



Nutley Public Schools

Practical Electricity

Grades: 9-12

Unit I: Introduction to Electricity	
Summary and Rationale	
Students will be introduced to how electricity is an integral part of their daily lives. Students will be able to understand how various materials are either conductive or non-conductive materials, and how the use of them will allow electricity to flow through a circuit. The student will be utilize algebraic formulas and become familiarized with critical scientific principles of chemistry and physics including parts of an atom, periodic table, attraction and repulsion of charged particles, Kirchoff's, Newton's, and Ohm's Laws. Students will also do many calculations and will be able to construct and re-create circuits of varying complexity using a multitude of hands on labs.	
Recommended Pacing	
30 Days	
Standards	
Career and Technical Education 9.3	
9.3.12.AC.3	Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
9.3.12.AC.5	Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-CST.2	Describe the approval procedures required for successful completion of a construction project.
9.3.12.AC-CST.3	Implement testing and inspection procedures to ensure successful completion of a construction project.
9.3.12.AC-CST.4	Apply scheduling practices to ensure the successful completion of a construction project.
9.3.12.AC-CST.5	Apply practices and procedures required to maintain jobsite safety.
9.3.12.AC-CST.8	Demonstrate the construction crafts required for each phase of a construction project.



Nutley Public Schools

9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
9.3.12.AC-DES.2	Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
9.3.12.AC-DES.8	Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.
9.3.12.AC-MO.1	Recognize and employ universal construction signs and symbols to function safely in the workplace.
9.3.MN-HSE.4	Evaluate a system of health, safety and/or environmental programs, projects, policies or procedures to determine compliance.
9.3.MN-LOG.2	Demonstrate proper handling of products and materials in a manufacturing facility.
9.3.MN-MIR.5	Implement a preventative maintenance schedule to maintain manufacturing equipment, tools and workstations.
9.3.MN-PPD.1	Produce quality products that meet manufacturing standards and exceed customer satisfaction.
9.3.MN-PPD.5	Develop procedures to create products that meet customer needs.
9.3.MN-PRO.4	Coordinate work teams when producing products to enhance production process and performance.
9.3.MN-QA.1	Evaluate production operations for product and process quality.
<u>Career Ready Practices</u>	
CRP1.	Act as a responsible and contributing citizen and employee.
CRP2.	Apply appropriate academic and technical skills.
CRP4.	Communicate clearly and effectively and with reason.
CRP5.	Consider the environmental, social and economic impacts of decisions.
CRP6.	Demonstrate creativity and innovation.
CRP7.	Employ valid and reliable research strategies.
CRP8.	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP10.	Plan education and career paths aligned to personal goals.
CRP11.	Use technology to enhance productivity.
CRP12.	Work productively in teams while using cultural global competence.
<u>Interdisciplinary Connections</u>	
Standard x.x	



Nutley Public Schools

5.2.2.A.2	Matter exists in several different states; the most commonly encountered are solids, liquids, and gases. Liquids take the shape of the part of the container they occupy. Solids retain their shape regardless of the container they occupy.
5.2.4.A.1	Some objects are composed of a single substance; others are composed of more than one substance
5.2.4.A.4	Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity.
5.2.8.A.1	All matter is made of atoms. Matter made of only one type of atom is called an element.
5.2.8.A.2	All substances are composed of one or more of approximately 100 elements
5.2.8.A.4	The Periodic Table organizes the elements into families of elements with similar properties.
5.2.8.A.6	Substances are classified according to their physical and chemical properties. Metals are a class of elements that exhibit physical properties, such as conductivity, and chemical properties, such as producing salts when combined with nonmetals.
5.2.12.A.1	Electrons, protons, and neutrons are parts of the atom and have measurable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.
5.2.12.A.3	In the Periodic Table, elements are arranged according to the number of protons (the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements.
5.2.4.C.1	Heat (thermal energy), electricity, light, and sound are forms of energy
5.2.4.C.2	Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows through wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy.
5.2.4.C.3	Energy can be transferred from one place to another. Heat energy is transferred from warmer things to colder things.
5.2.4.D.1	Electrical circuits require a complete loop through conducting materials in which an electrical current can pass.
5.2.6.D.1	The flow of current in an electric circuit depends upon the components of the circuit and their arrangement, such as in series or parallel. Electricity flowing through an electrical circuit produces magnetic effects in the wires.
5.2.8.D.1	When energy is transferred from one system to another, the quantity of energy before transfer equals the quantity of energy after transfer. As an object falls, its potential energy decreases as its speed, and consequently its kinetic energy, increases. While an object is



