BEXLEY CITY SCHOOLS

PHYSICAL SCIENCE | Curriculum Map and Pacing Guide

COURSE DESCRIPTION: Course provides a fundamental understanding of interrelationships between matter and energy. This understanding prepares students for future science courses and makes them more informed consumers of science in their everyday lives. This course incorporates frequent laboratory activities that emphasize learning of basic lab techniques, data collection, data analysis, and laboratory safety. Reading, writing and math skills learned in previous courses are further developed. Basic concepts of chemistry and physics is introduced.	**Course SCI300** **1 year, 1 credit** **Grade 9** **Prerequisite:** teacher recommendation

QUARTER 1		
Topic: Nature of Science		
Key Terms: Bias, constant, control, density, dependent variable, graph, hypothesis, independent variable, mass, matter, scientific law, scientific method, SI unit, standard, technology, theory, variable, volume		
Intellectual Disposition/Measurable Skills: making predictions, problem solving, investigating, collecting, interpreting and recording data, concluding and presenting data in a lab report		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.SI: Science Inquiry and Application	Describe the steps scientists use to solve problems and explain why scientists use variables.	Variable identification lab
	Explain the difference between a scientific law and theory.	
	Determine the hypothesis, control, constants, dependent and independent variables, and conclusions in any experiment.	Variable identification lab and bouncy ball lab
	Design an experiment.	Meditation lab
	Construct and interpret data tables.	Variable identification lab and meditation lab
	Construct a line graph including: Title, axes with units, and best fit line.	Graphing packet and noodle penny lab
	Name the SI prefixes, and indicate which multiple of 10 each one represents.	Metric conversion practice
	Demonstrate equality between quantities of differing SI Prefixes, and convert between SI units (e.g., How many cm are in 1 m?).	Metric conversion practice

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Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Identify the SI units and symbols for length, volume, mass, time, and temperature.	Metric conversion practice
	Represent numbers using scientific notation.	

QUARTER 1		
Topic: Motion		
Key Terms: Distance**,** Displacement, motion, speed, average speed, instantaneous speed, momentum, velocity, acceleration, centripetal acceleration		
Intellectual Disposition/ Measurable Skills: making predictions, collecting, recording, and interpreting data, describe, explain		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.FM.1: Motion	Explain how distance and displacement are different.	
	Describe how is an objects speed is calculated.	
	Explain what information a distance-time graph provides.	Distance-time graph practice
	Compare and contrast speed and velocity.	Buggy lab
	Describe the motion of two objects relative to each other.	Distance-time graph practice
	Explain and calculate how an objects momentum can be calculated.	Momentum lab
	Interpret and use motion graphs to identify the type of acceleration and explain the specific motion.	Acceleration lab and motion graphs
PS.FM.3: Dynamics	Explain how acceleration, time, and velocity are related.	Buggy lab
	Describe three ways an object can accelerate.	
	Calculate an object's acceleration in different types of problems.	Buggy lab

QUARTER 1		
Topic: Forces and Newton's Laws		
Key Terms: Field (gravitational field), force, friction, gravity, net force, weight, inertia, Newton's first law of motion, Newton's second law of motion, Newton's third law of motion, air resistance, centripetal force, free fall, law of conservation of momentum, terminal velocity.		
Intellectual Disposition/Measurable Skills: making predictions, collecting, recording, and interpreting data, describing, comparing.		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.FM.2: Forces	Explain how force and motion are related. Describe how to determine the net force of an object.	Launch lab
	Draw and interpret force diagrams to determine the forces involved, including the net force.	Motion PHET
	Explain what causes friction between objects.	Friction Lab
	Compare and contrast mass and weight.	Mass and weight worksheet
PS.FM.3: Dynamics	Define inertia and explain how it is related to Newton's first law.	Motion lab
	Explain Newton's second law of motion and calculate an object's acceleration, using Newton's second law.	F=ma practice
	Describe Newton's third law of motion and explain how forces between interacting objects are related.	
	Use Newton's first law of motion to explain what happens in a car crash.	
	Use Newton's second law of motion to explain the effects of air resistance.	Air resistance lab
	Explain when motion is conserved.	Motion lab

QUARTER 1

Topic: Work and Energy

Key Terms: work, chemical potential energy, elastic potential energy, energy, gravitational potential energy, kinetic energy, potential energy, system, law of conservation of energy, mechanical energy, power

Intellectual Disposition/Measurable Skills: making predictions, collecting, recording, and interpreting data, explaining, differentiating between

