

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Classifying reactions as belonging to one of five general types. • Balancing chemical equations • Predicting the products of a balanced chemical reaction using the general forms as a guide. • Predicting the products of and balancing single replacement reactions using the activity series. • Creating an activity series based on their lab results • Predicting the products of and balancing double replacement reactions using a solubility chart. • Writing a net ionic equation for precipitation reactions in aqueous solutions.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Signs of a chemical reaction lab** - Students will be given a number of reactions that display different signs of a chemical reaction and will be tasked with determining a series of signs to predict if a chemical reaction has taken place. **Single displacement Lab** - Students will be given a number of different solutions and metals and will then create an activity series based on their results https://assets.savvas.com/file-vault/experience-chemistry/Reactivity-of-Metals/index.html **Double displacement Lab** - Students will be

		given a number of different solutions and will have to determine if a reaction took place and if a reaction took place correctly write the reaction that took place. **Reactivity of Metals - What metals should we use for making jewelry?** Students will test a number of unknown metals to determine which metal would make the best choice for a ring.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoots or other active online learning activities • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan	
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - Did they turn a copper penny into gold? What do you think happened? • Formal pre-assessments to match the post assessment (optional)

	Summary of Key Learning Events and Instruction	Progress Monitoring
	The teacher will introduce the phenomenon (what metals should we use to make jewelry) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and acquisition depends on…*	• Warm-Up / Exit tickets • Monitor progress for depth and accuracy • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment
A	- **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3)	
A, M	- **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4)	
M, T	- **Lab work** applied to key concepts from the unit. Questions from the types of chemical reactions, single, and double replacement labs. (E1, E2, E3, E4, E5)	
M, T	- **Modeling** balancing chemical equation using **GIZMO, pHet** or any other approved virtual lab program (E2, E3, E4)	
M, T	- **Predicting and balancing** the type of reaction, products formed when different compounds are mixed (E3, E4, E5)	
	<u>Resources:</u> All Resources and materials must adhere to all New	

	Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

Unit 8: Stoichiometry

Phenomenon: Let's Have S'more Chemistry: Marshmallows, Chocolate, Grams, and Moles

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS1.B: Chemical reactions The fact that atoms are conserved , together with knowledge of the chemical properties of the elements involved , can be used to describe and predict chemical reactions

HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional

Transfer

Students will be able to independently use their learning to…

- SEP 1 - Ask Questions and Define Problems
- SEP 2 - Developing and Using Models
- SEP 3 - Plan and Carry Out Investigations
- SEP 5 - Using Mathematics and Computational Thinking
- SEP 6 - Construct Explanations
- SEP 7 - Engage in Argument from Evidence
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS
Students will understand that…

PS1.A: Structure and Properties of Matter

- The periodic table orders elements

ESSENTIAL QUESTIONS
Students will keep considering…

- What are some of the chemical reactions that occur within our environment everyday?

relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] HS-PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and	horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron state **PS1.B: Chemical Reactions** • In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. • The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	- How are the symbolic representations, chemical notation, and rules of nomenclature used in the language of chemistry?
	Acquisition	
	Students will know… • Stoichiometry compares the amount of substances in a chemical reaction (CCC: Energy and Matter) • STP represents standard temperature (0°C) and pressure (1 atm). • Stoichiometry problems involving chemical reactions can always be solved using mole ratios from the balanced chemical equation (CCC: Scientific Knowledge Assumes an Order and Consistency in Natural Systems)	*Students will be skilled at…* • Determining the moles of reactants or products from balanced chemical equations. • Calculate masses of reactants or products involved in chemical reactions given data in mass, moles, or volume of gasses at STP. • Interpret data to determine amounts of reactants or products • Calculate the percent yield of products.

chlorine, of carbon and oxygen, or of carbon and hydrogen.] HS-PS1-5: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. [Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.]	• The limiting reactant is the reactant that is consumed completely in a reaction. (CCC: Energy and Matter) • The theoretical yield is the amount of product that can be formed from a given amount of limiting reactant. • The actual yield is the amount of product collected from a real reaction.	

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Accurately calculate the amount of product that will be produced from known quotes of reactants • Accurately calculate the amount of reactant needed to produce the desired amount of product.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Decomposition of Baking Soda** - predicting the correct reaction based on stoichiometric results **Baking Soda and Vinegar Demo** - determining which is the limiting reagent **What Happens if I Run out of Ingredients?** - POGIL Activity

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoots or other active online learning activities • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan		
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - How many S'mores could they make? What was left over? • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction The teacher will introduce the phenomenon (S'more chemistry) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and*	Progress Monitoring • Warm-Up / Exit tickets • Monitor progress for depth and accuracy • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment

A A, M M, T M, T M, T	*acquisition depends on…* - **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3) - **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4) - **Lab work** applied to key concepts from the unit. Questions from the decomposition of baking soda lab. (E1, E2, E3, E4, E5) - **Modeling** stoichiometry and limiting reagents using **GIZMO, pHet or any other approved virtual lab program** (E2, E3, E4) - **Use stoichiometry** to determine the amount of product formed or the amount of reactant needed. (E3, E4, E5) <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	

Unit 9: Kinetic Molecular Theory

Phenomenon: Can I crush a soda can without touching it?