Nutley Public Schools

	falling, some of the object’s kinetic energy is transferred to the medium through which it falls, setting the medium into motion and heating it.
Integration of Technology	
Standard x.x	
CPI #	Cumulative Progress Indicator (CPI)
Instructional Focus	
Enduring Understandings	
<ul style="list-style-type: none"> ● Energy is transformed from one form to another during changes in matter. The amount of energy before a transformation is equal to the amount of energy after the transformation. ● Electricity is a form of energy that can be transformed by moving electric charges doing work in various devices ● The concept of the relationship of Voltage, Current and Resistance have ties to everything based in electricity, fluids, and even traffic. ● Effective strategies help us adjust to new technologies and the changing interactions among science, technology, and society. ● Quality workmanship and systematic problem solving are essential components of technology. ● What we learn through the study of technology can be applied to other disciplines. 	
Essential Questions	
<ul style="list-style-type: none"> ● What is energy? ● How can electrical energy be transformed? ● What impact does electricity have on our world? ● How does an electric circuit work? ● How do you know something has energy? In what ways do we witness the effects of something having energy? ● How do basic scientific and math principles and quality workmanship determine the effectiveness of an electronic device? ● Why are Christmas lights wired in series but house lights wired in parallel? What is the significance of the “no more than 3 strands” warning? ● What is the effect of electrical shock on the human body? 	
Evidence of Learning (Assessments)	
Successful completion of: <ul style="list-style-type: none"> ● Symbols/Components Quiz ● Series Circuit Quiz ● Series Circuit Calculations Quiz ● Parallel Circuits Calculations Quiz ● Switches Logic Quiz ● Series-Parallel Quiz ● Capstone project SES Trainer 	
Objectives	
Students will know: <ul style="list-style-type: none"> ● basic electron theory ● types of circuits 	



Nutley Public Schools

- components of a circuit
- unit conversion
- Ohm's Law
- Kirchoff's Law

Students will be able to:

- identify parts of an atom
- identify charges of atomic particles
- utilize a number line to convert Base units to Mega, Kilo, Milli units
- explain the relationship between current, voltage, resistance and power
- explain the difference between series, parallel, and series-parallel circuits
- identify and explain the components of a circuit (switches, power supplies, lamps, etc.)
- construct series circuits
- construct parallel circuits
- construct series-parallel circuits

Integration

Technology Integration

Writing Integration

Competencies

Suggested Resources

Practical Electricity Unit 2

Grades: 9-12

Unit II: Logic and Breadboards

Summary and Rationale

In electronics, a logic gate is an idealized or physical device implementing a Boolean function; that is, it performs a logical operation on one or more logical inputs, and produces a single logical output. Boolean operations can be found not only in electronics and electricity but also in our everyday lives including pneumatic and hydraulic technologies. By introducing students to logic gates, they can further understand smaller scale electronics projects including: circuit boards, relays/electronic switches, microprocessors, and more complex technology.

Breadboards are a medium for making semi-permanent attachments of components to one another to prototype a circuit before committing to the use of more permanent bonding mechanisms such



Nutley Public Schools

<p>as solder. By learning how to use this particular device, students will have another way of building circuits with a cleaner, more professional looking presentation while having the versatility of troubleshooting and fixing with increased speed as there will be no permanent bonds to destroy.</p>	
<p>Recommended Pacing</p>	
<p>35 Days</p>	
<p>Standards</p>	
<p>Career and Technical Education 9.3</p>	
9.3.12.AC.3	Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
9.3.12.AC.5	Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-CST.2	Describe the approval procedures required for successful completion of a construction project.
9.3.12.AC-CST.3	Implement testing and inspection procedures to ensure successful completion of a construction project.
9.3.12.AC-CST.4	Apply scheduling practices to ensure the successful completion of a construction project.
9.3.12.AC-CST.5	Apply practices and procedures required to maintain jobsite safety.
9.3.12.AC-CST.8	Demonstrate the construction crafts required for each phase of a construction project.
9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
9.3.12.AC-DES.2	Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
9.3.12.AC-DES.8	Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.
9.3.12.AC-MO.1	Recognize and employ universal construction signs and symbols to function safely in the workplace.
9.3.MN-HSE.4	Evaluate a system of health, safety and/or environmental programs, projects, policies or procedures to determine compliance.
9.3.MN-LOG.2	Demonstrate proper handling of products and materials in a manufacturing facility.