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
PS.EW.2: Transfer and transformation of energy	Define work.	
	Calculate the amount of work needed, when force and motion are parallel.	Work problems, work and power lab
	Explain how energy and power are related.	Work and power lab
PS.EW.1: Conservation of energy	Describe different forms of potential energy	
	Calculate gravitational potential energy and solve for gravitational potential energy in a math problem.	GPE problems
	Explain how to calculate kinetic energy, and calculate and solve for kinetic energy.	KE problems
	Compare and contrast kinetic energy and potential energy.	KE/GPE problems
	Explain the law of conservation of energy. Describe different energy transfers that occur that support this law.	Energy transformation practice
	Define mechanical energy.	
	Explain why mechanical energy is not always conserved.	Motion lab

QUARTERS 1-2

Topic: Thermal Energy

Key Terms: heat, specific heat, temperature, thermal energy, conduction, convection, radiation, thermal insulator, thermodynamics, first law of thermodynamics, second law of thermodynamics

Intellectual Disposition/Measurable Skills: making predictions, collecting, recording, and interpreting data, executing experiments, examining data

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
PS.EW.4: Thermal energy	Define temperature.	
	Explain how thermal energy and temperature are related.	Thermal energy lab
	Explain the difference between thermal energy and heat.	Thermal energy lab
	Calculate changes in thermal energy.	Thermal energy lab

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Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Compare and contrast conduction, convection, and radiation.	Thermal energy lab
	Compare and contrast thermal conductors and thermal insulators.	Thermal energy lab
	Explain how thermal insulators are used to control the transfer of thermal energy.	Thermal energy lab
	Explain the first and second laws of thermodynamics.	

QUARTER 2		
Topic: Electricity		
Key Terms: charging by contact, charging by induction, conductor, electric field, electroscope, insulator, law of conservation of charge, static electricity, electric circuit, electric current, AC, DC, Ohm's law, resistance, voltage difference, electric power, parallel circuit, series circuit		
Intellectual Disposition/Measurable Skills: constructing, comparing, and interpreting circuits, defending their position on influential scientists, discussing, and explaining		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.EW.5: Electricity	Describe how electric charges exert forces on each other.	
	Compare and contrast gravitational force and electric force.	
	Distinguish between conductors and insulators.	Thermal energy lab
	Explain how objects become electrically charged.	Mini lab
	Explain when and how a voltage difference produces an electric current.	
	Explain how batteries produce a voltage difference in a circuit.	Mini lab
	Define Ohm's law, and explain how it relates current, voltage difference, and resistance.	Series and parallel PHET
	Use Ohm's Law to calculate resistance, voltage, or current.	V=IR problems
	Compare and contrast alternating current and direct current	

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Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Describe the difference between series and parallel circuits.	Series and parallel PHET, "What makes an electric circuit lab?"
	Explain the function of circuit breakers and fuses.	
	Calculate electrical power.	P=IV problems
	Understand key differences regarding life of Thomas Edison and Nikola Tesla.	Research on Tesla and Edison

QUARTER 2		
Topic: Waves		
Key Terms: longitudinal wave, mechanical wave, medium, transverse wave, wave, amplitude, compression, crest, frequency, period, rarefaction, trough, wavelength, diffraction, interference, node, refraction, resonance, standing wave, decibel, Doppler effect, intensity, loudness, electromagnetic wave, photon, gamma ray, infrared wave, microwave, radio wave, ultraviolet wave, visible light, x-ray		
Intellectual Disposition/Measurable Skills: classifying, explaining, comparing and contrasting, demonstrating, experimenting, interpreting		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.EW.3: Waves	Recognize that waves carry energy, not matter, and explain how waves transfer energy.	
	Define mechanical waves.	
	Compare and contrast transverse waves and longitudinal (aka compressional) waves.	Waves PHET, waves lab
	Explain how wavelength and period are related.	Waves PHET, waves lab
	Describe the relationship between frequency and wavelength.	Waves PHET, waves lab
	Calculate the speed of a wave.	Waves PHET, waves lab
	State the Law of Reflection.	
	Explain why waves change direction when they travel from one material to another.	
	Compare and contrast refraction and diffraction.	

