Unit 4: Electric Charge and Electric Field/Electric Potential/Electric Current/DC Circuits/Magnetism (Physical Science, Engineering Design)

Content Area: **Sample Content Area**
Course(s): **Intro to Engineering**
Time Period:
Length: **25 Days**
Status: **Published**

Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Intro to Engineering, Unit 4

Electric Charge and Electric Field/Electric Potential/Electric Current/ DC Circuits

Belleville Board of Education

102 Passaic Avenue

Belleville, NJ 07109

Prepared by: Recep Balki

Dr. Richard Tomko, Ph.D., M.J., Superintendent of Schools

Ms. LucyAnn Demikoff, Director of Curriculum and Instruction K-12

Ms. Nicole Shanklin, Director of Elementary Education K-8, ESL Coordinator K-12

Mr. George Droste, Director of Secondary Education

Board Approved: September 23, 2019

Unit Overview

In this unit, students will investigate the electromagnetic nature of matter and energy and how everyday processes are affected by these properties. Students will be able to describe and explain the electrical properties of materials and how electric forces and fields are manipulated. Students will be able to apply Coulomb's Law to analyze the motion of charge and charged particles. Students will be able to describe, design, build, and analyze electric circuitry and will be able to explain how static electricity is used in everyday life to provide electrical power. Methods of power usage and generation will be investigated, and students will discuss and research the advantages and disadvantages of various methods of generating electrical power.

Enduring Understanding

Students will relate to their world in a more detailed and scientific manner.
Students will identify how their new understandings can be applied to real-world phenomena

Enduring understandings:

- Summarize important ideas and core processes that are central to a discipline and have lasting value beyond the classroom;
- Synthesize what students should understand - not just know or do - as a result of studying a particular content area;
- Frame the Big Ideas that give meaning and lasting importance to such discrete curriculum elements as facts and skills;
- Transfer to other fields and adult life;
- "Unpack" areas of the curriculum where students may struggle to gain understanding or where they demonstrate misunderstandings and misconceptions;
- Provide a conceptual foundation for studying the content area;
- Articulate what students should "revisit" over the course of their lifetimes in relationship to the content area;
- Are framed as declarative sentences that present major curriculum generalizatios and recurent ideas.

Examples:

- **Enduring Understanding**: Reading is a process by which we construct meaning about the information being communicated by an author within a print or non-print medium.

- **Essential Question**: How is reading a process for constructing meaning from text?

Essential Questions

What are the ways that electromagnetism affect our daily world?
How do physicists describe electromagnetic processes?Can students identify the flow of electricity from a circuit diagram?
Can students calculate electrical force using Coulomb's Law?
will students be able to identify different types of currents?
How is the electric force similar to the force of gravity? How is it different?

In what ways can static charge build up?
What is the meaning of electrical potential energy?
What is electrical potential?
In what ways is energy conserved?
Why do different materials exhibit different electrical properties, and how can these properties be utilized for specific purpose?

Essential Questions are:

- Questions that lie at the heart of a subject or a curriculum;
- Questions that promotes inquiry and the discovery of a subject.

Essential Questions:

- Help students discover patterns in knowledge and solve problems;
- Support inductive teaching?guiding students to discover meaning, which increases motivation to learn;
- Are one of the most powerful tools for helping students think at more complex levels;
- Engage the personal intellect?something that traditional objectives usually fail to do;
- Have no obvious ?right? answer;
- Raise other important questions, across the curriculum in other content areas;
- Address a concept;
- Recur naturally and appropriately;
- Stimulate critical thinking, ongoing reflection and re-thinking;
- Are framed to provoke and sustain student interest.

What makes a Question "Essential"?

- Continues throughout all our lives
- Refers to core ideas and inquiries within a discipline
- Helps students effectively ask questions and make sense of important and complex ideas, knowledge, and know-how
- Engages a specific and diverse set of learners

Two Types of Essential Questions are:

<u>Overaching ones:</u>

- Include the "Big Idea"
- Are broader & generalized;
- Point beyond specific topics or skills;
- Promote the transfer of understanding.

<u>Topical ones:</u>

- Are specific to the unit or lesson specific;
- Guides individual units or lessons;
- Promotes inquiry;
- Resists obvious answers;

- Requires explanation and justification.