Nutley Public Schools

9.3.MN-MIR.5	Implement a preventative maintenance schedule to maintain manufacturing equipment, tools and workstations.
9.3.MN-PPD.1	Produce quality products that meet manufacturing standards and exceed customer satisfaction.
9.3.MN-PPD.5	Develop procedures to create products that meet customer needs.
9.3.MN-PRO.4	Coordinate work teams when producing products to enhance production process and performance.
9.3.MN-QA.1	Evaluate production operations for product and process quality.
<u>Career Ready Practices</u>	
CRP1.	Act as a responsible and contributing citizen and employee.
CRP2.	Apply appropriate academic and technical skills.
CRP4.	Communicate clearly and effectively and with reason.
CRP5.	Consider the environmental, social and economic impacts of decisions.
CRP6.	Demonstrate creativity and innovation.
CRP7.	Employ valid and reliable research strategies.
CRP8.	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP10.	Plan education and career paths aligned to personal goals.
CRP11.	Use technology to enhance productivity.
CRP12.	Work productively in teams while using cultural global competence.
Interdisciplinary Connections	
Standard x.x	
5.2.2.A.2	Matter exists in several different states; the most commonly encountered are solids, liquids, and gases. Liquids take the shape of the part of the container they occupy. Solids retain their shape regardless of the container they occupy.
5.2.4.A.1	Some objects are composed of a single substance; others are composed of more than one substance
5.2.4.A.4	Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity.
5.2.8.A.1	All matter is made of atoms. Matter made of only one type of atom is called an element.
5.2.8.A.2	All substances are composed of one or more of approximately 100 elements
5.2.8.A.4	The Periodic Table organizes the elements into families of elements with similar properties.
5.2.8.A.6	Substances are classified according to their physical and chemical properties. Metals are a class of elements that exhibit physical properties, such as conductivity, and chemical properties, such as producing salts when combined with nonmetals.
5.2.12.A.1	Electrons, protons, and neutrons are parts of the atom and have measurable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are



Nutley Public Schools

	composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.
5.2.12.A.3	In the Periodic Table, elements are arranged according to the number of protons (the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements.
5.2.4.C.1	Heat (thermal energy), electricity, light, and sound are forms of energy
5.2.4.C.2	Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows through wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy.
5.2.4.C.3	Energy can be transferred from one place to another. Heat energy is transferred from warmer things to colder things.
5.2.4.D.1	Electrical circuits require a complete loop through conducting materials in which an electrical current can pass.
5.2.6.D.1	The flow of current in an electric circuit depends upon the components of the circuit and their arrangement, such as in series or parallel. Electricity flowing through an electrical circuit produces magnetic effects in the wires.
5.2.8.D.1	When energy is transferred from one system to another, the quantity of energy before transfer equals the quantity of energy after transfer. As an object falls, its potential energy decreases as its speed, and consequently its kinetic energy, increases. While an object is falling, some of the object's kinetic energy is transferred to the medium through which it falls, setting the medium into motion and heating it.
Integration of Technology	
Standard x.x	
CPI #	Cumulative Progress Indicator (CPI)
Instructional Focus	
Enduring Understandings	
<ul style="list-style-type: none"> • Effective strategies help us adjust to new technologies and the changing interactions among science, technology, and society • Quality workmanship and systematic problem solving are essential components of technology. • As complexity of circuitry increases, the need for relays and gates are used to limit the need of a physical switch. 	
Essential Questions	
<ul style="list-style-type: none"> • What are logic gates? • Where do we use logic gates on a daily basis? • Where have we seen the use of logic gates? • Why do we use breadboards instead of loose wires and components? 	



Nutley Public Schools

- How does a breadboard work? What parts are connected together? Why is this arrangement important?
- What basic programming/electronic circuit concepts are needed to design/build a working circuit?

