

8th GRADE PHYSICAL SCIENCE

Curriculum Guide

Physical Science

Glencoe Publishers ©1999 (ISBN 0-02-)

Students interact with their physical world on a daily basis. The 8th grade physical science curriculum at Sacred Heart School is designed to provide students with a solid and accurate understanding of the physical realm through a thematic and hands-on approach. Students will practice their science process skills, use scientific principles and processes, develop scientific, mathematical, and technological literacy, and apply these skills in solving problems. The topics covered include energy, motion, matter, waves, and electricity. A variety of exercises, labs, and activities provide a depth of learning in the physical science arena. Science Olympiad provides one such activity for learning.

I. Unit I: Physical Science Basics

A. Physical Science Methods

1. Standards of Measurement
 - a. Define a standard of measurement.
 - b. Identify the need for standards of measurement.
 - c. Identify the common SI prefixes, and indicate what multiple of ten each represents.
2. Using SI Units
 - a. Identify SI units and symbols for length, volume, mass, density, time, and temperature.
 - b. Define *derived unit*.
 - c. Convert a measurement among related SI units.
3. Graphing
 - a. Identify three types of graphs.
 - b. Explain how each type of graph is used.
 - c. Distinguish between dependent and independent variables.
 - d. Interpret graphs.
4. Science and Society: SI for All?
 - a. Analyze the advantages and disadvantages of universal use of SI measurements.
 - b. Give examples of SI units already commonly used in the United States.

II. Unit II: Energy and Motion

A. Exploring Motion and Forces

1. Motion and Speed
 - a. Define speed as a rate.
 - b. Perform calculations involving speed, time, and distance.
 - c. Interpret distance-time graphs.
2. Velocity and Acceleration
 - a. Compare and contrast speed, velocity, and acceleration.
 - b. Calculate acceleration.
3. Science and Society: A Crash Course in Safety

- a. Analyze the motions that take place in a car crash.
 - b. Evaluate the effects of wearing seat belts during a car crash.
 - c. State an informed opinion about whether laws should require people to wear seat belts.
4. Connecting Motion With Forces
 - a. Recognize different examples of forces.
 - b. Identify cause-and-effect relationships between force and changes in velocity.
 - c. Give examples of the effects of inertia.
 - d. State Newton's First Law of Motion.
 5. Gravity: A Familiar Force
 - a. Give examples of the effects of gravity.
 - b. Relate gravitational force to mass and distance.
 - c. Distinguish between mass and weight.
- B. Acceleration and Momentum
1. Accelerated Motion
 - a. Explain how force, mass, and acceleration are related.
 - b. Compare the rates at which different objects fall.
 - c. Observe the effects of air resistance.
 2. Projectile and Circular Motion
 - a. Explain why things that are thrown or shot follow a curved path.
 - b. Compare motion in a straight line with circular motion.
 - c. Define *weightlessness*.
 3. Science and Society: Sending Up Satellites
 - a. Explain how satellites are placed into orbit around the Earth
 - b. Give examples of the uses of satellites.
 4. Action and Reaction
 - a. Analyze action and reaction forces.
 - b. Define and calculate momentum.
 - c. Explain the *Conservation of Momentum*.
- C. Energy
1. Energy and Work
 - a. Distinguish between potential and kinetic energy.
 - b. Recognize that energy is conserved when changing from one form to another.
 - c. Identify various forms of energy.
 - d. Compare the scientific meaning of work with its everyday meaning.
 2. Temperature and Heat
 - a. Recognize the difference between the motion of an object and the motion of the particles that make up the object.
 - b. Contrast heat and temperature.
 - c. Explain what it is that determines the thermal energy of a sample of matter.
 3. Science and Society: Thermal Pollution: Waste You Can't See
 - a. Identify some causes and effects of thermal pollution.
 - b. Discuss possible solutions for thermal pollution problems.