Examples:

- What is a true friend?
- What makes an artist amazing?
- In what sense is the body a system?
- What is the law of nature, and how is it like or unlike social laws?
- To what extent is U.S. history a history of progress?
- In what ways do diet and exercise affect health?
- Must heroes be flawless?
- How do effective writers hook and hold their readers?
- How do cultures affect one another?
- Does practice make perfect?
- What is healthy eating?
- What is healthy living?
- How and when do we use mathematics?
- How does something acquire value?

Exit Skills

Students will:

1. Demonstrate that charged objects exert forces both attractive and repulsive.
2. Recognize that charging is the separation, not the creation, of electric charges.
3. Describe the differences between conductors and insulators.
4. Summarize the relationships between electric forces, charges, and distance.
5. Explain how to charge objects by conduction and induction.
6. Develop a model of how charged objects can attract a neutral object.
7. Apply coulomb's law to problems in one and two dimensions.
8. Define electric field.
9. Solve problems relating to charge, electric fields, and forces.
10. Diagram electric field lines.
11. Define electric potential differences.
12. Calculate potential difference from the work required to move a charge.
13. Describe how charges are distributed on solid and hollow conductors.
14. Solve problems pertaining to capacitance.
15. Describe conditions that create current in an electric circuit.
16. Explain Ohm's law.
17. Design closed circuits.
18. Differentiate between power and energy in an electric circuit.

19. Explain how electric energy is converted into thermal energy.
20. Explore ways to deliver electric energy to consumers near and far.
21. Define kilowatt-hour.
22. Describe series and parallel circuits.
23. Calculate currents, voltage drops, and equivalent resistances in series and parallel circuits.
24. Explain how fuses, circuit breakers, and ground-fault interrupters protect household wiring.
25. Analyze and solve problems involving combined series-parallel circuits.
26. Explain how voltmeters and ammeters are used in circuits.
27. Describe the properties of magnets and the origins of magnetism in materials.
28. Compare and contrast various magnetic fields.
29. Relate magnetic induction to the direction of the force on a current-carrying wire in a magnetic field.
30. Solve problems involving magnetic field strength and the forces on current-carrying wires, and on moving, charged particles in magnetic fields.
31. Describe the design and operation of an electric motor.
32. Explain how changing magnetic field produces an electric current.
33. Define electromotive force.
34. Describe how electromagnetic waves propagate through space.

What are the **Exit Skills** that the students should have acquired by the end of this Unit?

Examples:

By the end of Grade 1, ELA Unit 1, the student should be able to:

- Print his/her full name
- Identify/print capital letters
- Identify/print lowercase letters

New Jersey Student Learning Standards (NJSLS-S)

NextGen Science Standards

HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
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.
HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object sliding down a ramp, or a moving object being pulled by a constant force.
HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
HS-PS2-5	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
9-12.HS-ETS1-1.1.1	Analyze complex real-world problems by specifying criteria and constraints for successful solutions.
9-12.HS-ETS1-4.4.1	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows— within and between systems at different scales.
9-12.HS-ETS1-4.5.1	Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems.
9-12.HS-ETS1-3.6.1	Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
9-12.HS-ETS1-1.ETS1.A.1	Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
9-12.HS-ETS1-1.ETS1.A.2	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.
9-12.HS-ETS1-3.ETS1.B.1	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.
9-12.HS-ETS1-4.ETS1.B.1	Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a