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Intellectual Disposition/Measurable Skills: classifying, explaining, comparing and contrasting, demonstrating, experimenting, interpreting

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
	Describe how waves interfere with each other.	Waves PHET, waves lab
	Explain how sound travels through different mediums.	
	Explain what affects the speed of sound.	
	Explain the relationship between frequency and pitch.	
	Explain the Doppler Effect.	Doppler demos
	Explain how vibrating charges produce electromagnetic waves.	
	Describe properties of electromagnetic waves.	
	Describe how electromagnetic waves transfer energy.	
	Explain the different types of waves on the electromagnetic spectrum.	EM spectra activity
	Explain the properties of the different types of electromagnetic waves.	EM spectra activity
	Explain common uses of each type of electromagnetic wave.	EM spectra activity

QUARTER 3

Topic: Classification and States of Matter

Key Terms: boiling point, heat of fusion, heat of vaporization, endothermic, exothermic, melting point, plasma, sublimation, colloid, compound, element, heterogeneous mixture, homogeneous mixture, solution, substance, suspension, chemical change, chemical property, distillation, law of conservation of mass, physical change, physical property

Intellectual Disposition/Measurable Skills: experimenting, classifying, comparing, recognizing, describing

Ohio Science Standards (2018)	Student Learning Targets	Learning Activities/Investigations
PS.M.1: Classification of Matter	Explain how particles move in different states of matter.	
	Describe how particles behave at the boiling and melting points.	Heat of fusion lab
	List and explain the different phase changes that occur with matter.	Heat of fusion lab
	Identify which phases changes are endothermic and exothermic.	Heat of fusion lab

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Intellectual Disposition/Measurable Skills: experimenting, classifying, comparing, recognizing, describing		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Calculate the density of different materials, construct and interpret graphs that represent density.	Sugar content in beverages lab/density cube lab
	Explain the difference between substances and mixtures.	Matter lab
	Distinguish between elements and compounds and explain how they are classified.	Matter lab
	Compare and contrast suspensions, solutions, and colloids.	Matter lab
	Describe physical and chemical properties.	Chemical and physical properties/changes lab
	Compare and contrast chemical and physical changes.	Chemical and physical properties/changes lab
	Explain how the law of conservation of mass applies to chemical changes.	Chemical and physical properties/changes lab

QUARTER 3		
Topic: Properties of Atoms and the Periodic Table		
Key Terms: Anion, atom, cation, electron, electron cloud, ion, neutron, nucleus, proton, quark, atomic number, average atomic mass, isotope, mass number, electron dot diagram, group, period, periodic table		
Intellectual Disposition/Measurable Skills: locating, discussing, interpreting, relating, predicting, describing		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.M.2: Atoms	Identify the names and symbols of common elements.	
	Describe the structure of the atom.	Parts of the atom lab
	Explain how scientists study quarks.	
	Describe how the model of the atom has changed over time, and explain our current electron cloud model of the atom.	
	Explain how to determine the atomic number and the mass number of an atom.	Parts of the atom Lab

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Intellectual Disposition/Measurable Skills: locating, discussing, interpreting, relating, predicting, describing		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Define isotope, and describe how they are similar and different.	
	Explain how to calculate the average atomic mass of an element.	
	Describe how ions form, comparing cations and anions.	
PS.M.3: Periodic Trends of the Elements	Explain how the periodic table is organized	Periodic table lab
	Describe the trends on the periodic table.	Periodic table lab
	Describe the properties of metals, nonmetals, and metalloids.	Periodic table coloring activity

QUARTER 3		
Topic: Chemical Bonds		
Key Terms: chemical bond, chemical formula, covalent bond, ion, ionic bond, molecule, nonpolar bond, nonpolar molecule, polar bond, polar molecule, binary compound, hydrate, oxidation number, polyatomic ion		
Intellectual Disposition/Measurable Skills: listing, identifying, classifying, differentiating, describing		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.M.4: Bonding and Compounds	Explain how a compound differs from its component elements.	
	Describe what a chemical formula represents.	
	Explain how electron dot diagrams help predict chemical bonding.	Dot diagram practice
	Explain why chemical bonding occurs.	
	Describe ionic and covalent bonds.	
	Explain which particles are produced by ionic and covalent bonds.	Bond with a classmate lab
	Compare and contrast nonpolar and polar bonds.	Molecules and mixing launch lab
	Explain how oxidation numbers are determined.	Finding charges of cations and anions
	Demonstrate how to write formulas for ionic and covalent compounds.	Bond with a classmate lab and forming ionic compounds lab

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Intellectual Disposition/Measurable Skills: listing, identifying, classifying, differentiating, describing		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Demonstrate how to name ionic and covalent compounds.	Bond with a classmate lab and forming ionic compounds lab
	Define hydrate and explain how to determine the number of water molecules in it.	

