

Environmental Studies Unit 6: Minerals and Energy Resources

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Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

Environmental Studies

11,12

Belleville Board of Education

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Unit Overview

1. Dynamic processes move matter within the earth and on its surface and can cause volcanic eruptions, tsunamis, and earthquakes.
2. The three major types of rock found in the earth's crust are recycled very slowly by physical and chemical processes.
3. Some minerals in the earth's crust can be made into useful products, but extracting and using these resources can disturb the land, erode soils, produce large amounts of solid waste, and pollute the air, water, and soil.
4. Raising the price of a scarce mineral resource can lead to an increase in its supply, but there are environmental limits to this effect.
5. We can try to find substitutes for scarce resources, reduce resource waste, and recycle and reuse minerals.
6. Many of the poor have health problems from not getting enough food, while many people in affluent countries suffer health problems from eating too much.
7. The greatest obstacles to providing enough food for everyone are poverty, political upheaval, corruption, war, and the harmful environmental effects of food production.
8. The transfer of matter and energy between the biosphere, geosphere, atmosphere, and hydrosphere often takes place in soils.
9. The unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants.
10. The four major systems of Earth are the geosphere, hydrosphere, atmosphere, and biosphere. The geosphere includes a metallic core, solid and molten rock, soil, and sediments. The atmosphere is the envelope of gas surrounding Earth. The hydrosphere includes the ice, water vapor, and liquid water in the atmosphere, the ocean, lakes, streams, soils, and groundwater. The biosphere includes Earth's life, which can be found in many parts of the geosphere, hydrosphere, and atmosphere. Humans are part of

the biosphere, and human activities have important impacts on all four spheres.

11. More sustainable food production involves reducing overgrazing and overfishing, irrigating more efficiently, using integrated pest management, promoting agrobiodiversity, and providing government subsidies only for more sustainable agriculture, fishing, and aquaculture.
12. We can improve food security by creating programs to reduce poverty and chronic malnutrition, relying more on locally grown food, and cutting waste.
13. Future food production may be limited by soil erosion and degradation, desertification, water and air pollution, climate change from greenhouse gas emissions, and loss of biodiversity.
14. We have used high-input industrialized agriculture and lower-input traditional methods to greatly increase supplies of food.
15. The greatest obstacles to providing enough food for everyone are poverty, political upheaval, corruption, war, and the harmful environmental effects of food production.
16. Many of the poor have health problems from not getting enough food, while many people in affluent countries suffer health problems from eating too much.
17. All Earth processes are the result of energy flowing and mass cycling within and between Earth's systems. This energy is derived from the sun and Earth's interior.
18. The flowing energy and cycling matter cause chemical and physical changes in Earth's materials and living organisms. For example, large amounts of carbon continually cycle among systems of rock, water, air, organisms, and fossil fuels such as coal and oil.
19. The survival of human societies is dependent on Earth's resources. Overall, there are positive correlations between population, natural resource consumption and environmental degradation, although environmental policies and technology influence these relationships. This can be applied to the regional, national and global scales
20. Much of the complex behavior of the Earth system can be thought of as cycles involving physical, chemical and biological processes that transfer components among various storage locations over time.
21. Since the industrial revolutions, nonrenewable fossil fuels including coal, natural gas, and oil, have become our primary sources of energy
22. Fossil Fuels are formed very slowly as buried organic matter is chemically transformed by heat, pressure, and anaerobic decomposition.
23. In evaluating energy sources it is important to compare the amount of energy obtained from them with the amount invested in their extraction and production.
24. Coal is our most abundant fossil fuel. It results from organic matter that undergoes compression but little decomposition.
25. Coal is mined underground and strip-mined from the land surface, and is used today principally to generate electricity.
26. Natural gas is cleaner burning than coal or oil.
27. Natural gas often occurs with oil or coal deposits, is extracted in similar ways and becomes depleted in similar ways.
28. Crude oil is a thick, liquid mixture of hydrocarbons that is formed underground under high temperature and pressure.

HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.MS-LS1-7	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
SCI.MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
SCI.MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
SCI.MS-LS2-1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
SCI.MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
SCI.MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
SCI.MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Exit Skills

1. Analyze a problem, developing hypothesis, and design a scientific experiment to test those hypothesis
2. Use statistical analysis of data collected to make an argument based on purely scientific evidence
3. Develop a vernacular of scientific terms and current environmental problems
4. Data mine from scientific journals and articles evaluating their scientific methodology for validity

Enduring Understanding

1. Dynamic forces that move matter within the earth and on its surface recycle the earth's rocks, form deposits of mineral resources, and cause volcanic eruptions, earthquakes, and tsunamis.
2. The available supply of a mineral resource depends on how much of it is in the earth's crust, how fast we use it, mining technology, market prices, and the harmful environmental effects of removing and using it.
3. We can use mineral resources more sustainably by trying to find substitutes for scarce resources, reducing resource waste, and reusing and recycling nonrenewable minerals.
4. About 925 million people have health problems because they do not get enough to eat and 1.6 billion people face health problems from eating too much.
5. Modern industrialized agriculture has a greater harmful impact on the environment than any other human activity.
6. More sustainable forms of food production will greatly reduce the harmful environmental impacts of current systems while increasing food security and national security for all countries.
7. More sustainable food production involves reducing overgrazing and overfishing, irrigating more

- efficiently, using integrated pest management, promoting agro biodiversity, and providing government subsidies only for more sustainable agriculture, fishing, and aquaculture.
8. We can sharply cut pesticide use without decreasing crop yields by using a mix of cultivation techniques, biological pest controls, and small amounts of selected chemical pesticides as a last resort (integrated pest management).
 9. Future food production may be limited by soil erosion and degradation, desertification, water and air pollution, climate change from greenhouse gas emissions, and loss of biodiversity.
 10. We have used high-input industrialized agriculture and lower-input traditional methods to greatly increase supplies of food.
 11. The greatest obstacles to providing enough food for everyone are poverty, political upheaval, corruption, war, and the harmful environmental effects of food production.
 12. Many of the poor have health problems from not getting enough food, while many people in affluent countries suffer health problems from eating too much
 13. Movement of matter through Earth's system is driven by Earth's internal and external sources of energy and results in changes in the physical and chemical properties of the matter.
 14. Natural and human activities impact the cycling of matter and the flow of energy through ecosystems.
 15. Natural ecosystems provide an array of basic functions that affect humans. These functions include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients.
 16. Earth is a system in which chemical elements exist in fixed amounts and move through the solid Earth, oceans, atmosphere, and living things as part of geochemical cycles.
 17. The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity
 18. Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the univers

Essential Questions

1. To what extent can human behaviors impact our human activities have physical, chemical, and planet's life support system (environment)?
2. What are the "main" geographical hotspots that produce solar energy?
3. Is there a possibility of increasing the environmental impact through the collection of solar energy?
4. What are the differences between active and passive collection of solar energy?
5. What are the components of active and passive collection equipment?
6. What is a photovoltaic cell and how is it used in the production of electricity?
7. What are the major atomic components in the production of electricity in this fashion
8. What are the limitations of solar collection?
9. What is the process for collection of fuel in bio fuels, bio diesel, hydrogen fuel cells, and hybrid engines?
10. What are the environmental costs and benefits for each of the above technologies?
11. Should government involvement force the hands of car manufacturers to produce new more efficient fuels?
12. How is nuclear power produced?
13. What is the difference between nuclear fusion and fission?
14. What are the components of a nuclear reactor?
15. What are the similarities and differences of nuclear generated power verses coal generated power?

16. What is the environmental impact of radioactive emissions and wastes?
17. What are safety and security concerns surrounding nuclear power plants?
18. What are the similarities and differences of nuclear generated power verses coal generated power?
19. What is the environmental impact of radioactive emissions and wastes?
20. What are safety and security concerns surrounding nuclear power plants?
21. What is environmental policy and what is its connection to environmental changes that have been seen in the last thirty years?
22. How did the environmental movement begin and what has the policy reflected the movement?
23. What is more important: responsible energy or impeding the societal disruptions caused by solar energy?