4. Measuring Thermal Energy
 - a. Define *specific heat*.
 - b. Calculate changes in thermal energy.
- D. Using Thermal Energy
 1. Thermal Energy on the Move
 - a. Compare and contrast the transfer of thermal energy by conduction, convection, and radiation.
 - b. Differentiate between conductors and insulators.
 - c. Explain how insulation affects the transfer of energy.
 2. Using Heat to Stay Warm
 - a. Describe three types of conventional heating systems.
 - b. Explain how solar energy can be used to heat buildings.
 - c. Explain the differences between passive and active solar heating systems.
 3. Using Heat to Do Work
 - a. Describe how internal combustion engines and external combustion engines work.
 - b. Explain how a heat mover can transfer thermal energy in a direction opposite to that of its natural movement.
 4. Science and Society: Energy from the Oceans
 - a. Explain how differences in ocean temperature can be used to operate a heat engine.
 - b. Describe a heat engine that changes thermal energy to mechanical energy.
 - c. Discuss the advantages and disadvantages of ocean thermal energy conversion.
- E. Machines-Making Work Easier
 1. Why We Use Machines
 - a. Explain how machines make work easier.
 - b. Calculate mechanical advantage.
 2. The Simple Machines
 - a. Describe the six types of simple machines.
 - b. Calculate the ideal mechanical advantage for different types of simple machines.
 3. Science and Society: Mending with Machines
 - a. Explain what the science of bionics involves.
 - b. Contrast two methods of using electrical signals to trigger motion of a limb or other bodily process.
 4. Using Machines
 - a. Recognize the simple machines that make up a compound machine.
 - b. Calculate the efficiency of a machine.
 - c. Describe the relationship among work, power, and time.

III. Unit III: The Nature of Matter

- A. Solids, Liquids, and Gases
 1. Matter and Temperature
 - a. Describe the four states of matter.

- b. Use the kinetic theory of matter to explain the characteristics of solids, liquids, and gases.
 - c. Explain the thermal expansion of matter.
 2. Science and Society: Fresh Water: Will There Be Enough?
 - a. Describe how people use and pollute water.
 - b. Discuss how people can save water and stop pollution.
 3. Changes in State
 - a. Interpret state changes in terms of the kinetic theory of matter.
 - b. Account for the energy of the heats of vaporization and fusion in state changes.
 4. Behaviors of Gases
 - a. Explain how a gas exerts pressure on its container.
 - b. State and explain how the pressure of a container of gas is affected when the volume of the container is changed.
 - c. Explain the relationship between the temperature and volume of a gas.
 5. Uses of Fluids
 - a. State Archimedes' Principle.
 - b. Predict whether an object will sink or float in water.
 - c. State Pascal's Principle.
 - d. Describe the operation of a machine that uses Pascal's Principle.
 - e. State Bernoulli's principle and describe a way that Bernoulli's principle is applied.
- B. Classification of Matter
 1. Composition of Matter
 - a. Distinguish between substances and mixtures.
 - b. Compare and contrast solutions, colloids, and suspensions.
 2. Science and Society: The Colloid Connection
 - a. Identify two colloids related to air and water pollution.
 3. Describing Matter
 - a. Give examples of physical properties.
 - b. Distinguish between physical and chemical changes.
 - c. Distinguish between chemical and physical properties.
 - d. State and explain the law of conservation of mass.
- C. Atomic Structure and the Periodic Table
 1. Structure of the Atom
 - a. List the names and symbols of common elements.
 - b. Describe the present model of the atom.
 - c. Describe how electrons are arranged in an atom.
 2. Science and Society: Smaller Particles of Matter
 - a. Identify quarks as particles of matter that make up protons and neutrons.
 - b. Explain how particle accelerators are used to study particles within an atom.
 3. Masses of Atoms
 - a. Compute the atomic mass and mass number of an atom.
 - b. Identify and describe isotopes of common elements.
 - c. Interpret the average atomic mass of an element.

4. The Periodic Table
 - a. Describe the Periodic Table of the Elements and use it to find information about an element.
 - b. Distinguish between a group and a period.
 - c. Use the Periodic Table to classify an element as a metal, nonmetal, or metalloid.
- D. Chemical Bonds
 1. Why Atoms Combine
 - a. Describe how a compound differs from the elements that compose it.
 - b. Explain what a chemical formula represents.
 - c. State a reason why chemical bonding occurs.
 2. Kinds of Chemical Bonds
 - a. Describe ionic bonds and covalent bonds.
 - b. Identify the particles produced by ionic bonding and by covalent bonding.
 - c. Distinguish between a non-polar and a polar covalent bond.
 3. Science and Society: Chemical Risks in the Home
 - a. Describe the dangers posed by hazardous compounds in the home.
 - b. Demonstrate a knowledge of safer alternative compounds to use.
 4. Formulas and Names of Compounds
 - a. Explain how to determine oxidation numbers.
 - b. Write formulas for compounds from their names.
 - c. Name compounds from their formulas.
 - d. Describe hydrates and their formulas.