	given design will meet his or her needs.
9-12.HS-PS2-4.1.1	students observe patterns in systems at different scales and cite patterns as empirical evidence for causality in supporting their explanations of phenomena. They recognize classifications or explanations used at one scale may not be useful or need revision using a different scale; thus requiring improved investigations and experiments. They use mathematical representations to identify certain patterns and analyze patterns of performance in order to reengineer and improve a designed system.
9-12.HS-PS2-5.2.1	students understand that empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.
9-12.HS-PS2-3.2.1	Systems can be designed to cause a desired effect.
9-12.HS-PS2-1.2.1	students understand that empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.
9-12.HS-PS2-5.3.1	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
9-12.HS-PS2-2.4.1	When investigating or describing a system, the boundaries and initial conditions of the system need to be defined.
9-12.HS-PS2-1.4.1	Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
9-12.HS-PS2-4.5.1	Use mathematical representations of phenomena to describe explanations.
9-12.HS-PS2-2.5.1	Use mathematical representations of phenomena to describe explanations.
9-12.HS-PS2-3.6.1	Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.
9-12.HS-PS2-3.PS2.A.1	If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system.
9-12.HS-PS2-2.PS2.A.1	Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object.
9-12.HS-PS2-1.PS2.A.1	Newton’s second law accurately predicts changes in the motion of macroscopic objects.
9-12.HS-PS2-2.PS2.A.2	If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system.
9-12.HS-PS2-5.PS2.B.1	Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields.
9-12.HS-PS2-4.PS2.B.1	Newton’s law of universal gravitation and Coulomb’s law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects.
9-12.HS-PS2-1.PS2.B.1	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.
9-12.HS-PS2-3.PS2.B.1	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.
9-12.HS-PS2-4.PS2.B.2	Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields.
9-12.HS-PS2-5.PS3.A.1	“Electrical energy” may mean energy stored in a battery or energy transmitted by electric currents.
9-12.HS-PS2-3.ETS1.A.1	Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
9-12.HS-PS2-3.ETS1.C.1	Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.

Interdisciplinary Connections

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list all and any additional **Interdisciplinary Connections/Cross-Curricular** New Jersey Student Learning Standards that link to this unit, and which are not included in the NJSLS section above.

LA.RH.11-12.4	Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.RH.11-12.6	Evaluate authors’ differing perspectives on the same historical event or issue by assessing the authors’ claims, reasoning, and evidence.
LA.RH.11-12.9	Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.
LA.RH.11-12.10	By the end of grade 12, read and comprehend history/social studies texts in the grades 11-CCR text complexity band independently and proficiently.
LA.WHST.11-12.2.A	Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
LA.WHST.11-12.2.B	Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.
LA.WHST.11-12.2.D	Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

LA.WHST.11-12.2.E	Provide a concluding paragraph or section that supports the argument presented.
LA.WHST.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.WHST.11-12.6	Use technology, including the Internet, to produce, share, and update writing products in response to ongoing feedback, including new arguments or information.

Learning Objectives

Students will be able to...

Demonstrate that charged objects exert forces both attractive and repulsive.
Recognize that charging is the separation, not the creation, of electric charges.
Describe the differences between conductors and insulators.
Summarize the relationships between electric forces, charges, and distance.
Explain how to charge objects by conduction and induction.
Develop a model of how charged objects can attract a neutral object.
Apply Coulomb's law to problems in one dimension.
Define electric field.
Solve problems relating to charge, electric fields, and forces.
Diagram electric field lines.
Define electric potential differences.
Calculate potential difference from the work required to move a charge.
Describe how charges are distributed on solid and hollow conductors.
Solve problems pertaining to capacitance.
Describe conditions that create current in an electric circuit.
Explain Ohm's law.
Design closed circuits.
Differentiate between power and energy in an electric circuit.
Define kilowatt-hour.
Describe series and parallel circuits.
Calculate currents, voltage drops, and equivalent resistances in series and parallel circuits.
Explain how fuses and circuit breakers protect household wiring.
Analyze and solve problems involving combined series-parallel circuits.
Explain how voltmeters and ammeters are used in circuits.
Describe the properties of magnets and the origins of magnetism in materials.
Compare and contrast various magnetic fields.
Relate magnetic induction to the direction of the force on a current-carrying wire in a magnetic field.
Solve problems involving magnetic field strength and the forces on current-carrying wires, and on moving, charged particles in magnetic fields.
Describe the design and operation of an electric motor.
Explain how changing magnetic field produces an electric current.
Define electromotive force.
Describe how electromagnetic waves propagate through space.

Effective Learning Objectives Used in Lesson Planning:

- Begin with an action verb from one or more of Bloom's Taxonomy castegories listed below;
- Are measurable and/or observable, using action verbs, such as "differentiate," "classify," "justify;"
- Are not vague or passive verbs, such as "understand," "remember;"
- Increase the use of of verbs from Bloom's Taxonomy's higher order thinking categories, including **Analyze** and **Evaluate**