QUARTER 4		
Topic: Chemical Bonds		
Key Terms: balanced chemical reaction, chemical equation, chemical reaction, coefficient, molar mass, mole, products, reactants, combustion reaction, decomposition reaction, double-displacement reaction, oxidation, precipitate, reduction, single-displacement reaction, synthesis reaction, endergonic reaction, endothermic reaction, exergonic reaction, exothermic reaction		
Intellectual Disposition/Measurable Skills: classifying, experimenting, distinguishing, interpreting, executing, discussing, describing		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.M.5: Reactions of matter	Identify the reactants and products in a chemical reaction.	Snatoms balancing equations lab
	Describe the law of conservation of mass and apply it to chemical reactions.	Balancing equations activity
	Explain the importance of chemical equations.	Balancing chemical equations PhET
	Balance a chemical equation.	Snatoms balancing equations lab Types of reactions lab Balancing chemical equations PhET Balancing equations activity
	List and describe the five types of chemical reactions.	Types of reactions lab
	Use the activity series to predict if a metal will replace another one in a compound.	Activity series lab
	Compare and contrast oxidation and reduction.	
	Compare and contrast exergonic and endergonic reactions.	Demos
	Compare and contrast exothermic and endothermic reactions.	Demos

QUARTER 4		
Topic: Chemical Bonds		
Key Terms: balanced chemical reaction, chemical equation, chemical reaction, coefficient, molar mass, mole, products, reactants, combustion reaction, decomposition reaction, double-displacement reaction, oxidation, precipitate, reduction, single-displacement reaction, synthesis reaction, endergonic reaction, endothermic reaction, exergonic reaction, exothermic reaction		
Intellectual Disposition/Measurable Skills: classifying, experimenting, distinguishing, interpreting, executing, discussing, describing		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
	Apply the law of conservation of energy to chemical reactions.	

QUARTER 4		
Topic: Radioactivity and Nuclear Reactions		
Key Terms: radioactivity, fundamental forces, strong force, weak force, alpha particle, beta particle, chain reaction, transmutation, half-life, tracer.		
Intellectual Disposition/Measurable Skills: identifying, explaining, examining, and defending.		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.M.5: Reactions of Matter	Explain what force holds the atomic nucleus together.	
	Compare and contrast the fundamental forces.	
	Compare and contrast radioactive atomic nuclei and stable nuclei.	Radioactive decay lab
	Define alpha particles, beta particles, and gamma rays.	
	Compare and contrast nuclear fission and nuclear fusion.	Nuclear tech
	Explain how mass and energy are related.	
	Explain how radioactivity can be detected.	
	Identify some common sources of background radiation.	
	Identify the half-life of a radioactive material.	Radioactive decay lab
	Explain how radioactivity can be used to find the age of an object.	Radioactive decay lab

QUARTER 4		
Topic: Stars and Galaxies		
Key Terms: black hole, giant star, main sequence, nebula, neutron star, photosphere, sunspots, supernova, white dwarf, galaxy, local group, Milky Way, big bang theory, cosmic background radiation, cosmology, dark energy, dark matter.		
Intellectual Disposition/Measurable Skills: discussing, relating, interpreting, describing, comparing, supporting a claim.		
Ohio Science Standards (2018)	**Student Learning Targets**	**Learning Activities/Investigations**
PS.U.3: Stars	Describe how astronomers classify stars.	Among the stars
	Explain how stars form.	How the universe works extreme stars
	Explain how the sun forms.	How the universe works extreme stars
	Explain whether or not the sun evolves over time.	How the universe works extreme stars, sunspot activity
PS.U.2: Galaxies	Describe the three main types of galaxies.	Hubble Deep Field Academy
	Explain how galaxies form and how they interact.	Hubble Deep Field Academy
	Describe the shape of the Milky Way galaxy.	Hubble Deep Field Academy
PS.U.1: History of the Universe	Identify and describe the most accepted theory used to explain the origins of the universe.	Expanding universe activity
	Identify and describe the evidence that supports the notion of an expanding universe.	Expanding universe activity
	Describe dark matter.	
	Explain how dark energy affects the expansion of the universe.	

District Instructional Resource:

Glencoe Physical Science (2017) / McGraw-Hill (6-year online subscription: 2019-2020 to 2024-2025

Standards Alignment:

Ohio Learning Standards (2018) – retrieved Jan. 2, 2019
http://education.ohio.gov/getattachment/Topics/Learning-in-Ohio/Science/Ohios-Learning-Standards-and-MC/SciFinalStandards121018.pdf.aspx?lang=en-US