IV. **Unit IV: Kinds of Substances**

- A. Elements and their Properties
 1. Metals
 - a. Describe the properties of a typical metal.
 - b. Identify the alkali and alkaline earth metals.
 - c. Differentiate among three groups of transition elements.
 2. Science and Society: New Elements, New Properties
 - a. Distinguish among elements classified as lanthanides, actinides, and transuranium elements.
 - b. Determine the uses of transuranium elements.
 - c. Compare the pros and cons of making new elements.
 3. Non-Metals
 - a. Recognize hydrogen as a non-metal.
 - b. Compare and contrast properties of the halogens.
 - c. Describe properties and uses of the noble gases.
 4. Mixed Groups
 - a. Distinguish among metals, non-metals, and metalloids in groups 13 through 16 of the periodic table.
 - b. Describe the nature of allotropes.
 - c. Recognize the significance of differences in crystal structure in carbon.
- B. Useful Materials
 1. Materials with a Past

- a. Identify common alloys and ceramics.
- b. Compare and contrast alloys and ceramics.
2. New Materials
 - a. Compare and contrast plastics and synthetic fibers.
 - b. Describe a composite.
3. Science and Society: Record Breaking With Sports Technology
 - a. Compare and contrast the advantages of new materials used in sports with older materials.
 - b. Identify chemical elements and materials of technology used in sports.
 - c. Determine whether sports should alter the rules about the use of technology.

V. **Unit V: Interactions of Matter**

A. Solutions

1. How Solutions Form
 - a. Classify solutions into three types.
 - b. Identify solutes and solvents within each type.
 - c. Explain the dissolving process.
 - d. Describe the factors that affect the rates at which solids and gases dissolve in liquids.
2. Science and Society: Regulating Organic Solvents
 - a. Compare and contrast the effects of organic solvents.
 - b. Determine whether government agencies should regulate all usage of known organic solvents.
3. Solubility and Concentration
 - a. Discuss how solubility varies among different solutes and for the same solute at different temperatures.
 - b. Demonstrate an understanding of solution concentrations.
 - c. Compare and contrast a saturated, unsaturated, and supersaturated solution.
4. Particles in Solution
 - a. Compare and contrast the behavior of polar and non-polar substances in forming solutions.
 - b. Relate the processes of dissociation and ionization to solutions that conduct electricity.
 - c. Explain how the addition of solutes to solvents affects the freezing and boiling points of solutions.

B. Chemical Reactions

1. Chemical Changes in Matter
 - a. Identify reactants and products in a chemical reaction.
 - b. Explain how a chemical reaction satisfies the law of conservation of mass.
 - c. Interpret chemical equations.
2. Science and Society: Chemical Reactions-Up in the Air
 - a. Explain the effect of CFCs on ozone in the atmosphere.
 - b. Compare possible alternatives to CFCs.
3. Chemical Equations

- a. Explain what is meant by a balanced chemical equation.
- b. Demonstrate how to write balanced chemical equations.
- 4. Types of Chemical Reactions
 - a. Describe four types of chemical reactions using their generalized formulas.
 - b. Classify various chemical reactions by type.
- 5. Energy and Chemical Reactions
 - a. Differentiate between an exothermic and an endothermic reaction.
 - b. Describe the effects of catalysts and inhibitors on the speed of a chemical reaction.
- C. Acids, Bases, and Salts
 - 1. Acids and Bases
 - a. Define *acid* and *base*.
 - b. Describe the characteristic properties of acids and bases.
 - c. List the names, formulas, and uses of some common acids and bases.
 - d. Relate the processes of dissociation and ionization to the formation of acids and bases.
 - 2. Strength of Acids and Bases
 - a. Explain what determines the strength of an acid or base.
 - b. Differentiate between strength and concentration.
 - c. Define *pH*.
 - d. Describe the relationship between pH and the strength of an acid or a base.
 - 3. Science and Society: Acid Rain
 - a. Use pH units to define *acid rain*.
 - b. Describe the factors contributing to the formation of acid rain.
 - c. Discuss the effects of acid rain.
 - d. Evaluate methods of controlling acid rain.
 - 4. Acids, Bases, and Salts
 - a. Describe a neutralization reaction.
 - b. Explain what a salt is and how salts form.
 - c. Differentiate between soaps and detergents.
 - d. Explain how esters are made and what they are used for.

VI. Unit VI: Waves, Light, and Sound

- A. Waves and Sound
 - 1. Characteristics of Waves
 - a. Sketch a transverse wave and identify its characteristics.
 - b. Discuss the relationship between frequency and wavelength in a transverse wave.
 - c. Calculate using frequency, wavelength, and velocity.
 - 2. The Nature of Sound
 - a. Describe the transmission of sound through a medium.
 - b. Recognize the relationship between intensity and loudness.
 - c. Recognize the relationship between frequency and pitch.
 - d. Illustrate the Doppler effect with a practical example.
 - 3. Science and Society: Using Sound Advice in Medicine