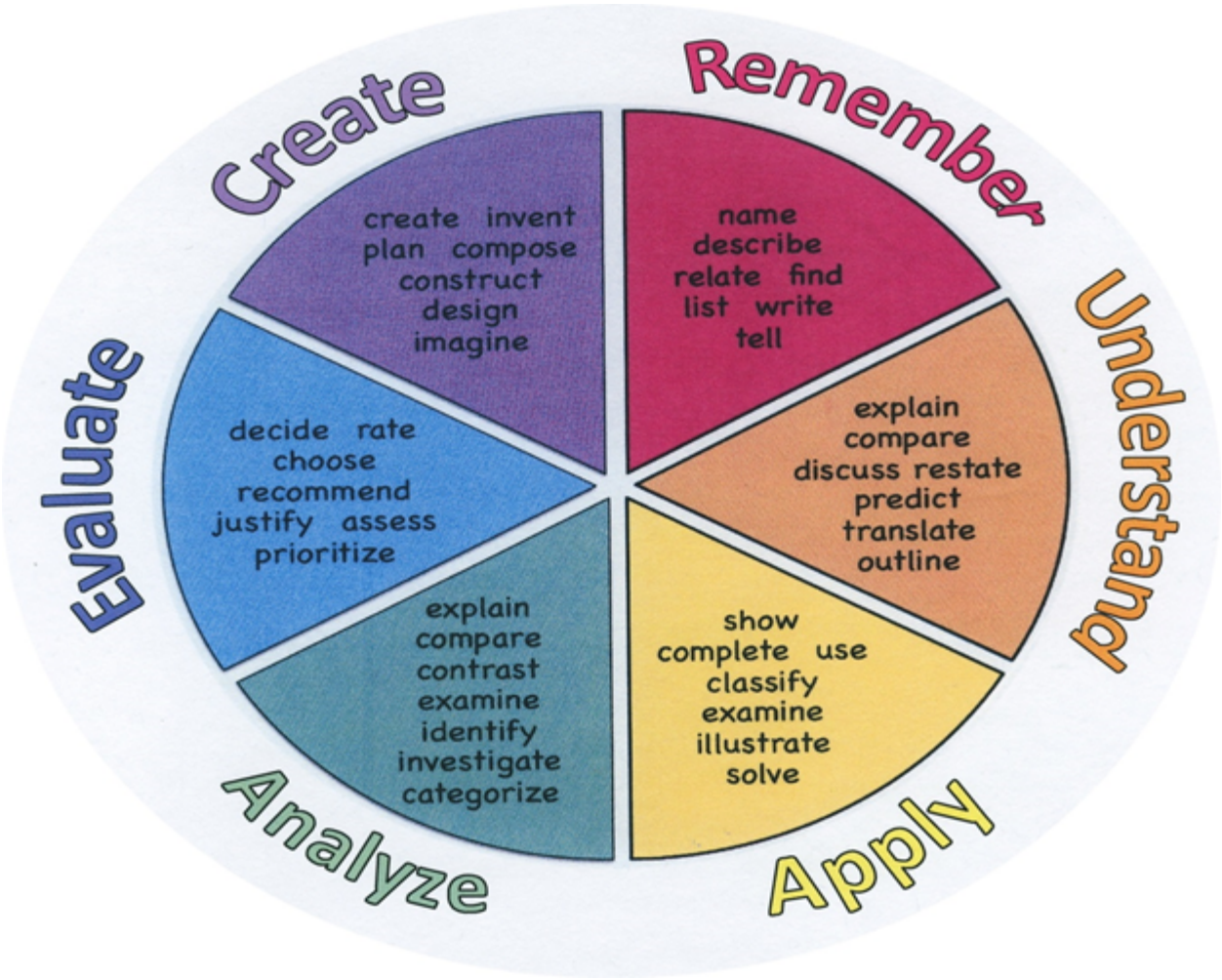
- Construct authentic learning activities and assessments that are derived from the Bloom's Taxonomy category - **Create**
- Minimize the use of lower order thinking categories - Remember and Understand.

Examples:

- **Identify** nutrients found in common food sources using the product's nutrition label;
- Use computer dietary analysis to assess a 2-day dietary intake and **categorize** the results;
- **Research** nutrition-related information on the internet and **evaluate** the reliability of the information.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

- What situations in ordinary life could help to master this unit?