Evidence of Learning (Assessments)

Successful completion of:

- Symbols and Logic Quiz
- Switches Logic Quiz
- Capstone project (SES Trainer, Breadboard trainer)

Objectives

Students will know:

- forms of logic gates
 - simple
 - not
 - and
 - or
 - nand
 - nor
 - X-or/Or selective
- how to problem solve or troubleshoot word problems
- how to utilize a breadboards

Students will be able to:

- identify the 7 forms of logic gates (Simple, Not, And, Or, Nand, Nor, and Or-Selective)
- explain the uses of the various logic gates
- design and construct circuits
- explain what a breadboard is and how it is used
- explain the anatomy of a breadboard
- construct circuits using a breadboard

Integration

Technology Integration

Writing Integration

Competencies

Suggested Resources



Nutley Public Schools

Practical Electricity Unit 3

Grades: 9-12

Unit III: Soldering	
Summary and Rationale	
<p>Soldering is the use of a low temperature melting metal to permanently bond two or more wire leads together. Soldering is the next step in the progression for fine, small scale electronics and robotics projects because it allows for the use of designed printed circuit boards (PCBs) that can be permanently installed in an enclosure for a project that may be exposed to external physical disturbances where a breadboard may be insufficient to hold the components in place. It is reinforcing the idea of going from idea, to schematic drawing, to proof of concept, and culminating with a high quality final product.</p>	
Recommended Pacing	
25 Days	
Standards	
Career and Technical Education 9.3	
9.3.12.AC.3	Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
9.3.12.AC.5	Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-CST.2	Describe the approval procedures required for successful completion of a construction project.
9.3.12.AC-CST.3	Implement testing and inspection procedures to ensure successful completion of a construction project.
9.3.12.AC-CST.4	Apply scheduling practices to ensure the successful completion of a construction project.
9.3.12.AC-CST.5	Apply practices and procedures required to maintain jobsite safety.



Nutley Public Schools

9.3.12.AC-CST.8	Demonstrate the construction crafts required for each phase of a construction project.
9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
9.3.12.AC-DES.2	Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
9.3.12.AC-DES.8	Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.
9.3.12.AC-MO.1	Recognize and employ universal construction signs and symbols to function safely in the workplace.
9.3.MN-HSE.4	Evaluate a system of health, safety and/or environmental programs, projects, policies or procedures to determine compliance.
9.3.MN-LOG.2	Demonstrate proper handling of products and materials in a manufacturing facility.
9.3.MN-MIR.5	Implement a preventative maintenance schedule to maintain manufacturing equipment, tools and workstations.
9.3.MN-PPD.1	Produce quality products that meet manufacturing standards and exceed customer satisfaction.
9.3.MN-PPD.5	Develop procedures to create products that meet customer needs.
9.3.MN-PRO.4	Coordinate work teams when producing products to enhance production process and performance.
9.3.MN-QA.1	Evaluate production operations for product and process quality.
<u>Career Ready Practices</u>	
CRP1.	Act as a responsible and contributing citizen and employee.
CRP2.	Apply appropriate academic and technical skills.
CRP4.	Communicate clearly and effectively and with reason.
CRP5.	Consider the environmental, social and economic impacts of decisions.
CRP6.	Demonstrate creativity and innovation.
CRP7.	Employ valid and reliable research strategies.
CRP8.	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP10.	Plan education and career paths aligned to personal goals.
CRP11.	Use technology to enhance productivity.
CRP12.	Work productively in teams while using cultural global competence.
<u>Interdisciplinary Connections</u>	
Standard x.x	
5.2.2.A.2	Matter exists in several different states; the most commonly encountered are solids, liquids, and gases. Liquids take the shape of the part of the container they occupy. Solids retain their shape regardless of the container they occupy.



Nutley Public Schools

5.2.4.A.1	Some objects are composed of a single substance; others are composed of more than one substance
5.2.4.A.4	Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity.
5.2.8.A.1	All matter is made of atoms. Matter made of only one type of atom is called an element.
5.2.8.A.2	All substances are composed of one or more of approximately 100 elements
5.2.8.A.4	The Periodic Table organizes the elements into families of elements with similar properties.
5.2.8.A.6	Substances are classified according to their physical and chemical properties. Metals are a class of elements that exhibit physical properties, such as conductivity, and chemical properties, such as producing salts when combined with nonmetals.
5.2.12.A.1	Electrons, protons, and neutrons are parts of the atom and have measurable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.
5.2.12.A.3	In the Periodic Table, elements are arranged according to the number of protons (the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements.
5.2.4.C.1	Heat (thermal energy), electricity, light, and sound are forms of energy
5.2.4.C.2	Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows through wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy.
5.2.4.C.3	Energy can be transferred from one place to another. Heat energy is transferred from warmer things to colder things.
5.2.4.D.1	Electrical circuits require a complete loop through conducting materials in which an electrical current can pass.
5.2.6.D.1	The flow of current in an electric circuit depends upon the components of the circuit and their arrangement, such as in series or parallel. Electricity flowing through an electrical circuit produces magnetic effects in the wires.
5.2.8.D.1	When energy is transferred from one system to another, the quantity of energy before transfer equals the quantity of energy after transfer. As an object falls, its potential energy decreases as its speed, and consequently its kinetic energy, increases. While an object is falling, some of the object's kinetic energy is transferred to the medium through which it falls, setting the medium into motion and heating it.