Learning Objectives

1. Describe the geologic processes that build and erode the Earth's surface
2. List the physical, chemical, and biological factors involved in soil formation
3. Explain the importance of humus to soil fertility
4. Differentiate between soil texture and soil structure
5. Explain how texture and structure influence soil atmosphere and soil water
6. Explain the role of living organisms in soil formation and fertility
7. Describe the various layers in a soil profile
8. Describe the processes of soil erosion by water and wind purposes
9. Explain how contour farming strip mining, terracing, waterways, windbreaks, and tillage to reduce soil erosion
10. Explain how land not suited for cultivated may still be productively used for other purposes
11. Explain how mechanization encouraged monoculture farming
12. List the advantages and disadvantages of monoculture farming
13. Explain why chemical fertilizers are used
14. Understand how fertilizers alter soil characteristics
15. Explain why modern agriculture makes extensive use of pesticides
16. Differentiate between persistent pesticides and non-persistent pesticides
17. List four problems associated with pesticide use
18. Define bio magnification and organic farming
19. Explain why integrated pest management depends on a complete knowledge of the pests life history

20. Recognize that genetically modified crops are created by using biotechnical techniques to insert genes from one species into another
21. Describe the rock cycle and discuss its importance in environmental science
22. Explain how soil forms and describe its characteristics
23. Explain how elements and minerals are extracted for human use.
24. Describe approaches and policies that promote sustainable land use
25. Describe human nutritional needs and the challenges of overcoming hunger and malnutrition
26. Explain the development of modern industrial agriculture, the role played by inputs such as irrigation water, fertilizers, and pesticides, and the environmental consequences of modern farming methods.
27. Identify the benefits and costs of using genetically modified organisms in agriculture
28. Describe alternatives to industrial farming methods
29. Explain the environmental impacts of various approaches to raising and harvesting meat and fish.
30. Identify the major components of the technology that is used for the conversion of alternative fuels into

- usable energy. Report on the history of human harvests of renewable energy options.
31. Determine the level of pollution generated and the impact of environmental degradation for the renewable resources including burning firewood, burning wastes, and burning bio fuel (specifically methane).
 32. Compare and contrast the benefits and drawbacks of nuclear power, wind power, and alternative bio fuels. Determine the availability, access, and public acceptance of nuclear power, wind power, and alternative bio fuels. Determine the maximum sustainable yield of renewable energy and describe the limitations of fuel production.
 33. Explain what radiation is and the sources of both natural and anthropogenic sources.
 34. Compare and contrast the benefits and drawbacks of nuclear power, wind power, and alternative bio fuels. Determine the availability, access, and public acceptance of nuclear power, wind power, and alternative bio fuels. Determine the maximum sustainable yield of renewable energy and describe the limitations of fuel production.
 35. Explain what radiation is and the sources of both natural and anthropogenic sources.
 36. What is the importance of the consistent development of new fuels for the future and what is the relationship of technology and environmental science?
 37. Summarize the effects of wastes from bio fuels, ethanol, and biodiesel in compared to hydrogen fuel cells, and new hybrid technology.
 38. Explain the development and collection process of solar productive electricity.
 39. Summarize the level of pollution generated and the technique for energy collection. What is the relationship of the techniques for the collection of solar energy and the efficiency of the conversion for energy for electricity and power
 40. Describe the geographical distribution of energy produced for solar energy. Predict the ecological impacts of the collection of solar energy.
 41. Describe how energy use and energy resources have varied over time, both in the united states and worldwide
 42. Compare the energy efficiencies of the extraction and conversion of different fuels
 43. Explain the various means of generating electricity
 44. Discuss the uses and consequences of using coal, oil, natural gas, and nuclear fuels
 45. Describe projections of future supplies of our conventional energy resources.
 46. Define renewable energy resources
 47. Describe strategies to conserve energy and increase energy efficiency
 48. Compare and contrast the various forms of biomass energy
 49. Explain the advantages and disadvantages of hydroelectricity, solar energy, geothermal energy, wind energy, and hydrogen as energy resources
 50. Describe the environmental and economic options we must assess in planning our energy future.

Interdisciplinary Connections

LA.11-12.RST.11-12.1

Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.

LA.11-12.RST.11-12.2

Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, process information presented in a text by paraphrasing them in simpler but still accurate terms.

LA.11-12.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.11-12.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LA.11-12.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
LA.11-12.RH.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of primary and secondary sources, connecting insights gained from specific details to develop an understanding of the text as a whole.
LA.11-12.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
LA.11-12.RH.11-12.2	Determine the theme, central ideas, information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary of how key events, ideas and/or author's perspective(s) develop over the course of the text.
LA.11-12.RH.11-12.3	Evaluate various perspectives for actions or events; determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain. Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take it into account.
LA.11-12.WHST.11-12.1	Write arguments focused on discipline-specific content. Functions may be used to describe data; if the data suggest a linear relationship, the relationship can be modeled with a regression line, and its strength and direction can be expressed through a correlation coefficient.
MA.9-12.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.