Build your own battery (Galvanic Cell)

Build your own battery (Potato Cell)

Using Van de Graaff generator to produce static charges

Using Van de Graaff generator to transmit static charges

Using Van de Graaff generator to identify conductors and insulators

Using Van de Graaff generator to mesure the amount of static charges

Test the effect of length of a conductor on resistance

Build the designed circuits (Using electricity kit)

Test the effect of length of a conductor on resistance

Compare the properties of resistors in series and parallel

Build your own electric motor

Virtual Lab on electric circuits (https://phet.colorado.edu/)

Separate mixtures using magnetic properties (sand, iron fillings, aluminium fillings)

Build your own electromagnet

Guidelines for Suggested Activities:

- Includes activities **appropriate & specific** to the development of the Unit;
- Is comprised of the variety of learning activities that will be referenced in lesson plans, constructed/developed and instructionally delivered in the classroom;
- Are authentic;
- Recognizes the learning styles of the students;
- Integrates problem- or project-based learning.

Assessment Evidence - Checking for Understanding (CFU)

Student must be able to graph fundamental quantities; coulomb force against distance (Formative)

Student must be able to graph fundamental quantities; coulomb force against charge (Formative)

Student must be able to graph fundamental quantities; electric field against distance (Formative)

Student must be able to graph fundamental quantities; electric field against charge (Formative)

Student must be able to graph fundamental quantities; electric potential against distance (Formative)

Student must be able to graph fundamental quantities; electric potential against charge (Formative)

Student must be able to graph fundamental quantities; length of conductor against resistance of conductor (Formative)

Student must be able to graph fundamental quantities; cross sectional area of conductor against resistance of conductor (Formative)

Student must be able to calculate equivalent resistor when resistors are connected in parallel (Formative)

Student must be able to calculate equivalent resistor when resistors are connected in series (Formative)

Student must be able to calculate equivalent resistor when resistors are connected in series and parallel (Formative)

Common, Department Quarterly Benchmarks (Benchmark)

Oncourse Assessment Tools (Formative)

Unit Test/Quiz (Summative)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline

- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Textbook: Conceptual Physics, Hewitt

Internet

Please list all district-provided Primary Resources & Materials and/or those outside that are accessed with district resources.

Ancillary Resources

Teacher Prepared Materials
Lab Materials
Study Guide Materials
United Streaming Videos
The Physics Classroom: www.thephysicsclassroom.com
STEM Lab

Please list all additional resources that will be used to strengthen this unit's lessons.

Technology Infusion

Students must be able to use Van de graph generator to produce static electricity

Students must be able to use Van de graph generator to produce identify conductors and insulators

Students must be able to use Van de graph generator to produce and transmit static electric charges