Nutley Public Schools

Integration of Technology	
Standard x.x	
CPI #	Cumulative Progress Indicator (CPI)
Instructional Focus	
Enduring Understandings	
<ul style="list-style-type: none"> ● High reliability is what ultimately defines success or failure in all fields of work. ● The influence of technological advances our society. ● Quality workmanship and systematic problem solving are essential components of technology. 	
Essential Questions	
<ul style="list-style-type: none"> ● How can the basic concepts of electricity and electrical circuits be applied to understand and construct both basic and complex electronic circuits? ● How has the introduction of soldering improved the field of electrical engineering? 	
Evidence of Learning (Assessments)	
Successful completion of: <ul style="list-style-type: none"> ● Soldering Safety Quizzes ● Capstone project (Soldering Kits) 	
Objectives	
Students will know: <ul style="list-style-type: none"> ● the anatomy of an iron ● what is solder ● what are the three states solder exists in -- solid, plastic, liquid ● what is the purpose for soldering ● how to solder Students will be able to: <ul style="list-style-type: none"> ● identify the parts of a soldering iron ● explain how a soldering iron works ● explain how the relationship of the parts of the iron affect the quality of a soldered joint ● inspect and identify good/poor solder joints (WPI - work piece indicators) ● explain the purpose and usage of flux ● explain Relative Thermal Mass ● explain Thermal Linkage ● utilize various soldering/desoldering tools -- helping hands, heat sinks, solder wicks, solder pumps (baster pump and spring loaded), ● desolder components ● solder components 	
Integration	
Technology Integration	
Writing Integration	
Competencies	
Suggested Resources	



Nutley Public Schools



Practical Electricity

Grades: 9-12

Unit 4: Principles of Home Wiring	
Summary and Rationale	
Basic wiring is easy to understand once you have a good overall look at the system that gets the power from the utility supply lines, through the transformer, and into your home to power our modern conveniences that we have become so accustomed to. The most basic wiring system found in the home is the circuits that feed the outlets such as receptacles, switches, and lights. When we have a grasp of the entire system, it makes all of the basic wiring principles within the home much less mysterious and intimidating.	
Recommended Pacing	
60 Days	
Standards	



Nutley Public Schools

<u>Career and Technical Education 9.3</u>	
9.3.12.AC.3	Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
9.3.12.AC.5	Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-CST.2	Describe the approval procedures required for successful completion of a construction project.
9.3.12.AC-CST.3	Implement testing and inspection procedures to ensure successful completion of a construction project.
9.3.12.AC-CST.4	Apply scheduling practices to ensure the successful completion of a construction project.
9.3.12.AC-CST.5	Apply practices and procedures required to maintain jobsite safety.
9.3.12.AC-CST.8	Demonstrate the construction crafts required for each phase of a construction project.
9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
9.3.12.AC-DES.2	Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
9.3.12.AC-DES.8	Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.
9.3.12.AC-MO.1	Recognize and employ universal construction signs and symbols to function safely in the workplace.
9.3.MN-HSE.4	Evaluate a system of health, safety and/or environmental programs, projects, policies or procedures to determine compliance.
9.3.MN-LOG.2	Demonstrate proper handling of products and materials in a manufacturing facility.
9.3.MN-MIR.5	Implement a preventative maintenance schedule to maintain manufacturing equipment, tools and workstations.
9.3.MN-PPD.1	Produce quality products that meet manufacturing standards and exceed customer satisfaction.
9.3.MN-PPD.5	Develop procedures to create products that meet customer needs.