Alignment to 21st Century Skills & Technology

Key SUBJECTS AND 21st CENTURY THEMES

- English, reading and language arts
- Mathematics
- Science
- Computer Science
- Economics and Government

21st Century/Interdisciplinary Themes

- Civic Literacy
- Environmental Literacy

- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

21st Century Skills

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks—personal and organizational—of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for

their communication and prepare accordingly to ensure the desired outcome.

CRP.K-12.CRP12.1

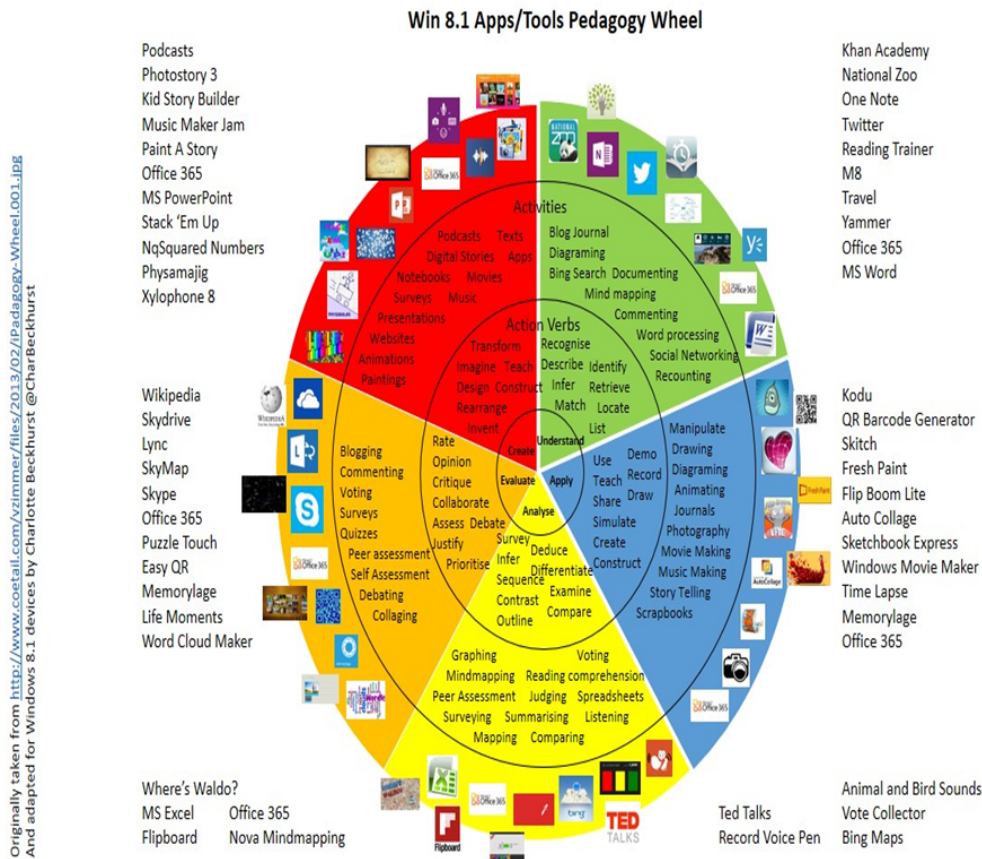
Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

CRP.K-12.CRP6.1

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

Technology Infusion

What technology can be used in this unit to enhance learning?



Differentiation

As a Reminder:

The basis of good differentiation in a lesson lies in differentiating by content, process, and/or product.

Resources:

- NJDOE: Instructional Supports and Scaffolds for Success in Implementing the Common Core State Standards <http://www.state.nj.us/education/modelcurriculum/success/math/k2/>

Special Education

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

Intervention Strategies

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Evidence of Student Learning-CFU's

Please list ways educators may effectively check for understanding in this section.

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

Primary Resources

Please list all resources available to you that are located either within the district or that can be obtained by district resources.

Ancillary Resources

1. Teacher and Publisher supplied powerpoints, notes, laboratory guides, and worksheets
2. Textbooks
3. Resource Manuals
4. Internet Resources
5. Computer and smartboard Activities

Sample Lesson