- a. Explain how sound waves can be used to create images of organs inside the body.
- b. Describe some of the uses of ultrasound technology in medicine.
- 4. Music to Your Ears
 - a. Distinguish between music and noise.
 - b. Describe why different instruments produce sounds of different quality.
 - c. Explain two types of wave interference.
- B. Light
 - 1. Electromagnetic Radiation
 - a. Contrast electromagnetic waves with other kinds of waves.
 - b. Describe the arrangement of electromagnetic waves on the electromagnetic spectrum.
 - c. Explain at least one application of each type of electromagnetic wave.
 - 2. Light and Color
 - a. Describe the differences among opaque, translucent, and transparent materials.
 - b. Explain how you see color.
 - c. Describe the difference between light color and pigment color.
 - 3. Science and Society: Battle of the Bulbs
 - a. Explain how incandescent and fluorescent bulbs work.
 - b. Analyze the advantages and disadvantages of different light sources.
 - 4. Wave Properties of Light
 - a. State and give an example of the law of reflection.
 - b. Explain how refraction is used to separate white light into the colors of the spectrum.
 - c. Describe how diffraction and interference patterns demonstrate the wave behavior of light.
- C. Mirrors and Lenses
 - 1. The Optics of Mirrors
 - a. Explain how an image is formed in three types of mirrors.
 - b. Identify examples and uses of plane, concave, and convex mirrors.
 - 2. The Optics of Lenses
 - a. Describe types of images formed with concave and convex lenses.
 - b. Cite examples of how these lenses are used.
 - c. Explain how lenses are used to correct vision.
 - 3. Optical Instruments
 - a. Compare refracting and reflecting telescopes.
 - b. Explain how a camera creates an image.
 - 4. Science and Society: The Hubble Space Telescope
 - a. Describe the development and repair of the Hubble Space Telescope.
 - b. Discuss the goals and uses of the Hubble Space Telescope.
 - 5. Applications of Light
 - a. Describe polarized light and the uses of polarizing filters.
 - b. Explain how a laser produces coherent light and how it differs from incoherent light.
 - c. Apply the concept of total internal reflection to the uses of optical fibers.

VII. Electricity and Energy Sources

A. Electricity

1. Electric Charge
 - a. Describe the effects of static electricity.
 - b. Distinguish between conductors and insulators.
 - c. Recognize the presence of charge in an electroscope.
2. Science and Society: To Burn or Not
 - a. Explain the occurrence of lightning in terms of induction and static discharge.
 - b. Evaluate the positive and negative aspects of lightning-induced forest fires.
3. Electric Current
 - a. Describe how static electricity is different from current electricity.
 - b. Explain how a dry cell is a source of electricity.
 - c. Conceptually and mathematically relate potential difference, resistance, and current.
4. Electrical Circuits
 - a. Sketch a series and a parallel circuit.
 - b. List the applications of each type of circuit.
 - c. Recognize the function of circuit breakers and fuses.
5. Electrical Power and Energy
 - a. Explain and calculate electric power.
 - b. Calculate electrical energy in terms of kilowatt-hours.

B. Magnetism and Its Uses

1. Characteristics of Magnets
 - a. Describe the properties of magnets.
 - b. Define the region of force around a magnet.
 - c. Model magnetic behavior using domains.
2. Uses of Magnetic Fields
 - a. Explain the magnetic effects of a current in a wire.
 - b. Compare and contrast ammeters and voltmeters.
 - c. Describe the function of an electric motor.
3. Producing Electric Current
 - a. Describe how a generator produces an electric current using electromagnetic induction.
 - b. Distinguish between alternating and direct current.
 - c. Explain how a transformer can step up or step down the voltage of an alternating current.
4. Science and Society: Superconductivity
 - a. Describe the characteristics of a superconductor.
 - b. Consider various applications of superconductivity.

C. Radioactivity and Nuclear Reactions

1. Radioactivity
 - a. Discuss the discovery of radioactivity.
 - b. Contrast properties of radioactive versus stable nuclides.
2. Nuclear Decay

- a. Distinguish among alpha, beta, and gamma radiation.
 - b. Calculate the amount of radioactive substance remaining after a time, based on the substance's half-life.
 - c. Relate half-life to the process of radioactive dating.
3. Detecting Radioactivity
 - a. Describe how radioactivity can be detected.
 - b. Explain how a Geiger counter can determine the quantity of nuclear radiation present.
4. Nuclear Reactions
 - a. Distinguish between nuclear fission and fusion.
 - b. Explain how nuclear fission can begin a chain reaction.
 - c. Discuss how nuclear fusion occurs in the sun.
5. Science and Society: Using Nuclear Reactions in Medicine
 - a. Describe how radioactive tracers and PET can be used to diagnose medical problems.
 - b. Discuss how radioactive isotopes can aid in the treatment of cancers.