Stage 1: Desired Results

ESTABLISHED GOALS

HS-PS3-4: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system. [Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.]

HS-PS1-4: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy

HS-PS3-2: Develop and use models to illustrate that energy at the macroscopic scale can be

Transfer

Students will be able to independently use their learning to…

- SEP 1 - Ask Questions and Define Problems
- SEP 2 - Developing and Using Models
- SEP 3 - Plan and Carry Out Investigations
- SEP 5 - Using Mathematics and Computational Thinking
- SEP 6 - Construct Explanations
- SEP 8 - Obtain, Evaluate, and Communicate Information

Meaning

UNDERSTANDINGS

Students will understand that…

PS3.D: Energy in Chemical Processes

- Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment.

PS3.A: Definitions of Energy

- Energy is transferred from one object to another and between different forms of energy but the total energy of the system is conserved at both the macroscopic and microscopic scales unless energy is transferred into or out of the system, in which case the total

ESSENTIAL QUESTIONS

Students will keep considering…

- What are the major gas laws?
- How are the different phases related to particle movement?
- How can you create a heating or cooling curve on a graph?
- How is the kinetic molecular theory used to explain the differences between solids, liquids, and gasses?
- How are the gas laws used to relate temperature, pressure, volume, and mole quantities?

accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). [Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions and computer simulations.] HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical	energy of the system and its surroundings is conserved • Chemical processes and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.	
	Acquisition	
	Students will know… • How particles move within different phases of matter • The information is given from a heating and cooling curve • How the molecular structure of molecules and compounds leads to macro properties • The general properties of gasses • The SI unit for pressure and how to convert between standard units of pressure • That the kinetic molecular theory states that gas particles are in constant random motion, and are relatively far apart, and have volumes that are negligible when compared with the total volume of a gas • How to relate the kinetic molecular theory to the properties of an ideal gas • How to solve problems where the volume, pressure, and temperature of a gas are known or unknown • How to differentiate ideal gas behavior	*Students will be skilled at…* • Convert temperature readings between the Kelvin, Celsius, and Fahrenheit scales. • Calculate the amount of energy released or absorbed during a chemical reaction • Calculate the energy within a chemical bond • Determining factors that affect gas pressure • Converting between various pressure units • Using the combined gas law to solve problems with various missing temperatures, pressures, or volumes • Using the ideal gas law to solve problems using pressure, volume, temperature, and moles of a gas

thinking and not on memorization and rote application of problem-solving techniques.]	from real gas behavior	

Stage 2: Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M & T	• Accurately calculating the missing variable in a combined gas law problem • Accurately calculating the missing variable in an ideal gas law problem • Correctly converting to the correct pressure unit • Correctly converting to the correct temperature unit • Accurately calculating the energy in a chemical bond	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Create a Tissue Paper Hot Air Balloon -** Students will work in groups to create a hot air balloon made out of tissue paper. This will demonstrate volume and temperature of gasses. **The Molar Mass of Butane -** Students will use a lighter to release butane gas and will collect the gas to determine the molar mass of butane. This will demonstrate the ideal gas law.
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* • Quizzes and Tests • Verbal Questioning / Class Discussions • Kahoots or other active online learning activities • Lab analysis questions • Warm-ups and exit tickets • Homework assignments • Google Form questions

Stage 3: Learning Plan		
Code	***Pre-Assessment*** • Informal assessment of prior knowledge • Ask students to talk about the phenomenon - Why did the soda can get crushed? What variables affected the soda can? • Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction The teacher will introduce the phenomenon (can I crush a soda can without touching it) at the beginning of the unit. The teacher will introduce the new topic for the students and will monitor progress. As the unit continues new topics will be introduced and the teacher will use/develop activities and laboratory investigations for the unit concepts. *Student success at transfer, meaning and acquisition depends on…*	Progress Monitoring • Warm-Up / Exit tickets • Monitor progress for depth and accuracy • Kahoot or other active online learning activities • Questions on activities/labs • Verbal questions for comprehension • End of unit assessment
A A, M M, T	- **Taking notes** from lecture, class discussions, videos and textbook readings on each topic (E2, E3) - **Working collaboratively** with partners or small groups to complete graphic depictions to summarize major concepts (E1, E2, E3, E4) - **Lab work** applied to key concepts from the unit. Questions from the molar mass of butane lab. (E1, E2, E3,	

M, T	E4, E5) - **Modeling** Kinetic Molecular Theory using **GIZMO, pHet** or any other approved virtual lab program (E2, E3, E4) <u>Resources:</u> All Resources and materials must adhere to all New Milford Board of Education policies and regulations and are subject to New Milford Board of Education approval. Resources and materials must be researched and vetted by the writers and department heads prior to submission for approval.	