Nutley Public Schools

9.3.MN-PRO.4	Coordinate work teams when producing products to enhance production process and performance.
9.3.MN-QA.1	Evaluate production operations for product and process quality.
<u>Career Ready Practices</u>	
CRP1.	Act as a responsible and contributing citizen and employee.
CRP2.	Apply appropriate academic and technical skills.
CRP4.	Communicate clearly and effectively and with reason.
CRP5.	Consider the environmental, social and economic impacts of decisions.
CRP6.	Demonstrate creativity and innovation.
CRP7.	Employ valid and reliable research strategies.
CRP8.	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP10.	Plan education and career paths aligned to personal goals.
CRP11.	Use technology to enhance productivity.
CRP12.	Work productively in teams while using cultural global competence.
<u>Interdisciplinary Connections</u>	
Standard x.x	
5.2.2.A.2	Matter exists in several different states; the most commonly encountered are solids, liquids, and gases. Liquids take the shape of the part of the container they occupy. Solids retain their shape regardless of the container they occupy.
5.2.4.A.1	Some objects are composed of a single substance; others are composed of more than one substance
5.2.4.A.4	Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity.
5.2.8.A.1	All matter is made of atoms. Matter made of only one type of atom is called an element.
5.2.8.A.2	All substances are composed of one or more of approximately 100 elements
5.2.8.A.4	The Periodic Table organizes the elements into families of elements with similar properties.
5.2.8.A.6	Substances are classified according to their physical and chemical properties. Metals are a class of elements that exhibit physical properties, such as conductivity, and chemical properties, such as producing salts when combined with nonmetals.
5.2.12.A.1	Electrons, protons, and neutrons are parts of the atom and have measurable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.
5.2.12.A.3	In the Periodic Table, elements are arranged according to the number of protons (the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements.



Nutley Public Schools

5.2.4.C.1	Heat (thermal energy), electricity, light, and sound are forms of energy
5.2.4.C.2	Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows through wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy.
5.2.4.C.3	Energy can be transferred from one place to another. Heat energy is transferred from warmer things to colder things.
5.2.4.D.1	Electrical circuits require a complete loop through conducting materials in which an electrical current can pass.
5.2.6.D.1	The flow of current in an electric circuit depends upon the components of the circuit and their arrangement, such as in series or parallel. Electricity flowing through an electrical circuit produces magnetic effects in the wires.
5.2.8.D.1	When energy is transferred from one system to another, the quantity of energy before transfer equals the quantity of energy after transfer. As an object falls, its potential energy decreases as its speed, and consequently its kinetic energy, increases. While an object is falling, some of the object's kinetic energy is transferred to the medium through which it falls, setting the medium into motion and heating it.
Integration of Technology	
Standard x.x	
CPI #	Cumulative Progress Indicator (CPI)
Instructional Focus	
Enduring Understandings	
<ul style="list-style-type: none"> • The resources, processes, concepts, and tools of technology must be used safely and effectively. • Effective strategies help us adjust to new technologies and the changing interactions among science, technology, and society. • Quality workmanship and systematic problem solving are essential components of technology. 	
Essential Questions	
<ul style="list-style-type: none"> • What are the essential safety requirements in this field of work? • What career opportunities are available in the field? • What calculations are required to prepare a cost proposal and how is a cost proposal submitted to a client? • What are the basic components of the wiring home construction? • What are the construction standards and practices required for safe wiring? • How does quality workmanship affect the final product? • How do the parts of an electrical circuit work together? 	
Evidence of Learning (Assessments)	
Successful completion of: <ul style="list-style-type: none"> • Home Wiring Quizzes • Capstone project (Home wiring trainer) 	
Objectives	
Students will know:	



Nutley Public Schools

- principals of Home Wiring
- proper tool selection and usage
- National Electric Code
- how to wire various components

Students will be able to:

- safely use the appropriate tool for the requested repair
- identify hot, neutral, and ground wires and terminals
- what are wire connectors and how are they used
- identifying parts of a service panel
- explain wire gauge and its importance
- utilize Ohm's Law to calculate power consumption for establishing appropriate breaker sizes in a panel
- perform safety and testing of circuits, rough-in wiring, wire: a service panel, grounding rod, electrical outlets, middle of run/end of run components, GFCI/AFCI, switches (SPST, 3-way, Dimmer), low voltage wiring (doorbells, intercoms), 220v wiring, light fixtures

Integration

Technology Integration

Writing Integration

Competencies

Suggested Resources