Students must be able to use voltmeter to measure the potential difference

Students must be able to use ammeter to measure the electric current

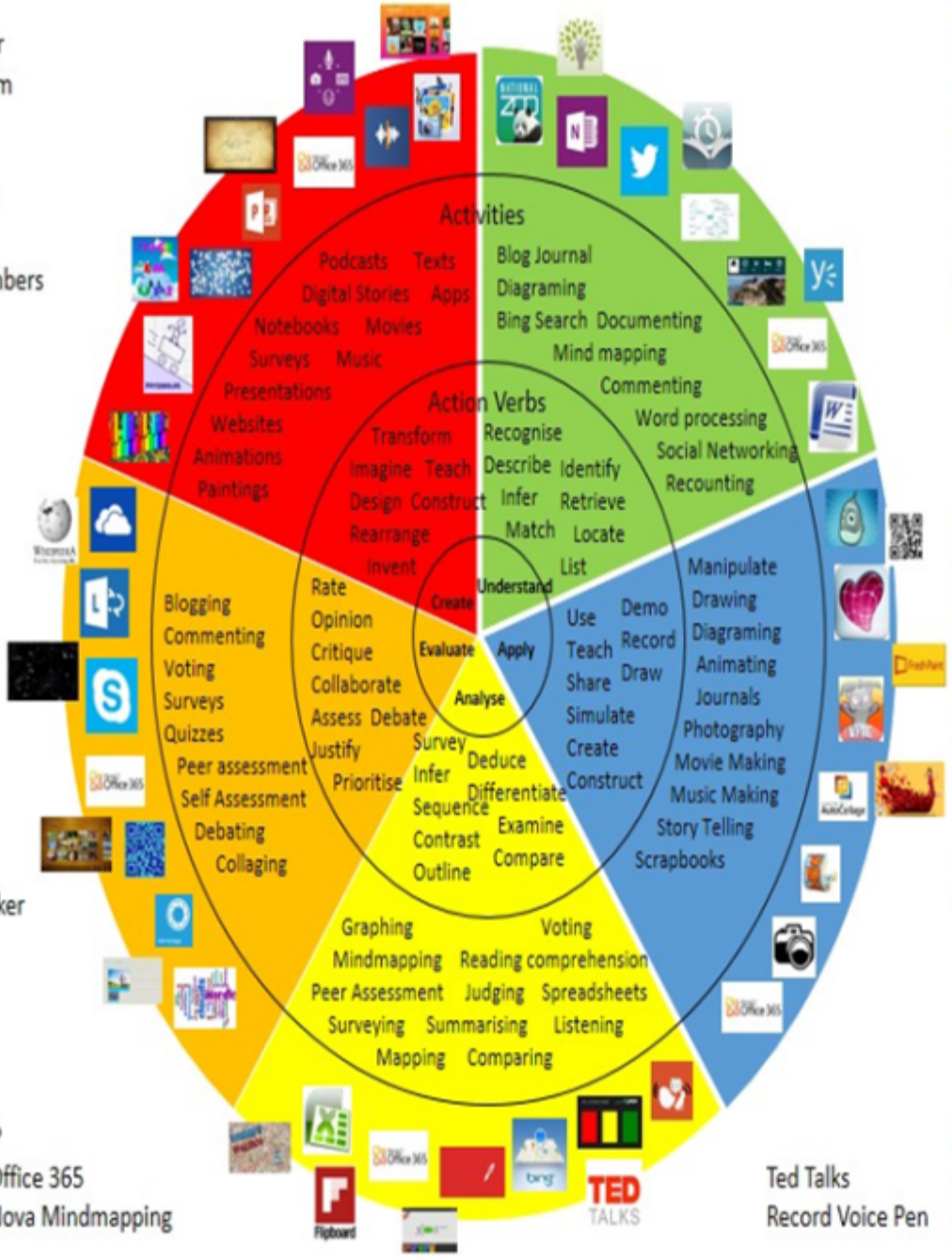
Students must be able to use multimeter to measure the resistance of a circuit

What **Technology Infusion** and/or strategies are integrated into this unit to enhance learning? Please list all hardware, software and strategies. Please find a technology pedagogy wheel for assistance while completing this section.

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.1.12.C.CS3	Develop cultural understanding and global awareness by engaging with learners of other cultures.
TECH.8.1.12.D.1	Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
TECH.8.1.12.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.

Alignment to 21st Century Skills & Technology

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP3.1	Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.
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.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the

	knowledge, skills, abilities, and resources required for owning and managing a business.
CAEP.9.2.12.C.8	Assess the impact of litigation and court decisions on employment laws and practices.
TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
TECH.8.1.12.D.CS3	Exhibit leadership for digital citizenship.

21st Century Skills/Interdisciplinary Themes

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century/Interdisciplinary Themes** that will be incorporated into this unit.

- 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

21st Century Skills

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century Skills** that will be incorporated into this unit.

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

Differentiation

Please remember: Effective educational **Differentiation** in a lesson lies within content, process, and/or product.

Please identify the ones that will be employed in this unit.

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas

- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Please identify the **Special Education Learning** adaptations that will be employed in the unit, using the ones identified below.

- Students must be able to draw a differentiate between conductors and insulators.

- Students must be able to draw a build electric circuit by using electric kit.

- 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
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- 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

English Language Learning (ELL)

Please identify the **English Language Learning** adaptations that will be employed in the unit, using the ones identified below.

- Students are provided with glossary in their native language.
- Spanish speaking students may utilize Spanish Edition of a Textbook

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- 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 workpresented 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

At Risk

Please identify Intervention Strategies that will be employed in the unit, using the ones identified below.

- Student provided access to virtual labs, presentations, videos, and practice questions.

- 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 workpresented 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

Talented and Gifted Learning (T&G)

Please identify the **Talented and Gifted** adaptations that will be employed in the unit, using the ones identified below.

- Students must be able to calculate the electric field produced by multiple charges.

- Above grade level placement option for qualified students
- Advanced problem-solving

- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Using the template below, please develop a **Sample Lesson** for the first unit only.

Unit Name:

NJSLS:

Interdisciplinary Connection:

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology: